GLENCORE OPERATIONS SOUTH AFRICA (PTY) LTD - LION SMELTER, A GLENCORE MERAFE VENTURE

SITE SENSITIVITY VERIFCATION REPORT (SSVR)

IN RELATION TO THE ENVIRONMENTAL AUTHORISATION APPLICATION
BY MEANS OF A
BASIC ASSESSMENT (BA) PROCESS AND INTENTION TO AMEND THE EXISTING AIR EMMISIONS LICENCE (AEL)

GLENCORE

JANUARY 2022

DEPARTMENTAL REFERENCE:

nettZero

Your sustainability. Our environment.

GLENCORE-MERAFE JV – LION SMELTER: ECF SITE SENSITIVIY VERIFICATION REPORT (SSVR)

Glencore Operations South Africa (Pty) Ltd. – Lion Smelter
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Limpopo

DOCUMENT CONTROL:

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TITLE	Energy Conversion Facility (ECF) – Site Sensitivity Verification Report (SSVR)			
	NAME	**SIGNATURE**	**DATE**	**QUALIFICATIONS AND REGISTRATIONS**
EAP	**Anandi Alers**		10.02.2022	*MSc Geography and Environmental Management* *Natural Scientist (400016/17) and registered EAP (2019/1514)*
REVIEWER	**Marius Alers**		10.02.2022	

DISTRIBUTION:

TO	DESCRIPTION	DATE	COMMENTS/CHANGES
Kennedy Owuor	Draft report for review and approval	31.01.2022	Query on the risk rating related to the visual aspect.
Frans Engelbrecht			
Hendrik Strumpfer			

EXCECUTIVE SUMMARY

The Lion Smelter, a Glencore Merafe Venture Operation, appointed Nettzero (Pty) Ltd as an independent Environmental Assessment Practitioner (EAP) in terms of Regulation 12 of the EIA regulations, to complete the necessary environmental applications associated to the proposed development.

Glencore Operations South Africa (Pty) Ltd has entered into an energy conversion service agreement with Swedish Sterling, which involves the proposed construction and commissioning of a standalone energy conversion facility located on the Lion Smelter complex premises. The proposed facility (hereafter referred to as Lion ECF or the proposed development), will convert the thermal energy from the excess furnace gas produced by Lion Smelter Complex into electrical energy in the Swedish Stirling's proprietary power generation technology (PWR BLOK 400-F units). The electric energy will then be fed back into the electrical supply of the Lion Smelter.

This Site Sensitivity Verification Report (SSVR) serves to confirm or dispute the land use and environmental sensitivities as provided in the Screening Report (Appendix A – Screening Report), identified by the national web-based environmental screening tool (hereafter referred to as the screening tool), in terms of Regulation 16 (1) (v) of the Environmental Impact Assessment (EIA) Regulations (GNR 982 GG 38282 of 4 December 2014, as amended).

Various specialist assessments were identified by the screening tool. The following table summarises the verification outcome following the required desktop analysis and on-site inspection:

SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	MOTIVATION PROVIDED IN SECTION REFERENCE
AGRICULTURAL IMPACT ASSESSMENT			
High	**Low**	Compliance Statement	6.2
LANDSCAPE AND VISUAL IMPACT ASSESSMENT			
ND	**Low – Potentially Moderate** - visual impact at a local and/or regional scale	Visual Impact Assessment (VIA)	6.3
ARCHAEOLOGICAL AND PALAEONTOLOGY IMPACT ASSESSMENT			
Low	**Low**	Phase 1 Heritage Impact Assessment (HIA)	6.4
TERRESTRIAL BIODIVERSITY, PLANT AND ANIMAL SPECIES IMPACT ASSESSMENT			
Low - terrestrial biodiversity	**Low** - terrestrial biodiversity	Compliance Statement	6.5

SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	MOTIVATION PROVIDED IN SECTION REFERENCE
Medium - plant species	**Low** - plant species		
High - animal species	**Low** - animal species		
AQUATIC BIODIVERSITY IMPACT ASSESSMENT			
Low	**Low**	Compliance Statement	6.6
HYDROLOGICAL AND GEOHYDROLOGICAL ASSESSMENT			
ND	**Low**	Conceptual Storm Water Management Plan (CSWMP)	6.7
NOISE IMPACT ASSESSMENT			
ND	**Low**	Compliance Statement	6.8
TRAFFIC IMPACT ASSESSMENT			
ND	**Low**	Traffic Impact Assessment	6.9
HEALTH IMPACT ASSESSMENT			
ND	TBA	Health Risk Assessment	6.10
SOCIO-ECONOMIC IMPACT ASSESSMENT			
ND	**Low**	Social Compliance Statement	6.11
AIR QUALITY IMPACT ASSESSMENT			
ND	TBA	Level 2 Air Quality Impact Assessment	6.12

* ND – Not Defined; TBA – to be assessed during the BA process

The information presented in this report, at this stage of the process, is based on the available information and expertise of the EAP and specialists.

This report will be submitted as part of the integrated application for Environmental Authorisation (EA) and Air Emissions Licence (AEL), by following a Basic Assessment (BA) process in line with the EIA regulations (see Table 3: Listed activities associated with the proposed ECF project).

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TABLES AND GRAPHS

ACRONYMS AND ABBREVIATIONS

AEL	Air Emissions Licence
AQMP	Air Quality Management Plan
BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
COTO	Committee of Transport Officials
DARDLEA	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs
DFFE	Department of Forestry, Fisheries, and the Environment
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ECF	Energy Conversion Facility
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecological Priority Area
FGTM	Fetakgomo Greater Tubatse Local Municipality
GIS	Geographic Information System
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Parties

LDEDET	Limpopo Department of Economic Development, Environment and Tourism
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MW	Mega Watt
NEMA	National Environmental Management Act, Act no. 107 of 1998
NEMAQA	National Environmental Management Air Quality Act, Act no. 39 of 2004
NEMBA	National Environmental Management: Biodiversity Act, Act no. 10 of 2004
NEMPA	National Environmental Management: Protected Areas Act, Act no. 57 of 2003
NHRA	National Heritage Resources Act, Act no. 25 of 1999
OEMF	Olifants Environmental Management Framework
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SCE	Sekhukhuneland Centre of Endemism
SEZ	Special Economic Zone
SSVR	Site Sensitivity Verification Report
STA	Site Traffic Impact Asssessment
TIA	Traffic Impact Assessment
VIA	Visual Impact Assessment
WMA	Water Management Agency

1 INTRODUCTION

This Site Sensitivity Verification Report (SSVR) serves to confirm or dispute the land use and environmental sensitivities as provided in the Screening Report (Appendix A – Screening Report), identified by the national web-based environmental screening tool (hereafter referred to as the screening tool), in terms of Regulation 16 (1) (v) of the Environmental Impact Assessment (EIA) Regulations (GNR 982 GG 38282 of 4 December 2014, as amended) .

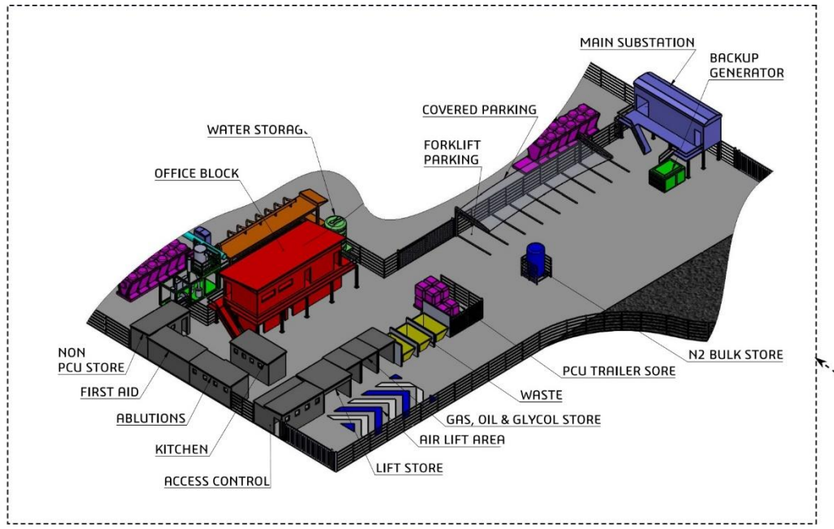
The Lion Smelter, a Glencore Merafe Venture Operation, appointed Nettzero (Pty) Ltd as an independent Environmental Assessment Practitioner (EAP) in terms of Regulation 12 of the EIA regulations, to complete the necessary environmental applications.

2 PROJECT BACKGROUND INFORMATION

2.1 PROJECT DETAILS

Glencore Operations South Africa (Pty) Ltd has entered into an energy conversion service agreement with Swedish Sterling, which involves the proposed construction and commissioning of a standalone energy conversion facility located on the Lion Smelter complex premises. The proposed facility (hereafter referred to as Lion ECF), will convert the thermal energy from the excess furnace gas produced by Lion Smelter Complex into electrical energy in the Swedish Stirling's proprietary power generation technology (PWR BLOK 400-F units). The electric energy will then be fed back into the electrical supply of the Lion Smelter.

Figure 1 illustrates the process flow of the proposed facility.



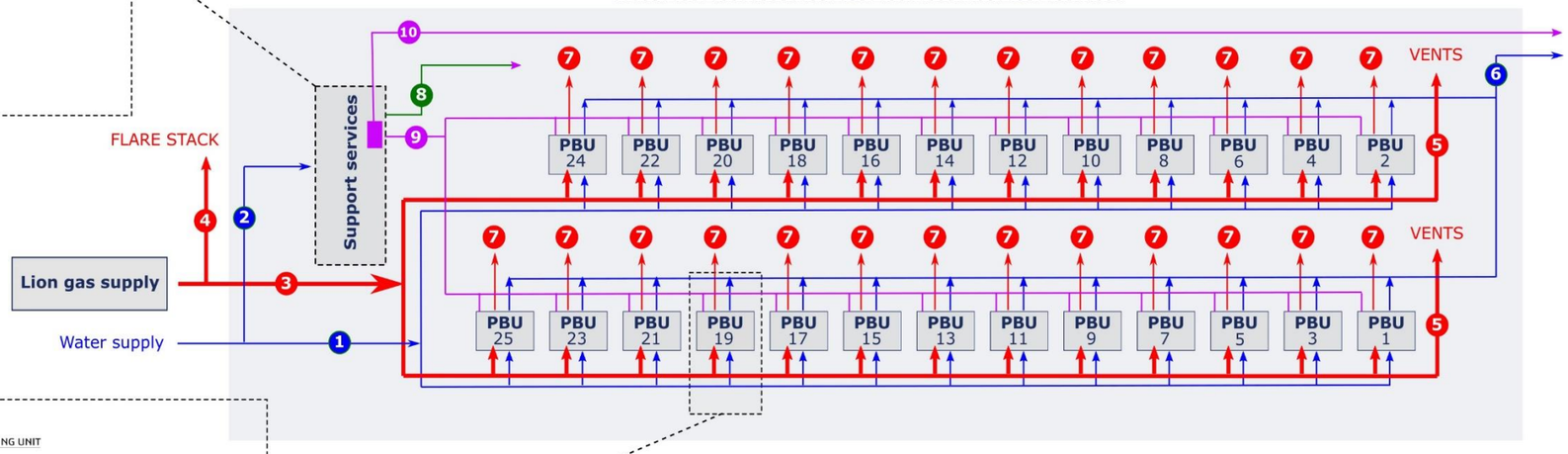
Isometric view of Support Services area

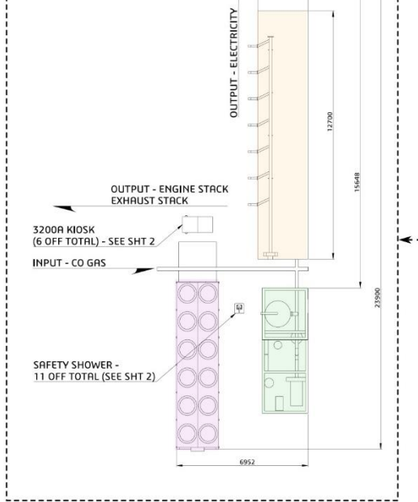
Main process descriptions.

1. - Water for top-up and seal water (Booster fan & CGC).
2. - Potable water to support area for domestic use.
6. - Condensate and seal water. To Lion sump.
3. - Furnace gas received from Lion smelter. To PBU's.
4. - Flare stack. To air.
5. - Vents for emergency use, such as purging. To air.
7. - Exhausts from the PWR Blok units. To air.
8. - Sewage from ablutions and kitchen. To Lion WWTW.
9. - Electricity from PBU's to substation.
10. - 11KV Electricity from substation to Lion.

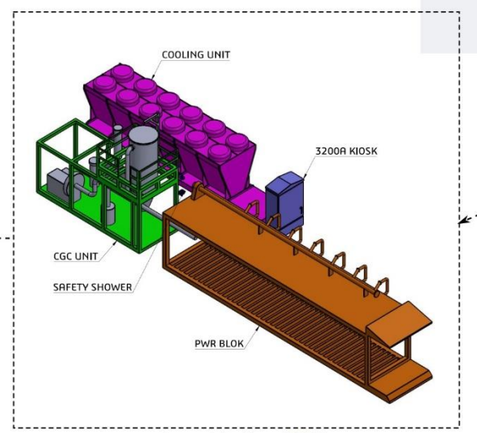
Abbreviations:

PBU - Power Block Unit
CGC - Containerised Gas Conditioner
WWTW - Waste Water Treatment Works





Schematic view of PBU



Isometric view of PBU

Figure 1: Process flow diagram

2.2 PROJECT LOCATION

The Lion Smelter site falls within the Fetakgomo – Greater Tubatse Local Municipality (FGTM) which is located within the Greater Sekhukhune District Municipality of the Limpopo Province of the Republic of South Africa. The Lion ECF will be located within the Lion Smelter premises, farm Xtrata 630 KT, with the following central coordinates: 24°49'15.69"S, 30° 6'35.76"E (WGS84).

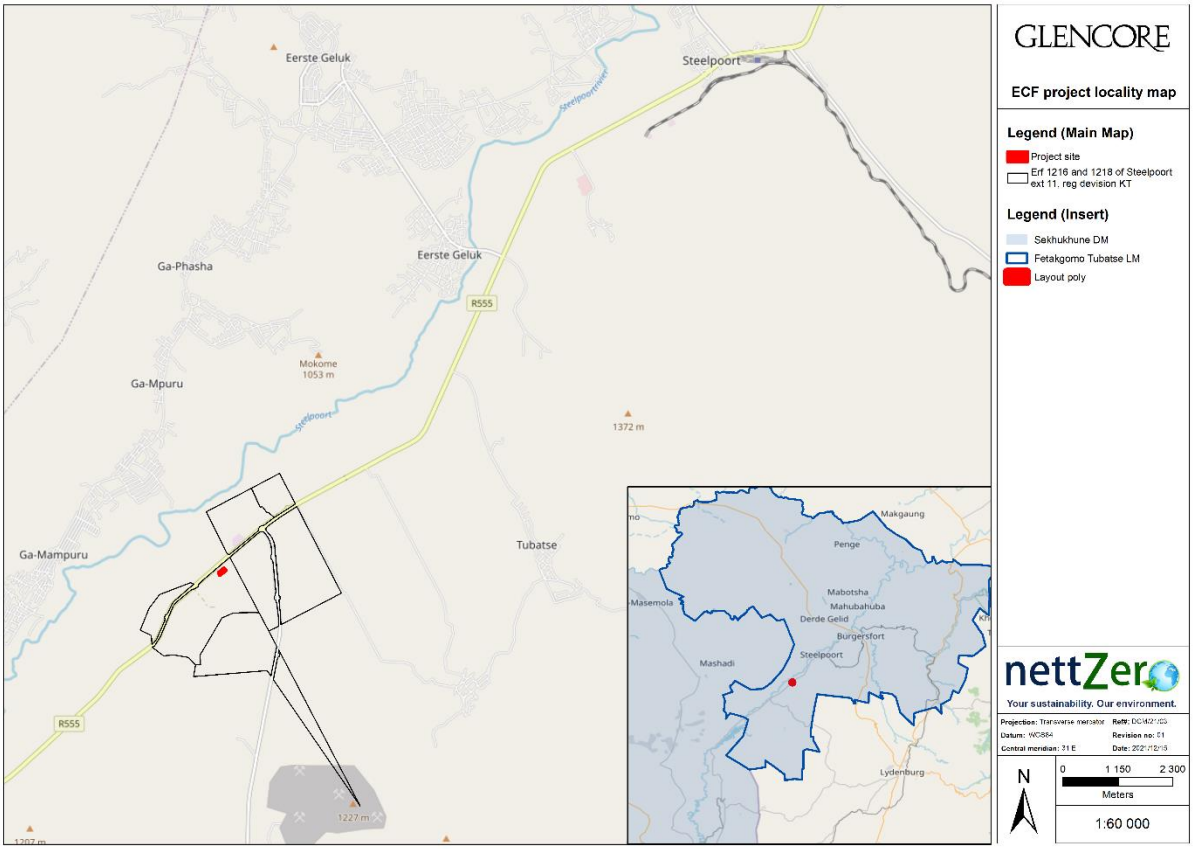


Figure 2: Locality map of the proposed development

2.3 DIRECTLY AFFECTED PROPERTIES

FARM/AREA	PORTIONS/HOLDINGS
Farm Xtrata	630 KT

2.4 CURRENT LAND USE

Large portions of land within the Sekhukhune District and the FTLM are subject to land claims which influences the land-uses. These land parcels usually fall under traditional authorities and sometimes competing claims have been lodged. Most of these claims are not likely to be easily resolved and need tenure reform rather than restitution. The nature of land claims in the district hampers development and result in shortages of land but can also cause instability amongst communities.

Although the study area does not fall under the jurisdiction of a tribal authority, land claims have been lodged for the farms Kennedy's Vale 361 KT (Bakgatla Ba Mosehla Community) and Spitskop 333 KT. These farms have been consolidated into the farm Xstrata 630 KT. The status of the land claims is under review, but the claims have not been settled (Government Gazette Vol 663 no 41473 dated 2 March 2018).

The land-use in the study area is characterised by various mining related activities. Some land parcels in the study area are zoned as Industrial 2. A Special Economic Zone (SEZ) is further proposed on the farm Spitskop 333 KT to the northeast of the proposed site along the R555.

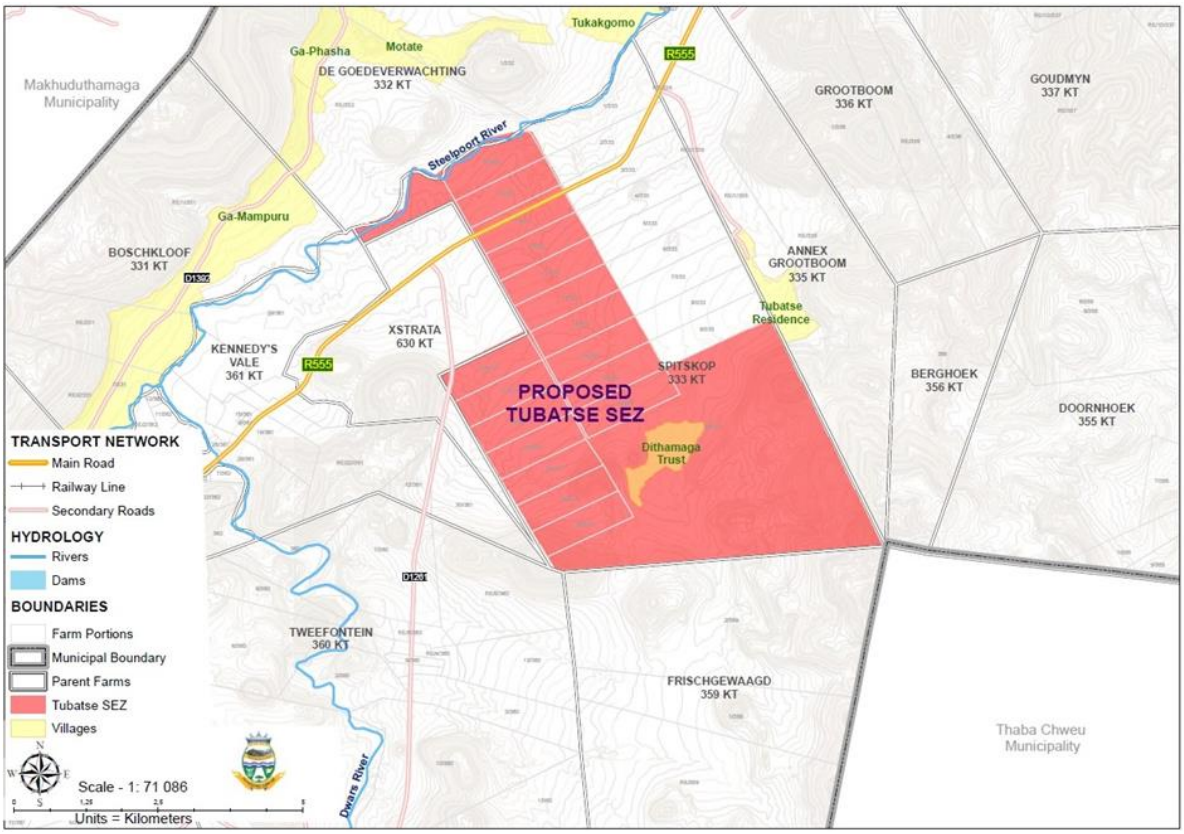


Figure 3: Proposed Tubatse SEZ (www.globalafricanetwork.com)

Steelpoort town is characterised by mixed used developments that include heavy engineering enterprises; suppliers to the mines; transport facilities; building material suppliers; distributors/ wholesale, medium density housing and a small retail component.

Various mines are found within the larger study area, and include the following mines to the northeast towards Burgersfort:

- Tubatse Ferrochrome;
- Winterveld Chrome Mine; and

- Modikwa Platinum Mine.

Mines to the south include:

- Tweefontein Mine;
- Dwarsrivier Chrome Mine;
- Two Rivers Platinum Mine;
- Thorncliffe Chrome Mine;
- Der Brochen Mine;
- Helena Mine; and
- Magareng Mine.

The land-uses in the larger area impact on the visual character which ranges from natural rural areas, and rural settlements to mining related activities and infrastructure. The proposed site for the ECF is thus surrounded by areas of mining activity as well as natural veld with some hills to the south and larger mountains further to the north.

2.5 OUTCOME OF NATIONAL WEBBASED SCREENING REPORT

A Screening Report, using the national web-based screening tool, was generated on 18 August 2021 and again on 2 February 2022 by Nettzero (Pty) Ltd in the following application category: "Activity requiring permit or licence in terms of National or Provincial legislation governing the release or generation of emissions".

The most recent generated Screening Report is attached as Appendix A – Screening Report.

2.5.1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

The proposed development falls within the Olifants Environmental Management Framework (OEMF), Zone B (Highveld to Bushveld transition area).

2.5.1.1 Constraints, opportunities, and potential conflicts within the OEMF

As per the EMF, several constraints have been identified for this zone, including the following:

- Over-allocation of water resources;
- Drought has been identified as a possible risk;
- A high possibility of containing critically endangered and endangered vegetation, which currently does not fall within a statutory or private protected area;
- Risk of losing vegetation from encroaching developments;
- Excessive medicinal plant harvesting;

- Pollution of water resources from human activities; and
- Poorly functioning municipal sewage treatment plants.

The following opportunities have been identified by the published EMF:

- Rich in mining resources (chrome, platinum and vanadium) and potential for future mining operation exists;
- Part of the Sekhukhuneland Centre of Endemism (SCE) and has a relatively unspoilt natural environment where large areas has been identified as possible conservation areas by the National Protected Areas Expansion Strategy (containing endangered vegetation);
- Good opportunity for conservation, recreation and tourism;
- Development of cultural activities also has some potential; and
- Some areas classified as highly arable land and irrigated agriculture also takes place in this zone.

There are, however, potential conflicts between the opportunities identified above, as in most instances the mining resources overlaps with the SCE, implying that an opportunity cost analysis will be required to determining how the course of action of one opportunity, will affect the viability of the other. In this zone the main conflict anticipated is tourism and conservation verses mining activities.

2.5.1.2 Desired state of the OEMF

Table 1 summarises the desired state of management Zone B and identified management guidelines:

Table 1: Summary of the desired state identified in the published Olifants Environmental Framework (OEMF)

TOPIC	REQUIRED STATE	GUIDELINES	RESPONSIBILITY
Water utilisation	• Due to the over-allocation of water resources within this zone, the ecological reserve requirements must always be met ensuring the health of the river ecosystem. • Due to current activities within this zone causing significant pollution, the strictest possible water quality release standards must be applied. • Releases must be monitored effectively, and transgressors should be dealt with in terms of the applicable legislation. • Introduction of a polluter pays charge system should be considered that allocates clean-up cost as well as the opportunity cost of the pollution to the polluter.	*Water allocation:* • No further negative impact on the ecological reserve of any part of the river system. • Water allocation to meet the needs of municipalities to take prevalence over the allocation to other users. • Water allocations for the agricultural, mining and industrial sectors must come from savings from existing allocations that are relocated. • Illegal use of water must be investigated, followed up and perpetrators should be prosecuted. Water quality: • Water released back into the system must comply with the relevant quality standards. • Water release quality standards must be applied strictly, and transgressors should be prosecuted. • Municipalities should be capacitated to upgrade and manage sewage works to acceptable standards. • Municipalities that fail, should be prosecuted.	Department of Water and Sanitation (DWS) and water users

TOPIC	REQUIRED STATE	GUIDELINES	RESPONSIBILITY
Conservation	• Due to the high conservation potential and several existing conservation areas, conservation should be the dominant and key land use in the area. • Establishment of conservation zones should be actively encouraged. • All other activities that are allowed in the area should be done in such a way that it does not diminish the conservation potential. • Ecology of river systems should be rehabilitated to a natural state. • Exotic fish species and other organisms in the zone should be eradicated to allow for the reestablishment of indigenous species in the rivers and streams.	• All natural wetlands, riparian areas and river systems that occur in the zone as depicted on Spot 5 satellite images dated on or before 30 November 2009 must be maintained in at least the area and condition as at 30 November 2009. • Conservation and associated tourism are the preferred land-use in the area and any other land-use that is allowed should not have significant detrimental long term impact on the conservation land-use focus.	• Land owners and users • DEA, Department of Mineral Resources and Energy (DMRE) , LDEDET and MDEDET
Tourism	• Due to the high potential for natural tourism, the active promotion of tourism in this zone should become a planning priority at national, provincial, and local levels of government. • Private investment in tourism with an emphasis on quality tourism products that match the tourism potential of the area should be encouraged.		
Mining	• Before any further mining is allowed in this zone, a Strategic Mining Plan (SMP) should be developed between the relevant government departments to	• A strategic mining plan should be developed for this zone that limits the unrehabilitated surface area of mines to the minimum possible.	• DMRE

TOPIC	REQUIRED STATE	GUIDELINES	RESPONSIBILITY
	ensure mining occurs in a manner that is appropriate to the overall nature of the zone. • Meets the requirements to ensure that the conservation and tourism potential of the area is not diminished. • Mining to be limited to an agreed maximum surface area and that further mining should be dependant on the successful completion and rehabilitation of mining activities as stipulated in the SMP.		
Industry	• Due to the conservation and tourism potential within this zone, heavy industry should not be allowed in this zone. • Metallurgical industries associated with mines in the zone should be located on derelict land outside the zone.	• The EMF principles should be used as guiding norms in the evaluation and decision-making processes of activities that requires an authorisation, licence or permit from government.	• All government institutions
Agriculture	• Agriculture is not regarded as growth activity in Zone B due to limited suitable land. • Cattle grazing as a land use on natural vegetation should continue where conservation is not established in a manner that does not lead to overgrazing. • The same applies to game farms.		
Transportation	• The current status of major roads within this area are exceptionally poor, and the repair and maintenance of these roads should therefore be a high priority.		

TOPIC	REQUIRED STATE	GUIDELINES	RESPONSIBILITY
Business, service and government	• The zone is rural in nature and business activities are limited to small rural towns and local service centres. • Legislation is ahead of the ability of government to implement it, prevails in this zone.	*Cooperative government:* • Government instructions at all levels should coordinate their activities in such a way that authorisations, licences and permits issued does not conflict with one another. • Government should focus on implementation of legislation and policies especially in respect to compliance monitoring and enforcement. *Air Quality:* • The Air Quality Management Plan (AQMP) (currently being compiled) that will apply to the zone should be implemented. • The implementation of the AQMP should be monitored and where it fails corrective action must be taken.	• All government institutions

2.5.2 RELEVANT DEVELOPMENT INCENTIVES, RESTRICTIONS, EXCLUSIONS OR PROHIBITIONS

The proposed development falls within the Strategic Transmission Corridor (International Corridor). Transmission development within the location of the site will be confirmed during the Basic Assessment process.

2.5.3 ENVIRONMENTAL SENSITIVITY IDENTIFIED

The screening tool identified the following sensitivities (Table 2):

Table 2: Environmental sensitivities identified by the Screening Report

THEME	VERY HIGH SENSITIVITY	HIGH SENSITIVITY	MEDIUM SENSITIVITY	LOW SENSITIVITY
Agriculture		x		
Animal Species			x	
Aquatic Biodiversity				x
Archaeological and Cultural Heritage				x
Civil Aviation		x		
Defence Theme				x
Palaeontology			x	
Plant Specie			x	
Terrestrial Biodiversity				x

The following list of specialist assessments have been identified for inclusion in the assessment report:

1. Agricultural Impact Assessment;
2. Landscape/Visual Impact Assessment;
3. Archaeological and Cultural Heritage Impact Assessment;
4. Palaeontology Impact Assessment;
5. Terrestrial Biodiversity Impact Assessment;
6. Aquatic Biodiversity Impact Assessment;
7. Hydrology Assessment;
8. Noise Impact Assessment;
9. Traffic Impact Assessment;
10. Health Impact Assessment;
11. Socio-economic Assessment;
12. Ambient Air Quality Impact Assessment;
13. Air Quality Impact Assessment;
14. Plant Specie Assessment; and
15. Animal Specie Assessment.

Figure 4: Representation of predetermined Terrestrial and Aquatic sensitivities as per the screening report

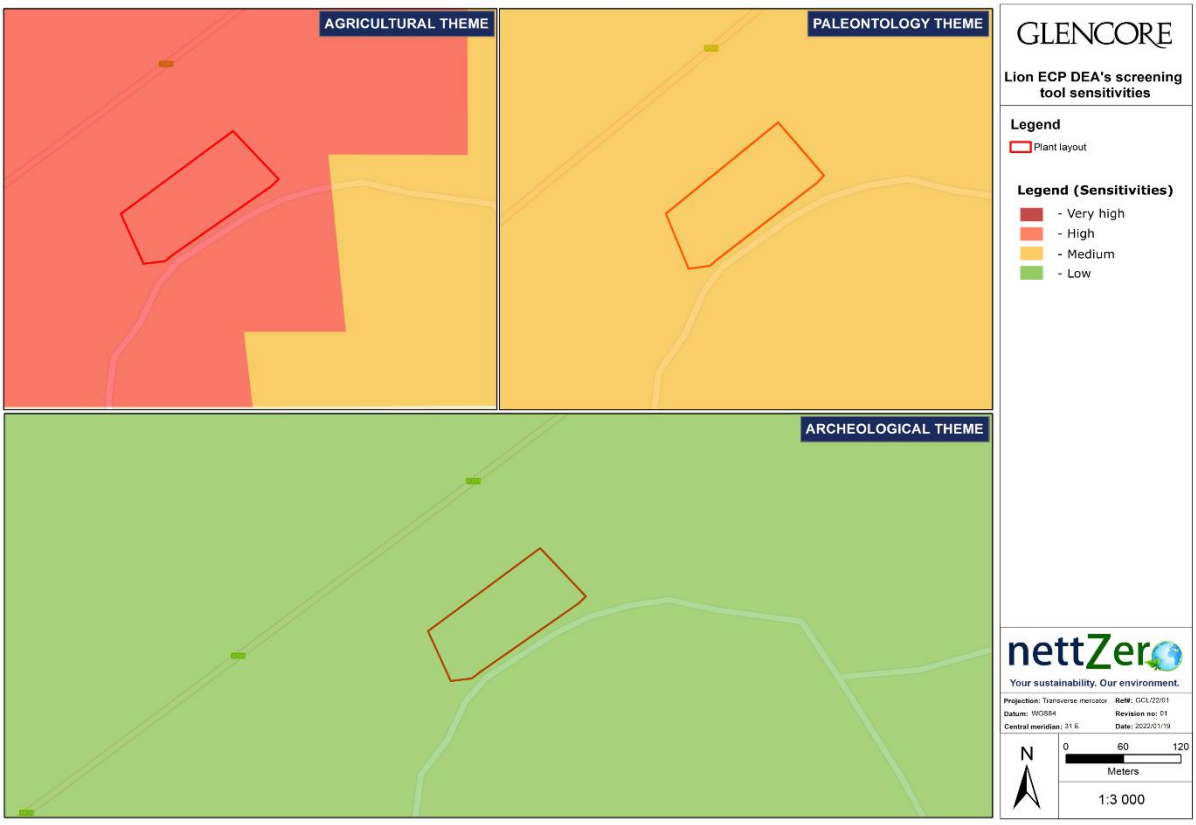


Figure 5: Representation of predetermined Agricultural, Archaeological and Palaeontology sensitivities as per the screening report

2.6 LISTED ACTIVITIES

Table 3 provides the listed activities expected at this stage as part of the Basic Assessment Process (BA) and Air Emissions Licence (AEL) application.

Table 3: Listed activities associated with the proposed ECF project

ACTIVITY DESCRIPTION	RELEVANT LEGISLATION	LISTED ACTIVITIES	KEY PROCESS COMPONENTS
Construction, operation, and Closure of the Energy Conversion Facility (PWR BLOK 400-F Units)	**GNR 983 GG 38282 dated 4 December 2014** (as amended by GN 327 GG 4077 dated 7 April 2017, GN 706 GG 41766 dated 13 July 2018, and GN 517 GG 44701 dated 11 June 2021) – Environmental Impact Assessment Regulations, Listing Notice 1	**Activity 2** - The development and related operation of facilities or infrastructure for the generation of electricity from a non-renewable resource where— (i) the electricity output is more than 10 megawatts but less than 20 megawatts; or (ii) the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare. **Activity 15 –** The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of vegetation is required for – (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan. **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	• Environmental Authorisation (EA) application in terms of NEMA; • Site Sensitivity Verification Report; • Basic Assessment Report (BAR), Environmental Management Programme (EMPr), and Closure Plan; • Specialist Reporting as required by the Screening Report generated by the National Web-based screening tool; • Amendment of the existing Air Emissions Licence (AEL); and • Engagement with the registered I&AP.

ACTIVITY DESCRIPTION	RELEVANT LEGISLATION	LISTED ACTIVITIES	KEY PROCESS COMPONENTS
		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.	
	GNR 985 GG 38282 dated 4 December 2014 (as amended by GN 324 GG 4077 dated 7 April 2017, GN 706 GG 41766 dated 13 July 2018, and GN 517 GG 44701 dated 11 June 2021) – Environmental Impact Assessment Regulations, Listing Notice 3	**Activity 12** - The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. e. Limpopo i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans; or iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.	

ACTIVITY DESCRIPTION	RELEVANT LEGISLATION	LISTED ACTIVITIES	KEY PROCESS COMPONENTS
Operation of the Energy Conversion Facility (PWR BLOK 400-F Units)	**GN 893 GG 37054 dated 22 November 2013** (as amended by GN 551 GG 38863 dated 12 June 2015, GN 1207 GG 42013 dated 31 October 2018, GN 687 GG 42427 dated 22 May 2019, and GN 421 GG 43174 dated 27 March 2020) – List of activities which result in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage	**Sub-category 1.5: Reciprocating Engines** – Liquid and gas fuel stationary engines used for electricity generation. (All installations with design capacity equal to or greater than 10 MW heat input per unit, based on the lower calorific value of the fuel used)	

3 PURPOSE OF THIS DOCUMENT

As per the GN 320 GG 43110 dated 20 March 2020 (hereafter referred to as the SSV regulations), prior to commencing with the required specialist assessment, as identified by the national web based environmental screening tool, the current use of land and the environmental sensitivity of the site under consideration must be confirmed by the undertaking of a site verification.

The main purpose of this document is to provide the outcome of the site sensitivity verification recorded in a form of a report that:

- Confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool; and
- Provides motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity.

The process of sensitivity verification was undertaken by a registered Environmental Assessment Practitioner (EAP) and team of specialists in the relevant field of practice.

4 EAP DETAILS AND EXPERIENCE SUMMARY

Nettzero (Pty) Ltd, designated Mrs. Anandi Alers (EAP registration no. 2019/1514) as the lead EAP to manage the application process on behalf of the Lion Smelter.

Table 4: Details of the appointed EAP

EAP:	Anandi Alers
EAP REGISTRATION:	2019/1514
CONSULTING COMPANY:	Nettzero (Pty) Ltd
CONTACT NUMBER:	+27 72 604 0455
FAX NUMBER:	+27 86 673 0945
EMAIL:	Anandi.alers@nettzero.co.za

4.1 SUMMARY OF EAP QUALIFICATION

Mrs. Anandi Alers completed a Master of Science degree in Environmental Management and Geography in 2015 at the North West University (Potchefstroom) under the guidance of Prof. Luke Sandham.

She holds a Bachelors of Science Honours degree in environmental sciences, specialising in Environmental Management and Geography, and a Bachelors of Science degree in Tourism, Zoology, and Geography.

4.2 SUMMARY OF EAP'S PAST EXPERIENCE

Mrs Anandi Alers has extensive knowledge of the South African EIA process and holds a Master of Science degree in Environmental Management on the subject of EIA follow-up. Her practical experience includes, but is not limited to the following:

- Environmental Management of a number of construction, mining, and industry related projects;
- Environmental auditing of a number of projects against the approved EMPr's and EA (Environmental Authorisations);
- The development and management of an ISO 14001 EMS (Environmental Management Systems) on a number of construction, mining and industry related projects;
- Development and implementation of policies and procedures managing environmental impacts; and
- Managing applications for a number of permits and licences (EA's, WML's, and WUL's).

4.3 APPOINTED SPECIALISTS

Nettzero has appointed the following independent specialist on behalf of the Lion Smelter, to verify the site sensitivities as well as conducting the required assessments following the SSV (Table 5):

Table 5: List of appointed independent specialist

NAME	DESIGNATION	PROF. REG. /ACCREDITATION	YEARS EXPERIENCE	QUALIFICATIONS
AGRICULTURAL IMPACT ASSESSMENT – LAND MATTERS ENVIRONMENTAL CONSULTING (PTY) LTD				
Rowena Harrison	Soil Scientist	SACNASP Reg. No. 400715/15	> 12 years	PhD Candidate - Soil Science (University of Free State and the University of Burgundy, France)
LANDSCAPE/VISUAL IMPACT ASSESSMENT - LOGIS				
Lourens du Plessis	Visual Impact Assessment Specialist	GISc Practitioner registered with the South African Geomatics Council (SAGC). Membership no. PGP0147	> 29 years	BA (Geography)

ARCHAEOLOGICAL, CULTURAL HERITAGE AND PALAEONTOLOGY IMPACT ASSESSMENT – BEYOND HERITAGE				
Jaco van der Walt	Air quality specialist	Accredited CRM Archaeologist with SAHRA Accredited CRM Archaeologist with AMAFA	> 20 years	Phd (Archaeology)(in progress) MA (Archaeology) BA. Hon. (Archaeology) BA (Archaeology)
TERRESTRIAL BIODIVERSITY, PLANT AND ANIMAL SPECIES IMPACT ASSESSMENT – THE BIODIVERSITY COMPANY				
Andrew Husted	Ecologist and Aquatic Scientist	SACNASP Reg. No. 400213/11	> 12 years	M.Sc in Aquatic Health
Lusanda Matee	Ecologist	SACNASP Reg. No. 11927/2018	> 4 years	B.Sc Honours, and MSc in Biological Sciences from the University of KwaZulu-Natal.
AQUATIC BIODIVERSITY IMPACT ASSESSMENT – THE BIODIVERSITY COMPANY				
Christian Fry	Aquatic Scientist	SACNASP Reg. No. 119082	> 8 years	M.Sc in Aquatic Health
Dale Kindler	Aquatic Scientist	SACNASP Reg. No. 114743	> 9 years	M.Sc in Aquatic Health
HYDROLOGY - GCS				
Hendrik Botha	Geohydrologist	SACNASP Reg. No. 400139/17	> 8 years	B.Sc. Chemistry and Geology B.Sc. Hon. Hydrology M.Sc. Geohydrology and Hydrology
NOISE IMPACT ASSESSMENT - DBACOUSTICS				
Barend van der Merwe	Environmental Noise Specialist	Member of the South African Acoustics Institute (SAAI)	> 20 years	M.Sc
TRAFFIC IMPACT ASSESSMENT - SIYAZI				
Paul van der Westhuizen	Road Engineer			
HEALTH IMPACT ASSESSMENT – INFOTOX (PTY) LTD				
Dr. Willie van Niekerk	Health Scientist	QEP (Qualified Environmental Professional), IPEP, USA, 1996. SACNASP Reg. No. 400284/04	> 20 years	BSc (Chemistry), Potchefstroom, 1965. Hons BSc (Chemistry), Potchefstroom, 1966. MSc (Chemistry), Potchefstroom, 1967. PhD (Chemistry), UNISA, 1973.
SOCIO-ECONOMIC ASSESSMENT – BATHO EARTH				

Ingrid Snyman	Social Scientist		> 20 years	B A (Political Science) University of Pretoria B A (Hons) Anthropology University of Pretoria
AIR QUALITY – ENVIRONGAKA (PTY) LTD				
Jan Potgieter	Chemical Engineer	ECSA Reg. No. 20040140	> 15 years	Degree in Chemical Engineering

5 VERIFICATION APPROACH & METHOD

The SSV regulations requires that the verification of environmental sensitivities must be undertaken through the use of:

- A desktop analysis, using satellite imagery;
- A preliminary on-site inspection; and
- Any other available and relevant information.

Following the outcome of the desktop analysis and the on-site inspection, the EAP and specialist confirmed or disputed the current land and environmental sensitivity as identified by the screening tool, providing the motivation and evidence thereof (see section 6).

5.1 DESKTOP ANALYSIS

Various sources were utilised by the EAP and specialist to conduct the required desktop analysis in order to verify the sensitivities associated with the proposed development. Table 6 summarises the sources used by the specialist:

Table 6: Sources used for the desktop analysis

SPECIALIST ASSESSMENT	SOURCES USED
Agricultural Impact Assessment	The desktop study involved the examination of aerial photography and Geographical Information System (GIS) databases. The study made use of the following data sources: • Google Earth™ satellite imagery was used at the desktop level. • Relief dataset from the Surveyor General was used to calculate slope. • Background Information was gathered from the Energy Conversion Facility – Overview of Works for Environmental Assessment' document prepared by Craig Roberson. (2021).

SPECIALIST ASSESSMENT	SOURCES USED
Landscape/Visual Impact Assessment	The study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from topographical data provided by the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) elevation model.
Archaeological and Cultural Heritage Impact Assessment, and Palaeontology Impact Assessment	A brief survey of available literature was conducted to extract data and information on the area in question to provide general heritage context into which the development would be set. This literature search included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). Google Earth and 1:50 000 maps of the area were utilised to identify possible places where sites of heritage significance might be located; these locations were marked and visited during the fieldwork phase. The database of the Genealogical Society was consulted to collect data on any known graves in the area.
Terrestrial Biodiversity, Animal, and Plans Specie Impact Assessment	The desktop assessment was principally undertaken using a Geographic Information System (GIS) to access the latest available spatial datasets to develop digital cartographs and species lists. The following data sets were used: • National Biodiversity Assessment 2018 (Skowno *et al*, 2019); • South Africa Protected Areas Database (SAPAD) (DEA, 2020); • National Protected Areas Expansion Strategy (NPAES) (SANBI, 2017); • The Limpopo Conservation Plan, Version 2 (LCPv2); • Important Bird and Biodiversity Areas (BirdLife South Africa, 2015); • South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Van Deventer *et al*., 2018); • The Vegetation of South Africa, Lesotho, and Swaziland (Mucina & Rutherford, 2006); • Plants of Southern Africa (POSA) database; • Red List of South African Plants (Raimondo *et al.,* 2009; SANBI, 2020);

SPECIALIST ASSESSMENT	SOURCES USED
	• Botanical Database of Southern Africa (BODATSA); • Field Guide to the Wild Flowers of the Highveld (Van Wyk & Malan, 1997); • A field guide to Wildflowers (Pooley, 1998); • Guide to Grasses of Southern Africa (Van Oudtshoorn, 1999); • Orchids of South Africa (Johnson & Bytebier, 2015); • Guide to the Aloes of South Africa (Van Wyk & Smith, 2014); • Mesembs of the World (Smith *et al.,* 1998); • Medicinal Plants of South Africa (Van Wyk *et al.,* 2013); • Freshwater Life: A field guide to the plants and animals of southern Africa (Griffiths & Day, 2016); and • Identification guide to southern African grasses. An identification manual with keys, descriptions and distributions (Fish *et al.,* 2015).
Aquatic Biodiversity Impact Assessment	The following databases was used to conduct the required desktop assessment: • Limpopo Biodiversity Conservation Plan (LCP, 2013)
Hydrology Assessment	Hydrometeorological data for the study area were obtained from the sources: • South African Water Resources Study WR2012 database **Invalid source specified.**; • South African Atlas of Agrohydrology, and Climatology **Invalid source specified.**; • Daily Rainfall Data Extraction Utility **Invalid source specified.**; • Köppen Climate Classification (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006); • World Climate Data CMIP6 V2.1 **Invalid source specified.**; • Meteoblue (Meteoblue, 2021).
Health Impact Assessment	The approach that will be taken to determine the health impact associated with the proposed development will be based on the following information: • Existing information as per the current atmospheric emissions from the existing Glencore Lion Smelter, regulated by the

SPECIALIST ASSESSMENT	SOURCES USED
	Atmospheric Emission Licence (no. SK17/1/8/5/AEL/Glencore/1); and • The outcome of the Dispersion Model of the proposed development. A comparative health risk assessment will be conducted between the current (baseline) scenario and the post-installation emissions scenario from the proposed ECF project.
Social - Economic Impact Assessment	The literature review assisted the consultants to establish the social setting and characteristics of the study area, as well as the key economic activities. Secondary data, which was not originally generated for the specific purpose of the study, were gathered and analysed for the purposes of the study. Such data included maps, census data, internet searches, and the Integrated Development Plan (IDP) of the Fetakgomo Tubatse Local Municipality (FTLM).
Air Quality Impact Assessment	As per the provided "Plan of Study", the following databases will be used to determine the baseline as part of the desktop analysis: • US Geological Survey (Earth Explorer/Data), SRTM at 30 m resolution elevation data; and • Meteorological date recorded at Lion Smelter.

5.2 ON-SITE INSPECTION

An onsite inspection was conducted by the EAP and the appointed specialist. The site inspection included verification of the sensitivities as recorded by the national web-based screening tool. Photographic evidence during the site visits were recorded and is attached as Appendix B.

Table 7 summarises the dates of the onsite inspection:

Table 7: Summary of dates the onsite inspections were conducted

SPECIALIST	DATE OF ONSITE INSPECTION
EAP	14 December 2021
Agricultural Impact Assessment	30 November 2021
Landscape/Visual Impact Assessment	N/A – verified by the EAP on behalf of the specialist on 14 December 2021
Archaeological and Cultural Heritage Impact Assessment, and Palaeontology Impact Assessment	29 November 2021

SPECIALIST	DATE OF ONSITE INSPECTION
Terrestrial Biodiversity, Animal, and Plant Species Impact Assessment	14 December 2021
Aquatic Biodiversity Impact Assessment	14 December 2021
Hydrology Assessment	N/A – verified by the EAP on behalf of the specialist on 14 December 2021
Noise Impact Assessment	29 November 2021
Traffic Impact Assessment	25 & 26 November 2021
Health Impact Assessment	N/A – verified by the EAP on behalf of the specialist on 14 December 2021
Social - Economic Impact Assessment	1 December 2021
Air Quality Impact Assessment	N/A – verified by the EAP on behalf of the specialist on 14 December 2021

6 VERIFICATION OUTCOME

This section will summarise the findings following the desktop analysis and the onsite inspection, with the focus verifying the land use and site sensitivities as identified in by the screening tool.

6.1 OVERVIEW OF SITE ENVIRONMENT

6.1.1 CLIMATE

6.1.1.1 Temperature

The average yearly temperature (refer to Figure 6) for the project area ranges from 23 to 37 ˚C (high) and 3 to 8 °C (Low). The study area is situated in a warm temperate, winter dry, hot summer climate (Cwa), as per the Köppen Climate Classification (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006). Hence, the area received summer rainfall.

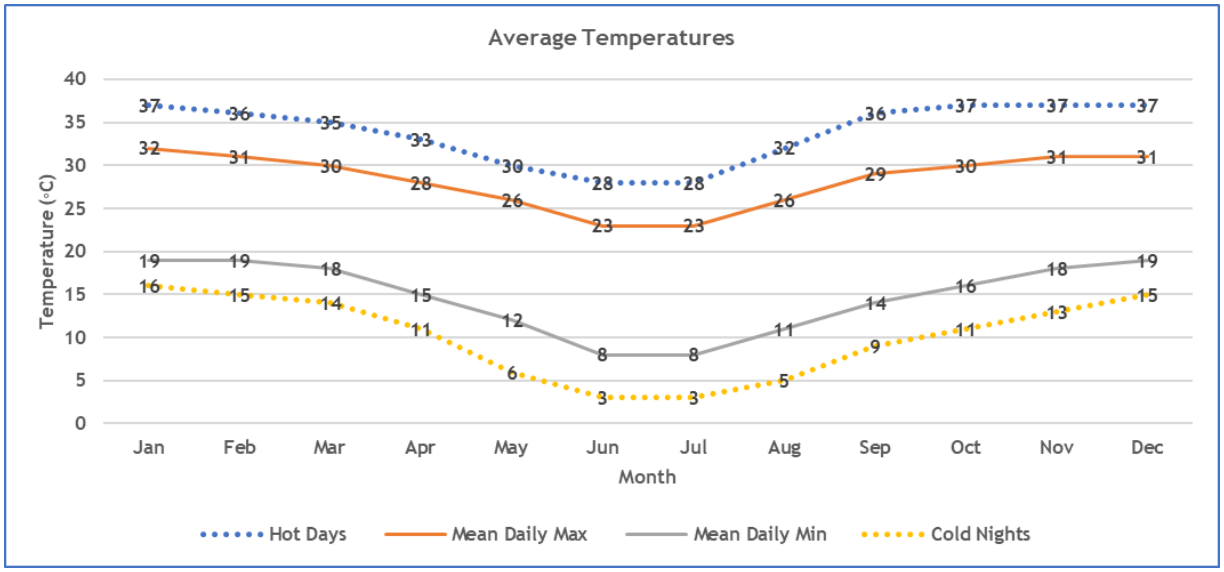


Figure 6: Average yearly temperatures (Meteoblue, 2021)

6.1.1.2 Wind speed and direction

Figure 7 shows the wind rose for the project area (the site used as a reference site) and presents the number of hours per year the wind blows from the indicated direction. Wind generally blows from North East, North-North East, at velocities from <5 to >28 km/h. Precipitation intensity during wind will likely cause intensity changes on slopes perpendicular to the wind direction, throughout the year.

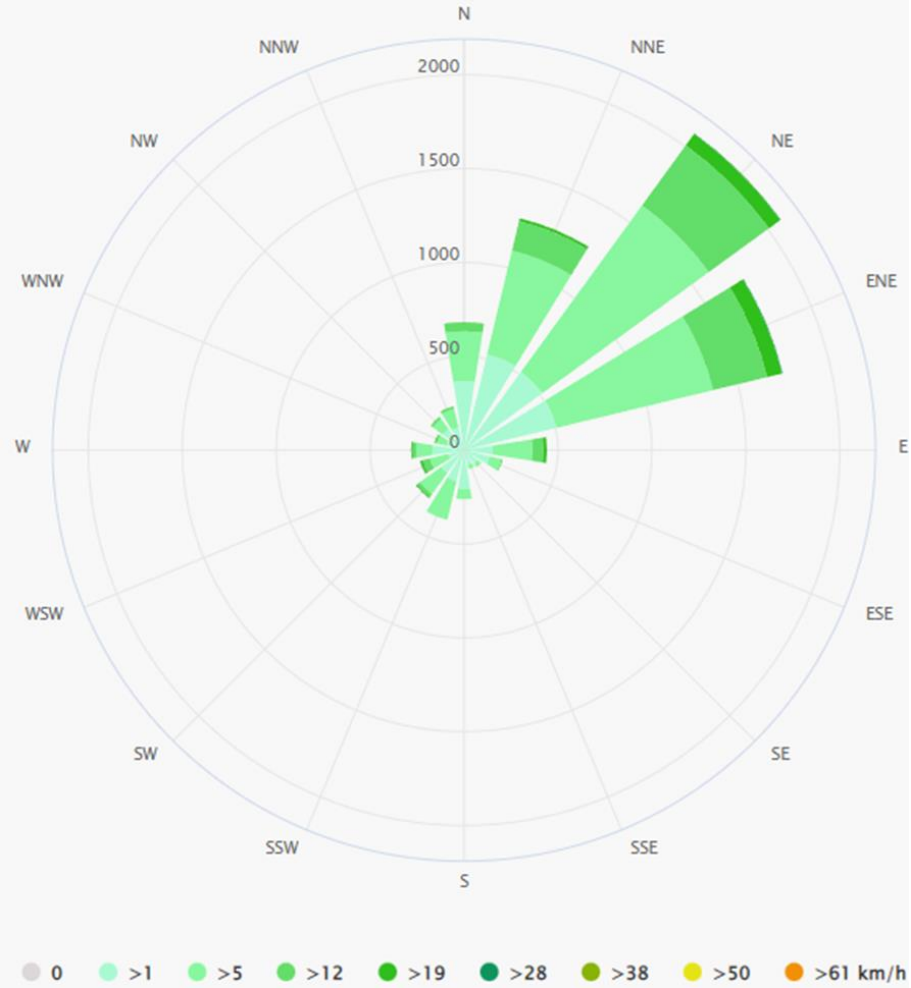
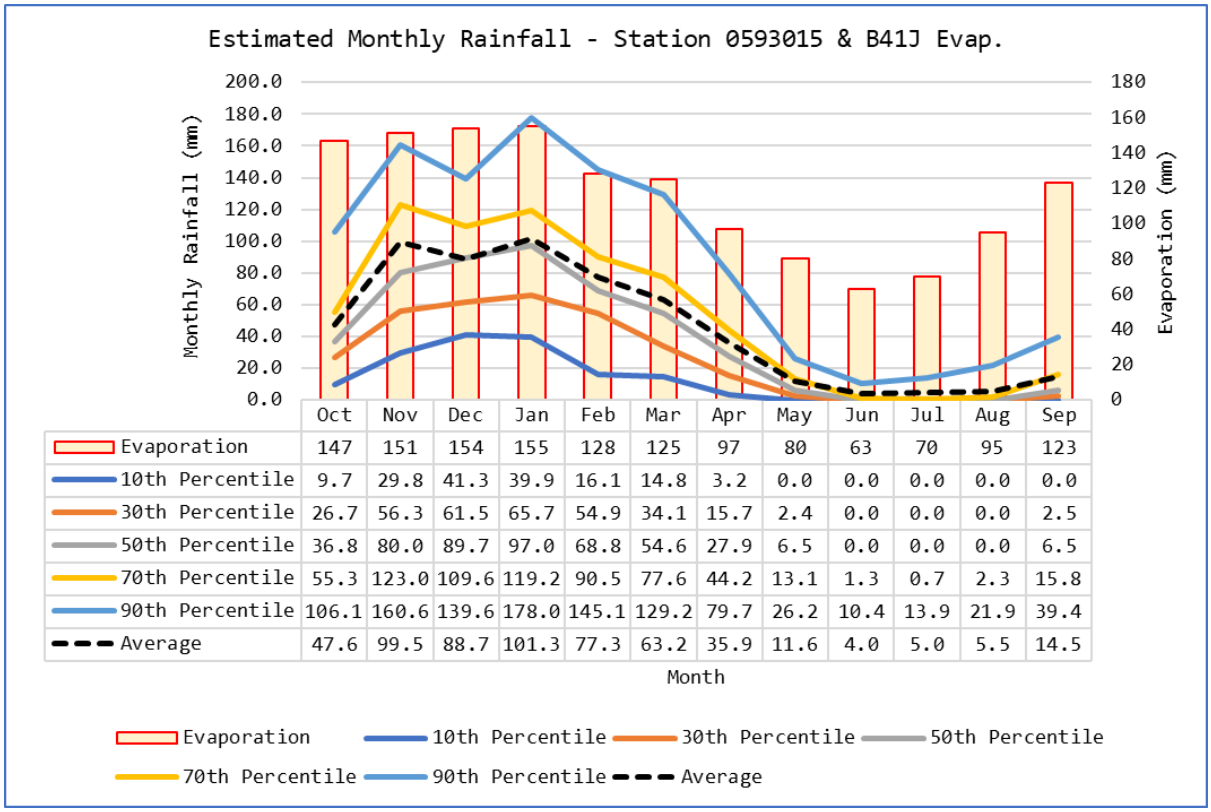


Figure 7: Wind rose for the proposed site as centre point (Meteoblue, 2021)

6.1.1.3 Rainfall and evaporation

The project area is situated in rainfall zone B4D. The rainfall data used to calculate Mean Annual Precipitation (MAP) was obtained from rainfall station 0593015 (station Sekhukhuneland situated 12km NW of the site). Available rainfall data suggest a MAP ranging from 319 (30th percentile) to 1050 (90th percentile) mm/yr, based on a historical record of 76 years (i.e., 1907 to 1983). The average rainfall is in the order of 554 mm/yr. Design rainfall data (Station: Sekhukhuneland) suggest a MAP in the order of 552 mm/yr – hence the data is in the same order of magnitude. Monthly rainfall for the site is likely to be distributed as shown in Figure 8, below.

The site falls within evaporation zone 4A, of which Mean Annual Evaporation (MAE) ranges from 1 300 to 1 500 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Monthly evapotranspiration for the site is likely to be distributed as shown in Figure 8, below.

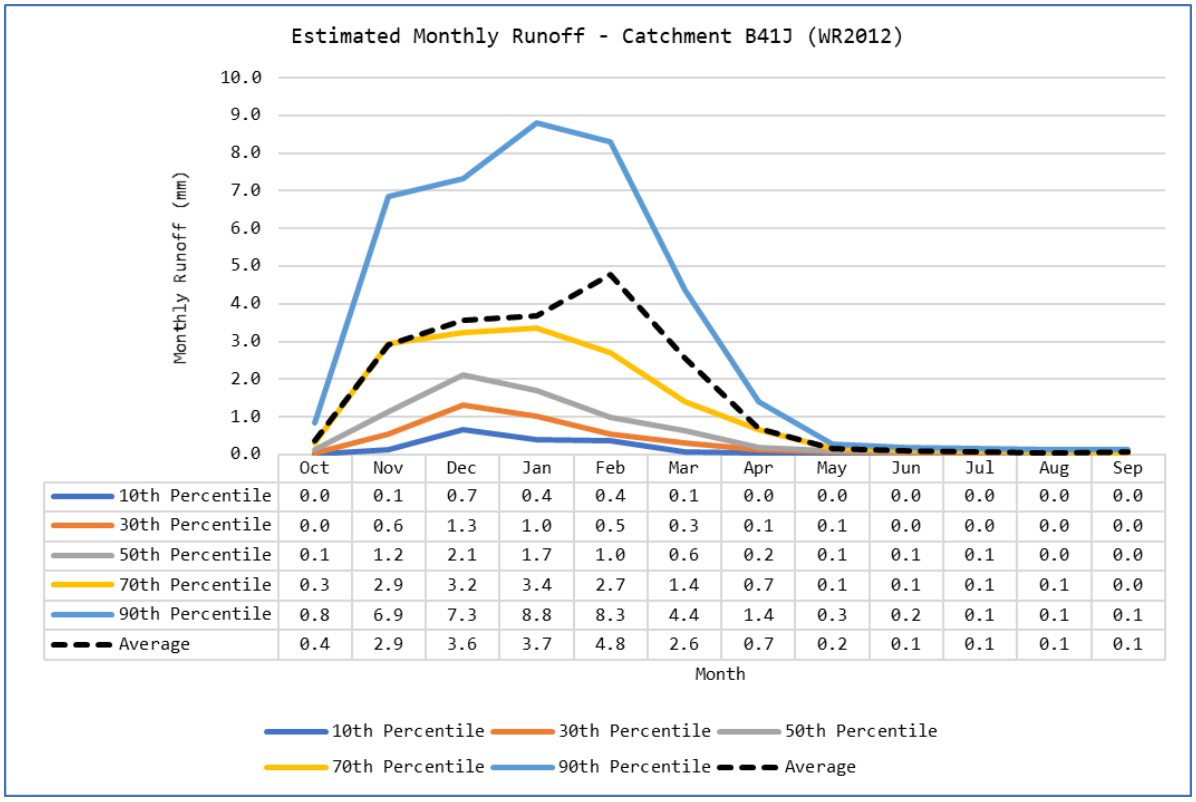


	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation	147	151	154	155	128	125	97	80	63	70	95	123
10th Percentile	9.7	29.8	41.3	39.9	16.1	14.8	3.2	0.0	0.0	0.0	0.0	0.0
30th Percentile	26.7	56.3	61.5	65.7	54.9	34.1	15.7	2.4	0.0	0.0	0.0	2.5
50th Percentile	36.8	80.0	89.7	97.0	68.8	54.6	27.9	6.5	0.0	0.0	0.0	6.5
70th Percentile	55.3	123.0	109.6	119.2	90.5	77.6	44.2	13.1	1.3	0.7	2.3	15.8
90th Percentile	106.1	160.6	139.6	178.0	145.1	129.2	79.7	26.2	10.4	13.9	21.9	39.4
Average	47.6	99.5	88.7	101.3	77.3	63.2	35.9	11.6	4.0	5.0	5.5	14.5

Figure 8: Rainfall distribution (station o593014) (WRC, 2015)

6.1.1.4 Runoff

Runoff from natural (unmodified) catchments in Catchment B41J is simulated in WR2012 as being equivalent to 19 mm/yr over the surface area (WRC, 2015). This is equal to approximately 3% of the MAP and amounts to approximately 13 Mm^3/yr over the surface of the quaternary catchment. Monthly runoff is distributed as shown in Figure 9, below.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	0.0	0.1	0.7	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
30th Percentile	0.0	0.6	1.3	1.0	0.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0
50th Percentile	0.1	1.2	2.1	1.7	1.0	0.6	0.2	0.1	0.1	0.1	0.0	0.0
70th Percentile	0.3	2.9	3.2	3.4	2.7	1.4	0.7	0.1	0.1	0.1	0.1	0.0
90th Percentile	0.8	6.9	7.3	8.8	8.3	4.4	1.4	0.3	0.2	0.1	0.1	0.1
Average	0.4	2.9	3.6	3.7	4.8	2.6	0.7	0.2	0.1	0.1	0.1	0.1

Figure 9: Simulated runoff for catchment B41J (WRC, 2015)

6.1.2 TOPOGRAPHY

The larger area in which the project is to be located is characterised by a landscape dominated by flat plains which are surrounded by hills of moderately steep topography. The project site is situated within an anthropogenically modified environment as a result of the existing Lion Smelter infrastructure. It has a north-westerly aspect with a gentle slope. Average slopes are 3-4%, with a maximum slope of 8.5%. The project site ranges in altitude from 812 m above sea level (absl) along the eastern boundary to 806m absl along the western boundary. Topography is therefore not a limitation to agricultural production.

6.1.3 LAND TYPE

Land type data for the site was obtained from the Agricultural Research Council (ARC). The land type data is presented at a scale of 1:250 000 and entails the division of land types, typical terrain cross sections for the land type and the presentation of dominant soil types for each of the identified terrain units (in the cross section). The soil data is classified according to the Binomial System. The soil data was interpreted and re-classified according to the Taxonomic System (Land Type Survey Staff, 1972-2006).

The project site is situated within the Ae27 Land Type as defined in the relevant Land Type Map (2430 Pilgrims Rest). Ae indicates land with red and yellow soils with a high base status. Soil forms are therefore represented by either a red apedal (structureless), yellow-brown apedal or neocutanic horizons. These soils are classified as the Hutton, Clovelly, Griffin, and Oakleaf soil forms. They are regarded as mature soils and have a high infiltration rate. They generally have an increase in clay content with depth in the profile. The soils are however expected to be shallow in nature (>300mm deep). These soils therefore have limitations for crop cultivation.

6.2 AGRICULTURAL AND SOIL

In field data collection was taken on the 30th of November 2021. Soil sampling was conducted throughout the project area using a standard hand-held auger with a depth of 1200mm. At each sampling point the soil was described to form and family level according to "Soil Classification: A Natural and Anthropogenic System for South Africa" (Soil Classificatoin Working Group, 2018).

The following properties were recorded:

- Soil diagnostic horizons;
- Depth of the profile;
- Soil colour – as per the Munsell System;
- Soil field texture;
- Permeability of the B horizon (wetness indicators);
- Effective rooting depth; and
- Observations at the sampling point including any surface crusting, vegetation cover and rockiness.

6.2.1 SOIL CHARACTERISTICS

Table 8 gives information on the different soil characteristics identified within the project site.

Table 8: Soil data collected at the site

SOIL FORM	DIAGNOSTIC HORIZONS	SOIL FAMILY CODE	FIELD TEXTURE	EFFECTIVE ROOTING DEPTH (MM)	PERMEABILITY	SLOPE CLASS (%)
Palala	Orthic A Neocutanic B Pedocutanic	Pl 2120	Sandy Clay	450	Restricted	0-2%
Palala	Orthic A Neocutanic B Pedocutanic	Pl 2120	Sandy Clay	400	Restricted	0-2%
Hofmeyr	Orthic A Neocutanic B Hard Rock	Hf 2122	Sandy Clay Loam	400	Restricted	6-8%

SOIL FORM	DIAGNOSTIC HORIZONS	SOIL FAMILY CODE	FIELD TEXTURE	EFFECTIVE ROOTING DEPTH (MM)	PERMEABILITY	SLOPE CLASS (%)
Grabouw	Physically Disturbed Anthrosol	Gr 1000	Sandy Clay	100	Severely Restricted	3-5%

The desktop and field investigation identified the following important soil and landscape characteristics of the site:

- **Soil texture:** Analysis of the texture during the field investigation revealed that the soils within the site are a sandy clay loam to a sandy clay texture. These soils therefore have a clay percentage of 30-60%, with an increase in clay content with depth in the soil profile. The soils were found to be luvic in nature, meaning that there was an identifiable increase in clay content with depth in the profile. The presence of a pedocutanic layer in the Palala soils is a clear textural contrast between the overlying neocarbonate layer. A pedocutanic horizon has a strong structure and is seen as a limitation to plant growth as well as the infiltration of stormwater.
- **Soil depth:** Soil depth for crop growth is limited within the project site as a result of the presence of the pedocutanic horizon as well as the presence of hard rock. Profiles varied from 400mm to 450mm, limiting the type of crop that can be grown within the site. The area is therefore more suited to grazing activities.
- **Soil permeability:** The permeability of the soils associated with the site was found to be restricted as a result of the pedocutanic horizon, the presence of hard solid rock, as well as anthropogenic changes to the soi profiles through the construction of dirt roads. Soil permeability is identified as a limitation to agricultural productivity within the site.
- **Slope:** The site consisted of gentle terrain with the slope percentages recorded in the 0-8% category. Slope is therefore not a limitation to cultivation.
- **Rockiness:** Hard rock was identified within the subsurface horizons and is a limitation to the depth of soils. Surface rocks or surface calcrete was identified throughout the project site and is seen as a limitation to cultivation. The site is more suited to grazing activities.
- **Existing disturbances:** Portions of the proposed project site have existing disturbances as a result of dirt roads (*Figure 11*). Due to the existence of the roads, the soils within these areas are described as Physically Disturbed Anthrosols. This soil is further classified as the Grabouw soil form and is no longer suitable for agricultural production as the original soil profile has been mixed and is no longer identifiable. The Grabouw soils occupy 0.81ha (19.4%) of the site.

Figure 10: Soil forms identified within the project site

Figure 11: Observed dirt road within the site boundary of the proposed development which have been classified as disturbed Anthrosol, Grabouw soils.

6.2.2 VERIFICATION OUTCOME

As per section 2.5.3, the screening tool identified the proposed development to fall within an area with a "high sensitivity" in terms of the agricultural theme.

Following the findings of the desktop analysis and the samples taken during the site inspection, it was concluded that the site consists of land which is subject to severe permanent limitations including the pedocutanic horizon as well as hard rock. It is therefore only suitable for occasional row cropping in long ley rotations, or for use under grazing.

As such the site is classified as having a "low agricultural potential". This is a change from the "high sensitivity" category for the site as set in the screening tool.

6.2.3 PLAN OF STUDY FOR BASIC ASSESSMENT

Due to the dispute of the "high sensitivity" as per the screening tool, it has been concluded that a "Agricultural Compliance Statement" as per the "Protocol for the specialist assessment and minimum report content requirements for environmental impact on agricultural resources" will be completed as part of the Basic Assessment (BA) process.

6.3 LANDSCAPE AND VISUAL

The verification study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility.

The viewshed analysis was undertaken from a representative number of vantage points within the development footprint at an offset of 5m above ground level (the maximum height of the ECF structures) and 10m for the emission stacks. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures associated with the facility.

The methodology utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model of the potentially affected environment.
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.
- The identification of sensitive environments or receptors upon which the proposed facility could have a potential impact.
- The creation of viewshed analyses from the proposed project site in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures and activities.

6.3.1 OUTCOME OF ANALYSIS

The result of the viewshed analysis for the proposed facility is shown on the map below (Figure 12).

It is clear that the relatively constrained dimensions of the ECF would amount to a fairly limited core area of potential visual exposure. The shorter distance visual exposure would largely be contained within a 1.5 km radius of the proposed development site, with the predominant long-distance exposure to the north-west, especially along the south-east facing slopes of the Sekhukhune Mountain.

The following is evident from the viewshed analyses:

6.3.1.1 0 – 0.5km

The Lion ECF may be highly visible within a 500m radius of the development. Most of this zone falls within the Lion Smelter Plant property or within the Kennedy's Vale Mine property. These properties are not expected to contain any sensitive visual receptors, due to their inherent mining or industrial characters, and due to their association with the Glencore Lion Smelter.

The R555 traverse this zone and observers travelling along this road are expected to have a clear view of the ECF infrastructure, if no mitigation is undertaken. It should however be noted that the viewing of the infrastructure will not be in isolation, but within the context of the existing visual disturbances (i.e. the smelter plant and mine dumps) at this location.

6.3.1.2 0.5 – 1.5km

Visibility within this zone will still only encompass mining and industrial land and potentially sections of the R555 main road. The visual exposure is more scattered and interrupted due to the undulating nature of the topography.

6.3.1.3 1.5 - 3km

Within a 1.5 – 3km radius, the visual exposure is predominantly from the higher-lying terrain to the north of the Steelpoort River. This zone also contains parts of the Ga-Mampuru (north) and Ga-Mpuru settlements. The proposed Lion ECF infrastructure would theoretically be visible from the south-eastern outlying parts of these settlements, although the exposure would once again not be in isolation, but within the context of the existing visual disturbances of industrial and mining structures and activies.

6.3.1.4 > 3km

At distances exceeding 3km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer. This zone contains parts of the Ga-Mampuru (south) settlement and northern parts of the Ga-Mpuru settlement.

6.3.2 VERIFICATION OUTCOME

The Screening Report (Appendix A) generated using the national web-based screening tool, at this stage do not predetermine sensitivities in terms of the landscape and/or visual environment.

In general terms it is envisaged that the structures, where visible from shorter distances (e.g. less than 0.5km and potentially up to 1.5km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a visual impact.

Sensitive visual receptors are expected to predominantly include observers (commuters or visitors to the region) travelling along the R555 main road in closer proximity to the facility. Residents of the settlements mentioned above, is less likely to be affected due to the general long distance between the observers and the development, and due to the presence of existing visual clutter at the proposed Lion ECF site.

Anticipated issues related to the potential visual impact of the proposed Lion ECF include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the R555 main road.
- The visibility of the facility to, and potential visual impact on residents of dwellings within the study area, with specific reference to the settlements of Ga-Mampuru and Ga-Mpuru.
- The potential visual impact of the facility on the visual character or sense of place of the region.
- The potential visual impact of the facility on tourist routes or tourist destinations/facilities (if present).
- The potential visual impact of the construction of ancillary infrastructure (i.e. internal access roads, buildings, etc.) on observers in close proximity to the facility.
- The visual absorption capacity of the natural vegetation (if applicable).
- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the placement of the Lion ECF within close proximity of the Lion Smelter.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility (if present).
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may potentially constitute a low to potentially moderate visual impact at a local and/or regional scale.

6.3.3 PLAN OF STUDY FOR BASIC ASSESSMENT

The fact that some components of the proposed Lion ECF and associated infrastructure may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but potentially not restricted to) a 1.5km buffer zone from the facility need to be identified and the severity of the visual impact assessed during the BA.

Additional spatial analyses will be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the core ECF as well as for the ancillary infrastructure, as these structures (e.g. the substation, storage facilities and electrical infrastructure) are envisaged to have varying levels of visual impact at a more localised scale. The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

In this respect, the Plan of Study for the Visual Impact Assessment (VIA) during the BA will be approached as follows:

- The level of the VIA is determined according to the nature, extent, duration, intensity or magnitude, probability and significance of the potential visual impacts, and will propose management actions and/or monitoring programs, and may include recommendations related to the solar energy facility layout.
- The visual impact is determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) are not considered.
- The VIA considers potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region.

The following VIA-specific tasks will be undertaken:

- **Determine potential visual exposure:** The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if (or where) the proposed facility and associated infrastructure were not visible, no impact would occur. The viewshed analyses of the proposed facility and the related infrastructure are based on a detailed digital terrain model of the study area. The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

- **Determine visual distance/observer proximity to the facility:** In order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for this type of structure. Proximity radii for the proposed infrastructure are created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment. The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly (anticipated) negative visual perception of the proposed facility.
- **Determine viewer incidence/viewer perception (sensitive visual receptors):** The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that may be exposed to the project infrastructure. This is done in order to focus attention on areas where the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative. Related to this data set, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, protected areas, etc.), that should be addressed.
- **Determine the visual absorption capacity (VAC) of the landscape:** This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing, sparse and patchy vegetation will have a low VAC. The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low. The VAC also generally increases with distance, where discernible detail in visual characteristics of both environment and structure decreases.
- **Calculate the visual impact index:** The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential magnitude of the visual impact. Geographical Information Systems (GIS) software is used to perform all the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Determine impact significance:** The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section are displayed in impact tables and summarised in an impact statement.
- **Propose mitigation measures:** The preferred alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.
- **Reporting and map display:** All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in the VIA report.
- **Site visit:** Undertake a site visit in order to collect a photographic record of the affected environment, to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

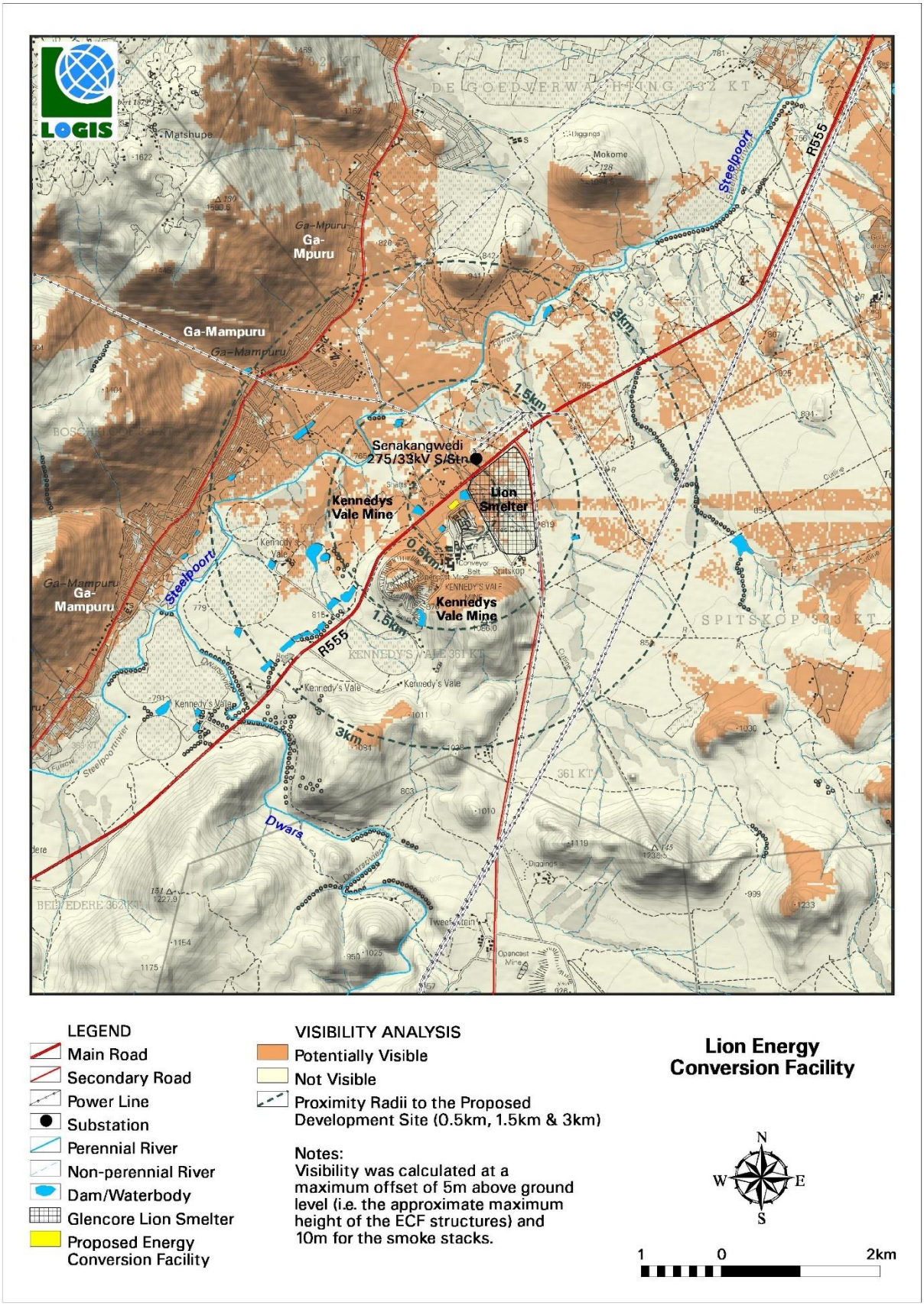


Figure 12: Map indicating the potential (preliminary) visual exposure of the proposed Lion ECF development.

6.4 ARCHAEOLOGICAL AND PALAEONTOLOGY

A site visit was conducted on 29 November 2022 by the appointed specialist to verify the desktop information available.

6.4.1 OUTCOME OF SURVEY

6.4.1.1 Heritage Resources

Previous disturbances relating to clearing for roads as well as mining activities are evident in the larger area and heritage finds were limited to sparsely scattered Iron Age ceramics (findspots) recorded as observation points (Figure 13 and Table 9). The ceramics are weathered, probably from water displacement and found on vertic soils. Iron Age settlements were usually not located on vertic soils although these areas were used for cultivation. Few pieces with decoration were found, consisting of incised lines and stylistically date to the Early Iron Age. No surface features were noted, and the ceramics are likely out of context and are of low significance with a Field Rating of Generally Protected C. General site conditions are illustrated in Figure 14 – Figure 17. No other heritage resources such as buildings or burial sites were noted.

Table 9: Recorded heritage observations during site inspection

OBSERVATION POINT	DESCRIPTION	LONGITUDE	LATITUDE	ELEVATION
202	Small scatter of ceramic sherds	30° 06' 45.5940" E	24° 49' 07.4891" S	903,1923
203	Small scatter of ceramic sherds	30° 06' 44.8776" E	24° 49' 08.2631" S	905,2637
204	Small scatter of ceramic sherds	30° 06' 45.2195" E	24° 49' 07.3307" S	904,4333
205	Small scatter of ceramic sherds	30° 06' 46.3103" E	24° 49' 09.7679" S	909,4252

Figure 13: Spatial location of recorded artefacts in the study area.

Figure 14: Isolated ceramics recorded next to a gravel road.

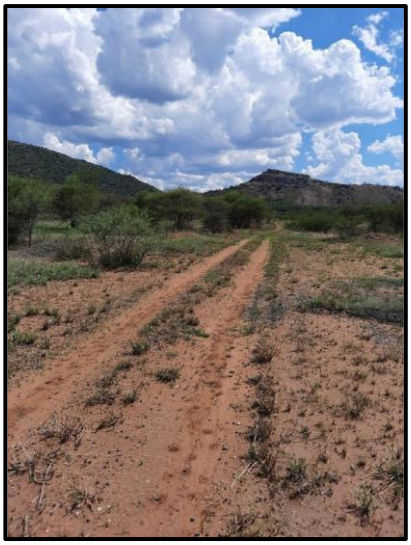


Figure 15: General site conditions where ceramic scatters were noted.

Figure 16: Iron Age ceramic sherd.

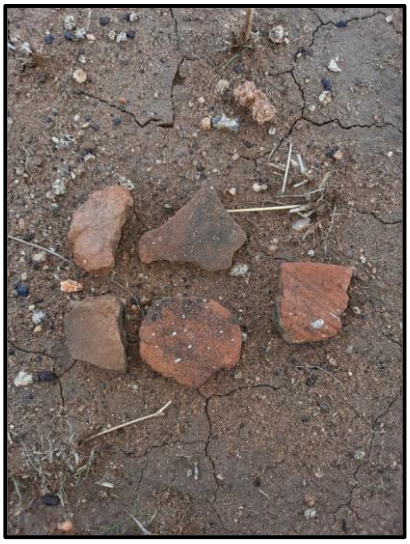


Figure 17: Decorated and undecorated ceramics.

6.4.1.2 Cultural Landscape

The cultural landscape of the region is characterised by a rural area that is extensively disturbed by mining activities and in the past by agricultural activities. From the archaeological database of the general area archaeological settlements show different land use patterns. Many agriculturally orientated societies dating to the Early and Middle Iron Age built their villages in the valleys near cultivatable alluvium. Others (probably Ndebele) built terraced settlements on basal slopes of the valley edge, while farm labourers usually lived in the valleys as well. Historical maps indicate the impact area as being cultivated from before the 1970's (Figure 18 & Figure 19) with extensive mining activities in the surrounding areas (Figure 20) that would have impacted on any heritage features if any ever occurred in the study area.

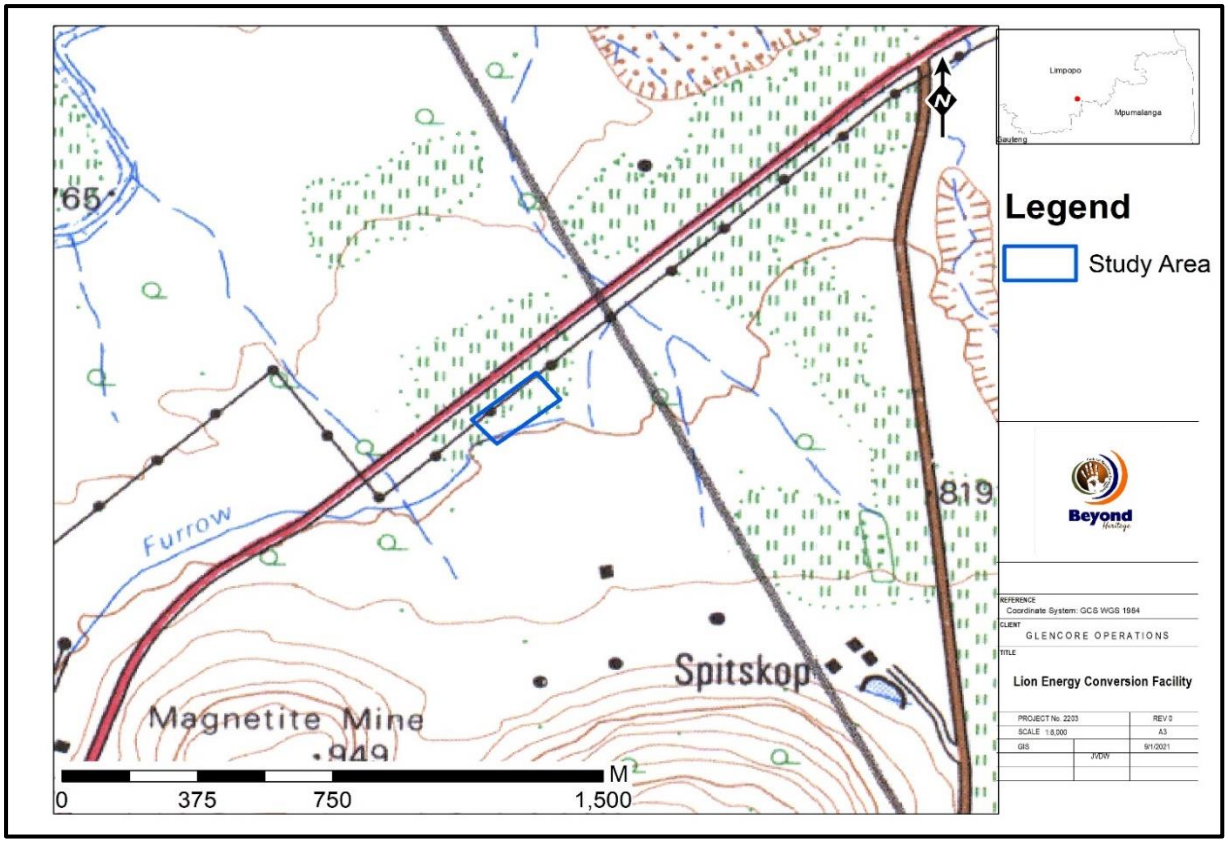


Figure 18: 1976 Topographical map of the study area indicating the area as cultivated with a powerline that traverses the study area.

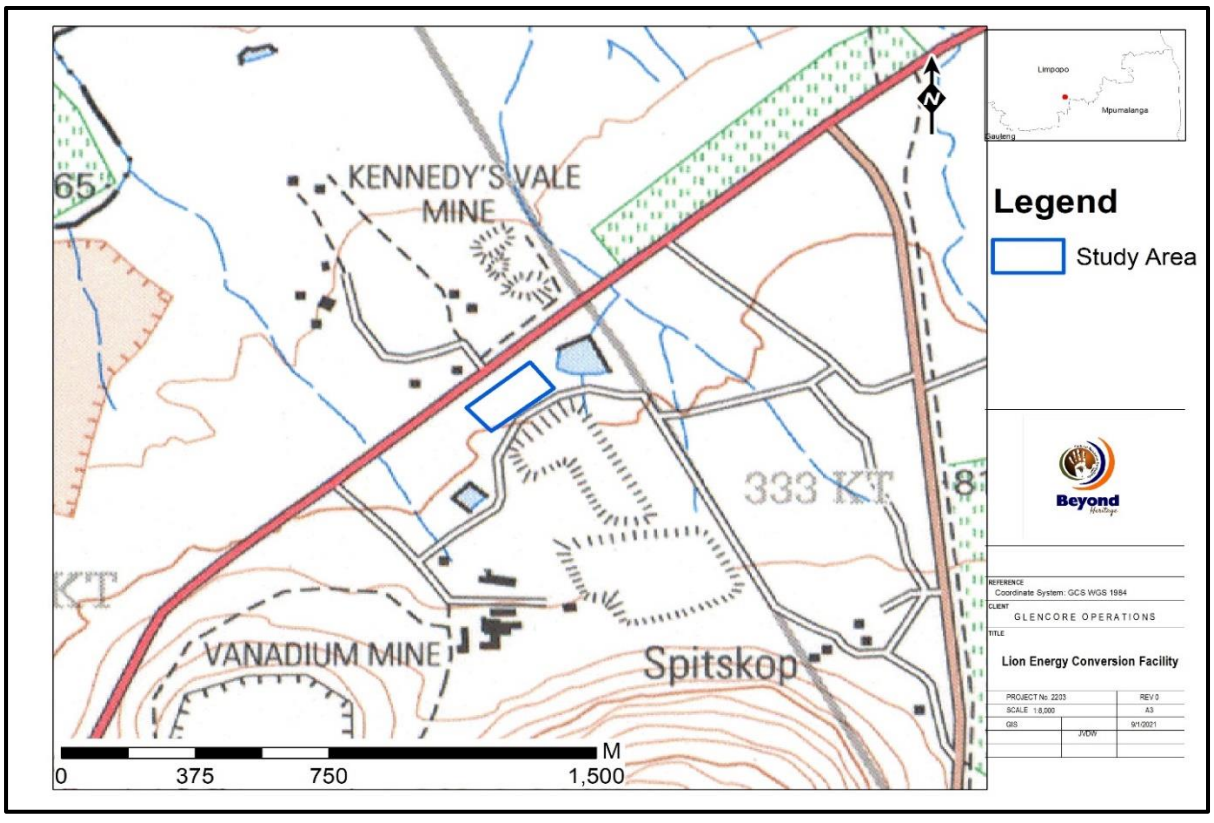


Figure 19: 1977 Topographic map of the study area indicating mining activities in the surrounding area.

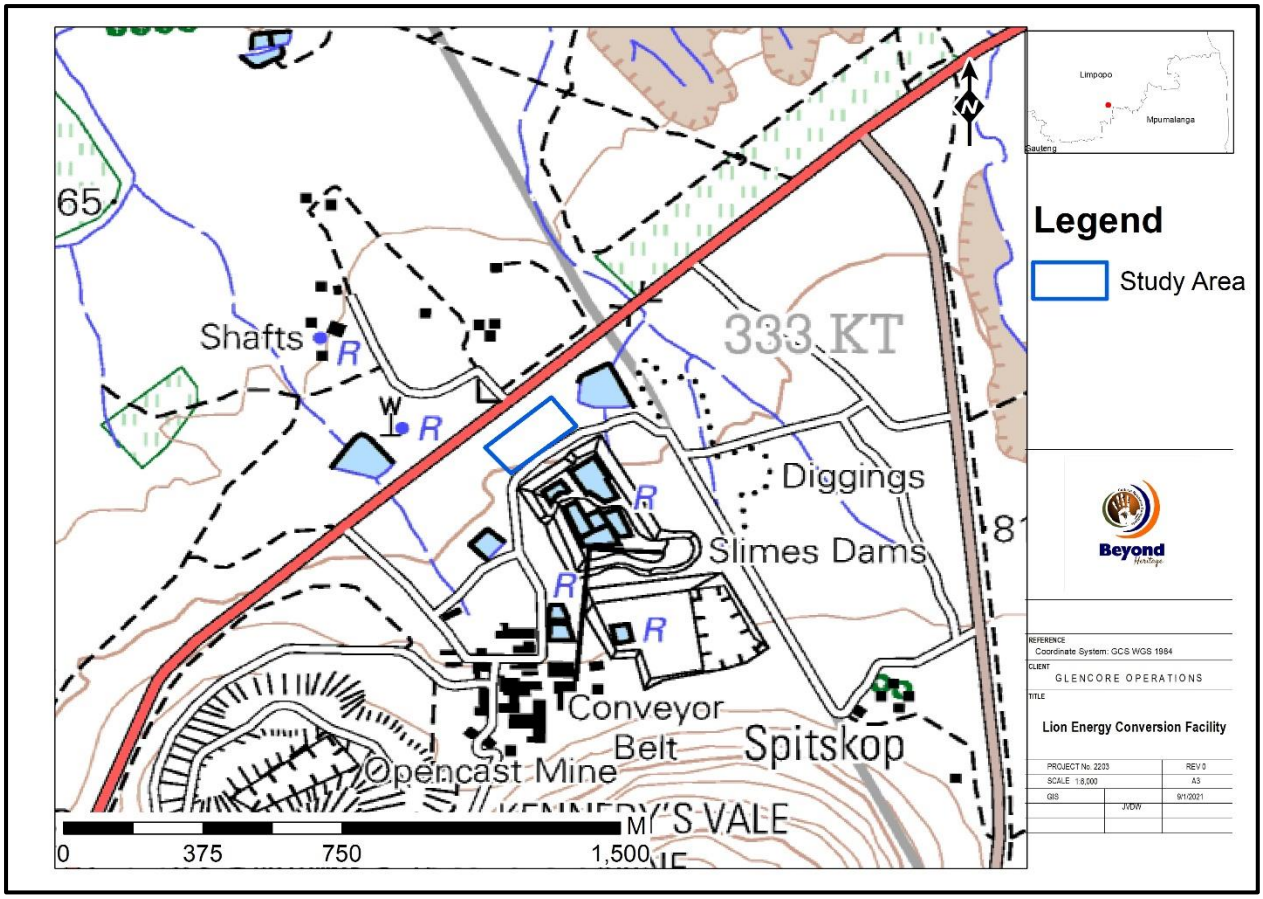


Figure 20:. 2002 Topographic map of the study area indicating several mining developments in the surrounding area.

6.4.1.3 Paleontological Heritage

Based on the SAHRA Paleontological map the study area is of low sensitivity and no further studies are required in this regard (Figure 21).

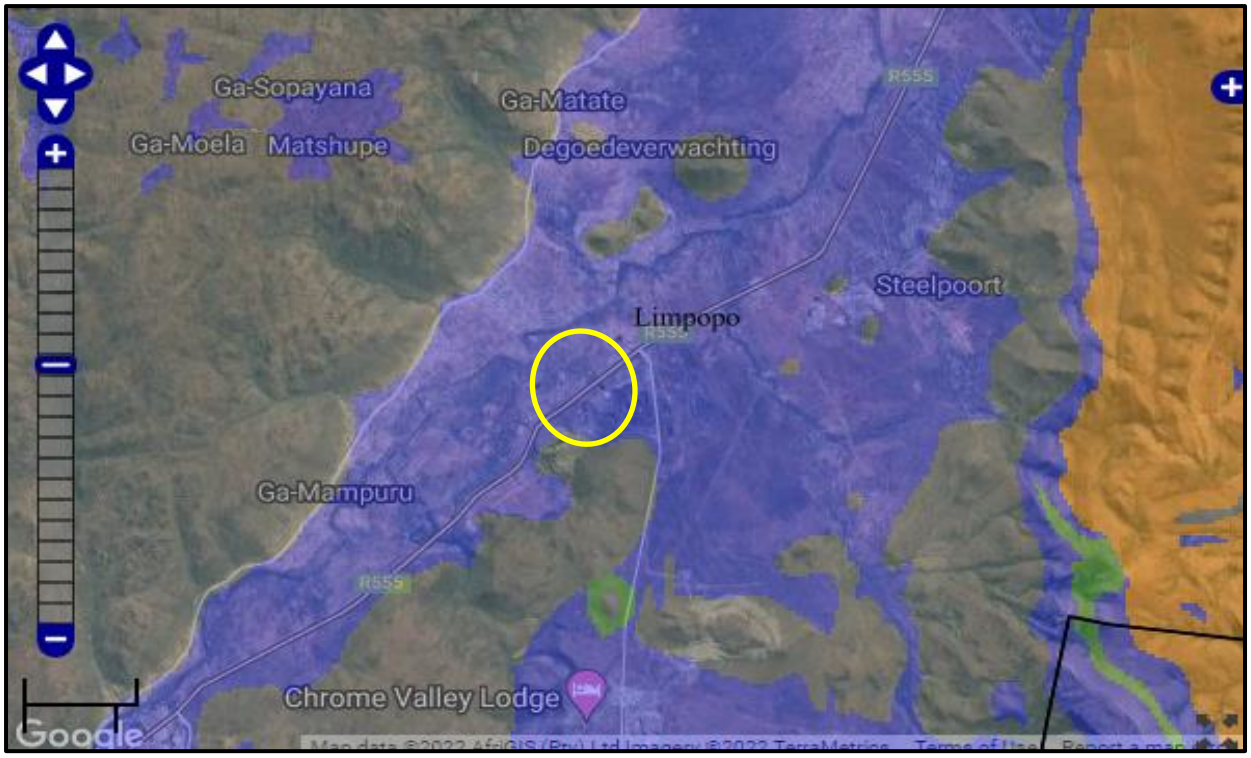


Figure 21: Paleontological sensitivity of the approximate study area as indicated on the SAHRA Palaeontological sensitivity map.

Table 10: Sensitivity colour indication associated with Figure 21

COLOUR	SENSITIVITY	REQUIRED ACTION
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map

6.4.2 VERIFICATION OUTCOME

As per section 2.5.3, the screening tool identified the proposed development to fall within an area with a "low sensitivity" in terms of the archaeological and cultural heritage theme.

The study area has been subjected to cultivation from the 1970's and impacted on by road developments as well as mining activities. These developments would have impacted on heritage resources if any were present in the area. This was confirmed during the site visit and recorded finds were limited to displaced and scattered Iron Age artefacts. The ceramics are weathered, probably from water displacement and found on vertic soils. Iron Age settlements were usually not located on vertic soils although these areas were used for cultivation. Few pieces with decoration were found, consisting of incised lines and stylistically date to the Early Iron Age. No surface features were noted associated with these ceramics and the ceramics are likely out of context and are of low significance. Although no surface sites are impacted on, there is a chance that completely buried sites would still be impacted on, but this cannot be quantified.

The impact of the proposed project on heritage resources is "low" and the project is acceptable from a heritage perspective. Therefore the sensitivity of the screening report is hereby confirmed.

6.4.3 PLAN OF STUDY FOR BASIC ASSESSMENT

The Heritage Impact Assessment (HIA), as a specialist sub-section of the BA, is required under the following legislation:

- National Heritage Resources Act (NHRA), Act No. 25 of 1999)
- National Environmental Management Act (NEMA), Act No. 107 of 1998 - Section 23(2)(b)
- Mineral and Petroleum Resources Development Act (MPRDA), Act No. 28 of 2002 - Section 39(3)(b)(iii)

A Phase 1 HIA is a pre-requisite for development in South Africa as prescribed by SAHRA and stipulated by legislation. The overall purpose of heritage specialist input is to:

- Identify any heritage resources, which may be affected;
- Assess the nature and degree of significance of such resources;
- Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;
- Assess the negative and positive impact of the development on these resources; and
- Make recommendations for the appropriate heritage management of these impacts.

The HIA should be submitted, as part of the impact assessment report or EMPr, to the PHRA if established in the province or to SAHRA. SAHRA will ultimately be responsible for the evaluation of Phase 1 HIA reports upon which review comments will be issued. 'Best practice' requires Phase 1 HIA reports and additional development information, as per the impact assessment report and/or EMPr, to be submitted in duplicate to SAHRA after completion of the study. SAHRA accepts Phase 1 HIA

reports authored by professional archaeologists, accredited with ASAPA or with a proven ability to do archaeological work.

6.5 TERRESTRIAL BIODIVERSITY

6.5.1 DESKTOP ASSESSMENT OUTCOME

6.5.1.1 Ecologically Important Landscape Features

The GIS analysis pertaining to the relevance of the proposed development to ecologically important landscape features are summarised in Table 11.

Table 11: Summary of relevance of the proposed project to ecologically important landscape features

DESKTOP INFORMATION CONSIDERED	RELEVANT/IRRELEVANT
Ecosystem Threat Status	Relevant – Overlaps with an EN ecosystem.
Ecosystem Protection Level	Relevant – Overlaps mainly with a Poorly Protected Ecosystem.
Protected Areas	Irrelevant – The proposed development does not occur within any protected area and there is no protected area in close proximity to the project area. The De Hoop Private Nature Reserve is more than 20 km away from the project area.
Limpopo Conservation Plan	Relevant –The project area traverses areas that are classified as NNR areas
National Threatened Ecosystems (2011)	Irrelevant - The project area does not fall within any National Threatened Ecosystems (2011).
Important Bird and Biodiversity Areas	Irrelevant – More than 10 from the closest IBAs

6.5.1.2 Flora Assessment

This section is divided into a description of the vegetation type expected under natural conditions and the expected flora species.

6.5.1.2.1 Regional Vegetation

The project area is located within the vast Savanna biome, which covers large parts of southern Africa. At a more intricate spatial scale, it is located within the Sekhukhune Plains Bushveld unit (SVcb 27) (Mucina & Rutherford 2006; SANBI,2018) previously referred to as the Mixed Bushveld (Acocks, 1953; Low and Rebelo, 1996). It is distributed in the Limpopo and Mpumalanga Provinces and occurs on the low lying areas where the altitude ranges between 700 and 1 100 m. The vegetation unit is described

as semiarid plains and open valleys, surrounded by low hills and mountains associated with the escarpment (Mucina and Rutherford, 2006). The vegetation is further described as open to closed Thornveld with Aloe species and succulents with large areas degraded and over exploited. This resulted in encroachment by indigenous and alien species (Mucina and Rutherford, 2006)

6.5.1.2.2 Sekhukhune Plains Bushveld (SVcb 27)

The Sekhukhune Plains Bushveld occurs in the Limpopo and Mpumalanga Provinces, mainly in semi-arid plains and open valleys in between small mountains. The vegetation consists predominantly of open to close thornveld with large numbers of Aloe species.

Important Taxa

Tall Trees: *Vachellia erioloba, Philenoptera violacea.*

Small Trees: *Senegalia mellifera subsp. detinens, Vachellia nilotica, V. tortilis subsp. heteracantha, Boscia foetida subsp. rehmanniana, Acacia grandicornuta, Albizia anthelmintica, Balanites maughamii, Combretum imberbe, Commiphora glandulosa, Maerua angolensis, Markhamia zanzibarica, Mystroxylon aethiopicum subsp. schlechteri, Ptaeroxylon obliquum, Schotia brachypetala, Ziziphus mucronata.*

Succulent Tree: *Euphorbia tirucalli*.

Tall Shrubs: *Searsia engleri, Cadaba termitaria, Dichrostachys cinerea, Ehretia rigida subsp. rigida, Grewia bicolor, Karomia speciosa, Maerua decumbens, Rhigozum brevispinosum, R. obovatum, Tinnea rhodesiana, Triaspis glaucophylla*.

Low Shrubs: *Felicia clavipilosa subsp. transvaalensis, Seddera suffruticosa, Gnidia polycephala, Gossypium herbaceum subsp. africanum, Jamesbrittenia atropurpurea, Jatropha latifolia var. latifolia, Lantana rugosa, Melhania rehmannii, Monechma divaricatum, Myrothamnus flabellifolius, Pechuel-Loeschea leubnitziae, Plinthus rehmannii*.

Succulent Shrubs: *Aloe cryptopoda, Euphorbia enormis, Kleinia longiflora, Aloe castanea, A. globuligemma*.

Woody Succulent Climber: *Sarcostemma viminale*.

Herbaceous Climbers: *Coccinia rehmannii, Decorsea schlechteri*.

Graminoids: *Cenchrus ciliaris, Enneapogon cenchroides, Panicum maximum, Urochloa mosambicensis, Aristida adscensionis, A. congesta, Eragrostis barbinodis, Paspalum distichum, Schmidtia pappophoroides, Stipagrostis hirtigluma subsp. patula, Tragus berteronianus*.

Herbs: *Becium filamentosum, Phyllanthus maderaspatensis , Blepharis integrifolia, Corchorus asplenifolius, Hibiscus praeteritus, Ipomoea magnusiana*.

Geophytic Herbs: *Drimia altissima, Sansevieria pearsonii*.

Biogeographically Important Taxa

Small Tree: *Lydenburgia cassinoides*.

Tall Shrub: *Nuxia gracilis*

Low Shrubs: *Amphiglossa triflora, Asparagus fourei, Hibiscus barnardii, Orthosiphon fruticosus, Petalidium oblongifolium, Searsia batophylla*.

Woody Climber: *Asparagus sekukuniensis*.

Herb: *Aneilema longirrhizum*.

Geophytic Herb: *Chlorophytum cyperaceum*.

Succulent Herb: *Piaranthus atrosanguineus*.

Conservation Status of the Vegetation Type

According to Mucina and Rutherford (2006), this vegetation type is classified as VU. The national target for conservation protection for this vegetation type is 19%, with approximately 2% statutorily conserved in Potlake, Bewaarkloof and Wolkberg Caves Nature Reserves. Approximately 25% of this area has been transformed and is mainly under dry-land subsistence cultivation.

6.5.1.2.3 Sekhukhuneland Centre of Plant Endemism

The project area is situated within the Sekhukhuneland Centre of Plant Endemism (SCPE). SCPE has an extraordinary level of endemism, with 2 000 indigenous species within 4 000 km^2. This number or rather figure is extraordinary if compared with islands in the world, namely New Zealand has 2 000 species on 268 000 km^2 and Hawaii which has 2000 indigenous species on 16600 km^2. SCPE comprises a mountainous region with flat to undulating valleys. Sekhukhune land is known for its parallel belts or rocky ridges and mountains, including the Leolo and Dwars River ranges. The core of the Centre is formed by the surface outcrops of the Rustenburg Layered Suite of the eastern Bushveld Complex.

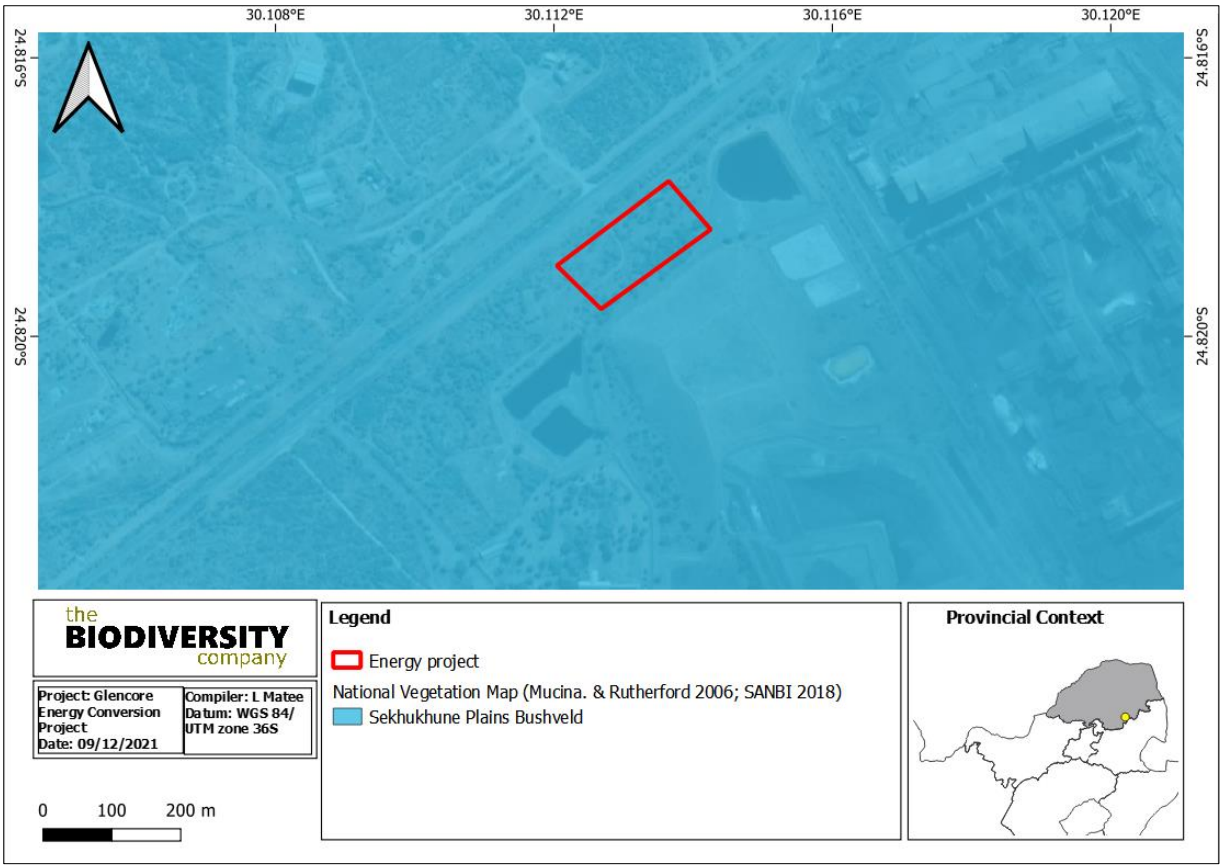


Figure 22: Map illustrating the vegetation type associated with the project area

6.5.1.2.4 Expected Flora Species

According to the new Plants of Southern Africa (POSA) database underpinned by the Botanical Database of Southern Africa (BODATSA), a total of 485 species of indigenous plants are expected to occur within the assessment area and immediate landscape. A total of 8 Red List/ SCC according to the IUCN Red List status could be expected to occur within the assessment area and are provided in Table 12 below (according to the relevant POSA Grid Squares represented on Figure 23).

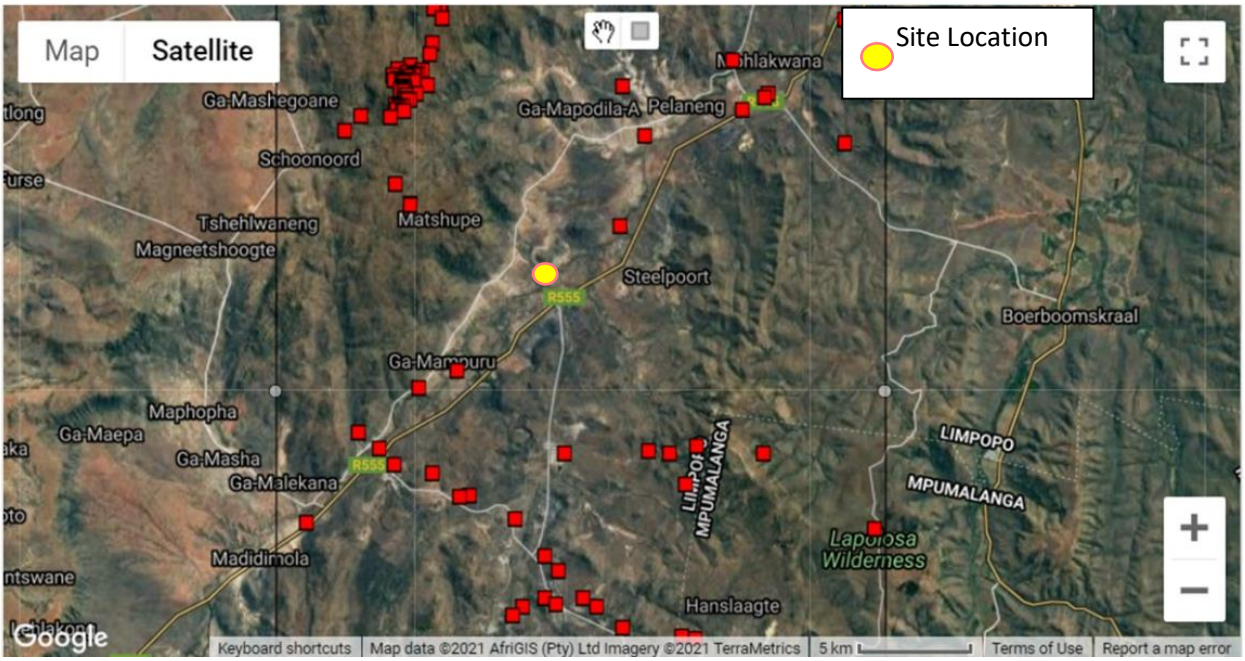


Figure 23: Map showing the grid drawn to compile an expected species list (BODATASA-POSA, 2016)

Table 12: Threatened flora species that may occur within the assessment area associated with the proposed project area. EN=Endangered

FAMILY	SPECIES	IUCN	DIAGNOSTIC	ECOLOGY
Acanthaceae	*Dicliptera fruticosa*	NT	herb;	Indigenous; Endemic
Iridaceae	*Gladiolus reginae*	CR	geophyte;	Indigenous; Endemic
Anacardiaceae	*Searsia batophylla*	VU	shrub;	Indigenous; Endemic
Hyacinthaceae	*Ledebouria dolomiticola*	VU	geophyte;	Indigenous; Endemic
Passifloraceae	*Adenia fruticosa*	NT	tree; succulent; climber; shrub;	Indigenous; Endemic
Scrophulariaceae	*Nemesia zimbabwensis*	EN		Indigenous
Polygalaceae	*Polygala sekhukhuniensis*	VU		Indigenous
Scrophulariaceae	*Jamesbrittenia macrantha*	NT	shrub; dwarf shrub;	Indigenous; Endemic

6.5.2 FIELD ASSESSMENT

The following sections provide the results from the field survey for the proposed development that was undertaken on 14 of December 2021.

6.5.2.1 Flora Assessment

A total of 28 woody, graminoid, shrub and herbaceous plant species were recorded in the project area during the field assessment (Table 13). This includes two species that have been assigned alien invader plant categories under the National Environmental Management: Biodiversity Act (NEMBA). Plants listed in Category 1b appear in green. Some of the plant species recorded can be seen in Table 13.

Table 13: Trees, shrub, graminoid and herbaceous plant species recorded in the site boundary of the proposed development

SCIENTIFIC NAME	COMMON NAME	THREAT STATUS (SANBI, 2017)	SA ENDEMIC	ALIEN CATEGORY
Aloe globuligemma	Knoppiesaalwyn	LC	Not Endemic	
Argemone ochroleuca	Mexican Poppy		Not Indigenous; Naturalised; Invasive	NEMBA Category 1b.
Asparagus laricinus	Wild asparagus	LC	Indigenous, Not Endemic	
Dichrostachys cinerea subsp. africana	Small-leaved Sickle Bush	LC	Not Endemic	
Digitaria eriantha	Woolly Finger Grass	LC	Not Endemic	
Elephantorrhiza elephantina	Elephant's root	LC	Indigenous, Not Endemic	
Eragrostis chloromelas	Blue Love Grass	LC	Not Endemic	
Eragrostis curvula	Weeping Love Grass	LC	Not Endemic	
Eragrostis gummiflua Nees	Gum Grass	LC	Not Endemic	
Eragrostis superba Peyr.	Heart-seed Grass	LC	Not Endemic	
Euphorbia ingens	Cactus Euphorbia	LC	Indigenous, Not Endemic	
Gomphocarpus tomentosus	Woolly Milkweed	LC	Not Endemic	
Gymnosporia senegalensis	Red Spike-thorn	LC	Indigenous, Not Endemic	
Hibiscus engleri	Wild Hibiscus	LC	Indigenous, Not Endemic	
Jatropha gossypiifolia	Bellyache Bush		Not Indigenous; Naturalised; Invasive	
Leonotis nepetifolia	Lion's Ear	LC	Not Endemic	
Opuntia stricta	Shell Mound Pricklypear		Not Indigenous; Naturalised; Invasive	NEMBA Category 1b.
Panicum maximum	Guinea Grass	LC	Indigenous, Not Endemic	
Sansevieria hyacinthoides	Mother-in-law's-tongue	LC	Indigenous, Not Endemic	
Solanum lichtensteinii Willd.	Large Yellow Bitter Apple	LC	Not Endemic	
Tricholaena monachne	Blousaadgras	LC	Not Endemic	
Urochloa mosambicensis	Herringbone Grass	LC	Indigenous, Not Endemic	
Vachellia karroo	Sweet Thorn, Cape Gum	LC	Indigenous, Not Endemic	
Vachellia tortilis	Umbrella Thorn	LC	Not Endemic	
Viscum combreticola Engl.	Bushwillow Mistletoe	LC	Not Endemic	
Xanthium spinosum	Spiny cocklebur		Not Indigenous; Naturalised; Invasive	
Xanthium strumarium	Large Cocklebur		Not Indigenous; Naturalised; Invasive	
Ziziphus mucronata	Buffalo thorn	LC	Not Endemic	

Figure 24:Photographs illustrating some of the flora recorded within the assessment area. A) Dichrostachys cinerea subsp. africana, B) Vachellia tortilis., C) Euphorbia ingens., D) Aloe globuligemma., and E) Solanum lichtensteinii Willd

6.5.2.1.1 Invasive Alien Plants

The National Invasive Species Council (Invasive Species Advisory Committee, 2006) defines alien invasive species that are non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Invasive Alien Plants (IAPs) tend to dominate or replace indigenous flora, thereby transforming the structure, composition and functioning of ecosystems. Therefore, these plants must be controlled using an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species. Although bush encroachment and invasion are sometimes used loosely and commonly interchangeably it is crucial to recognise that these are different processes. Bush encroachment refers to the spread of plant species into an area

where previously it did not occur, thus, bush encroachment could occur even with indigenous species, and it is more defined by plant density than species themselves.

NEMBA is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the NEMBA. The Alien and Invasive Species Regulations were published in Government Gazette No. 44182, 24th of February 2021. The legislation calls for the removal and/or control of AIP species (Category 1 species). In addition, unless authorised thereto in terms of the NWA, no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse. Below is a brief explanation of the three categories in terms of the NEMBA:

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued;
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government-sponsored invasive species management programme. No permits will be issued;
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones; and
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- Notify the competent authority in writing; and
- Take steps to manage the listed invasive species in compliance with:
    - Section 75 of the Act;

- The relevant invasive species management programme developed in terms of regulation 4; and
- Any directive issued in terms of section 73(3) of the Act.

Two IAP species listed under the Alien and Invasive Species List 2016, Government Gazette No. 40166 as Category 1b were recorded for the area. These IAP species must be controlled by implementing an Invasive Alien Plant Management Programme in compliance of section 75 of the Act as stated above. Plants listed as Category 1 alien or invasive species under the National Environmental Management: Biodiversity Act (NEMBA) appear in the green text (Table 13).

6.5.2.2 Faunal Assessment

6.5.2.2.1 Avifauna

A total of twenty-five (25) bird species were recorded in the project area during the survey based on either direct observation or the presence of visual tracks & signs. Avian diversity within this habitat was relatively poor due to the project area's surrounding land-use. In addition to this, the avian diversity recorded was not considered unique and is typical of what occurs across large areas of the Savannah Biome, which therefore suggests that the sensitivity of the site, from an avian perspective, will not be of any great significance.

Table 14: Avifaunal species recorded in the project area

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (SANBI, 2016)	IUCN (2017)
Acridotheres tristis	Myna, Common	Unlisted	LC
Apus affinis	Swift, Little	Unlisted	LC
Cercotrichas leucophrys	Scrub-robin, White-browed	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Corvinella melanoleuca	Shrike, Magpie	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Cossypha humeralis	Robin-chat, White-throated	Unlisted	LC
Dendroperdix sephaena	Francolin, Crested	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Hirundo dimidiata	Swallow, Pearl-breasted	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Laniarius atrococcineus	Shrike, Crimson-breasted	Unlisted	LC
Mirafra africana	Lark, Rufous-naped	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (SANBI, 2016)	IUCN (2017)
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Turdoides bicolor	Babbler, Southern Pied	Unlisted	LC
Turdoides jardineii	Babbler, Arrow-marked	Unlisted	LC
Turdus libonyana	Thrush, Kurrichane	Unlisted	Unlisted
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC

6.5.2.2.2 Amphibians and Reptiles

No reptile or amphibian species were recorded in the project area during the survey, this can be attributed to the lack of suitable habitat and a river system that is also ephemeral and the lack of water (albeit standing or flowing) and the past human settlements and mining areas.

6.5.2.2.3 Mammals

No mammal species were recorded in the project area due to lack of suitable habitat as well as ecological risk from past or current smelter-related emissions as well as edge effects from smelter related activities resulting in the project area being in a degraded state.

6.5.3 VERIFICATION OUTCOME

As per section 2.5.3, the screening tool identified the proposed development to fall within an area with a “low sensitivity” in terms of the terrestrial biodiversity theme and “medium sensitivity” in terms of the plant and animal theme.

The “medium to low sensitivity” for the plant species theme is confirmed, as presented in the sensitivity map (Figure 25) confirming the sensitivity observed on site.

The “medium-high sensitivity” animal species theme is disputed as no faunal species or signs of any were recorded in the project area, with the exception of avifaunal species.

The “low sensitivity” terrestrial biodiversity sensitivity is confirmed. As stated above the vegetation structure and species composition of the two habitats have been completely altered as such, has a very low conservation value and ecological sensitivity from both a faunal and floral perspective.

Table 15: Summary of habitat types delineated within the site boundary of the proposed development

HABITAT	CONSERVATION IMPORTANCE	FUNCTIONAL INTEGRITY	BIODIVERSITY IMPORTANCE	RECEPTOR RESILIENCE	SITE ECOLOGICAL IMPORTANCE
Degraded Bushveld	**Low**	**Low**	**Low**	Medium	**Low**
Riparian zone	**Low**	**Low**	**Low**	Medium	**Low**

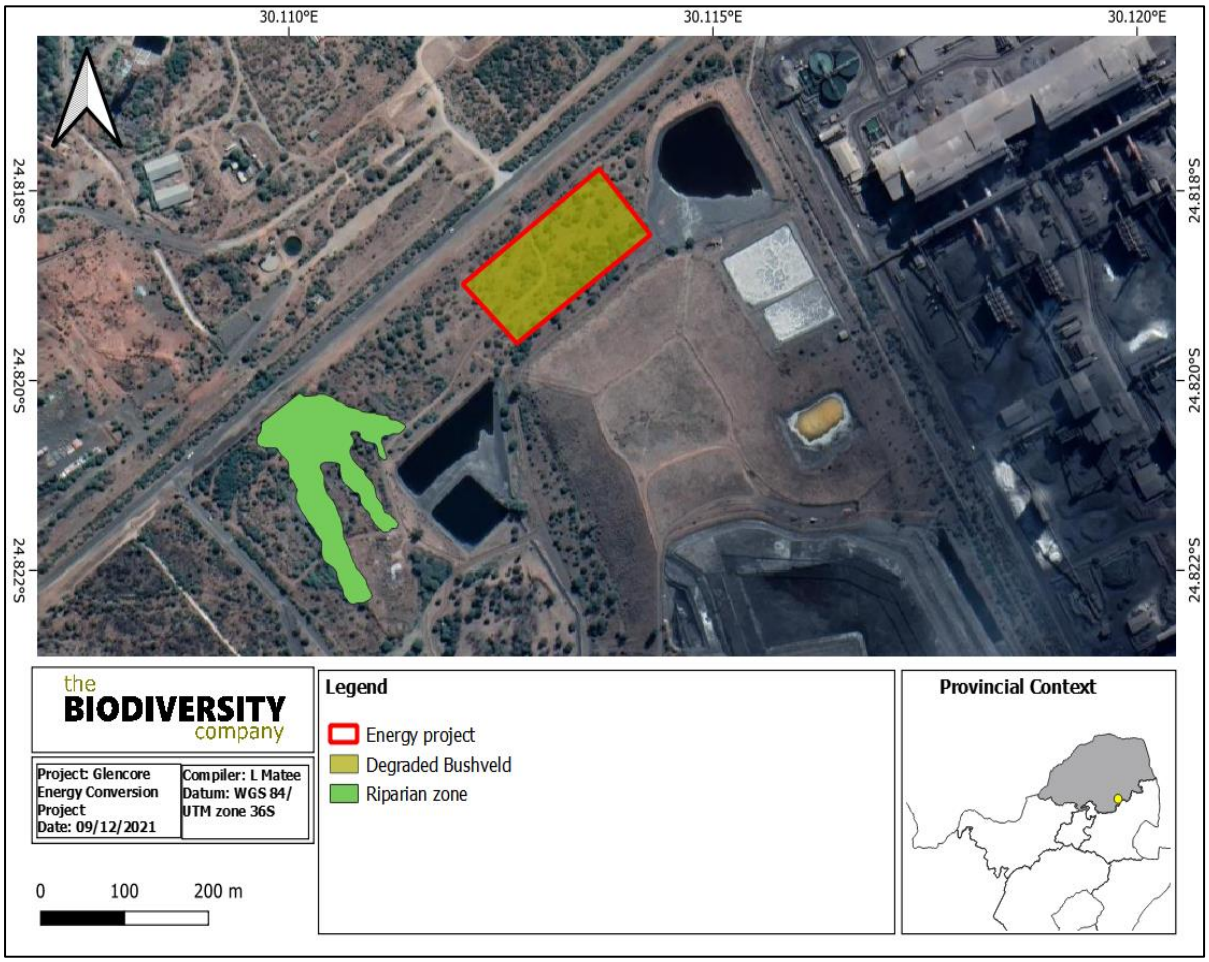


Figure 25:The habitat units identified in the site boundary of the proposed development

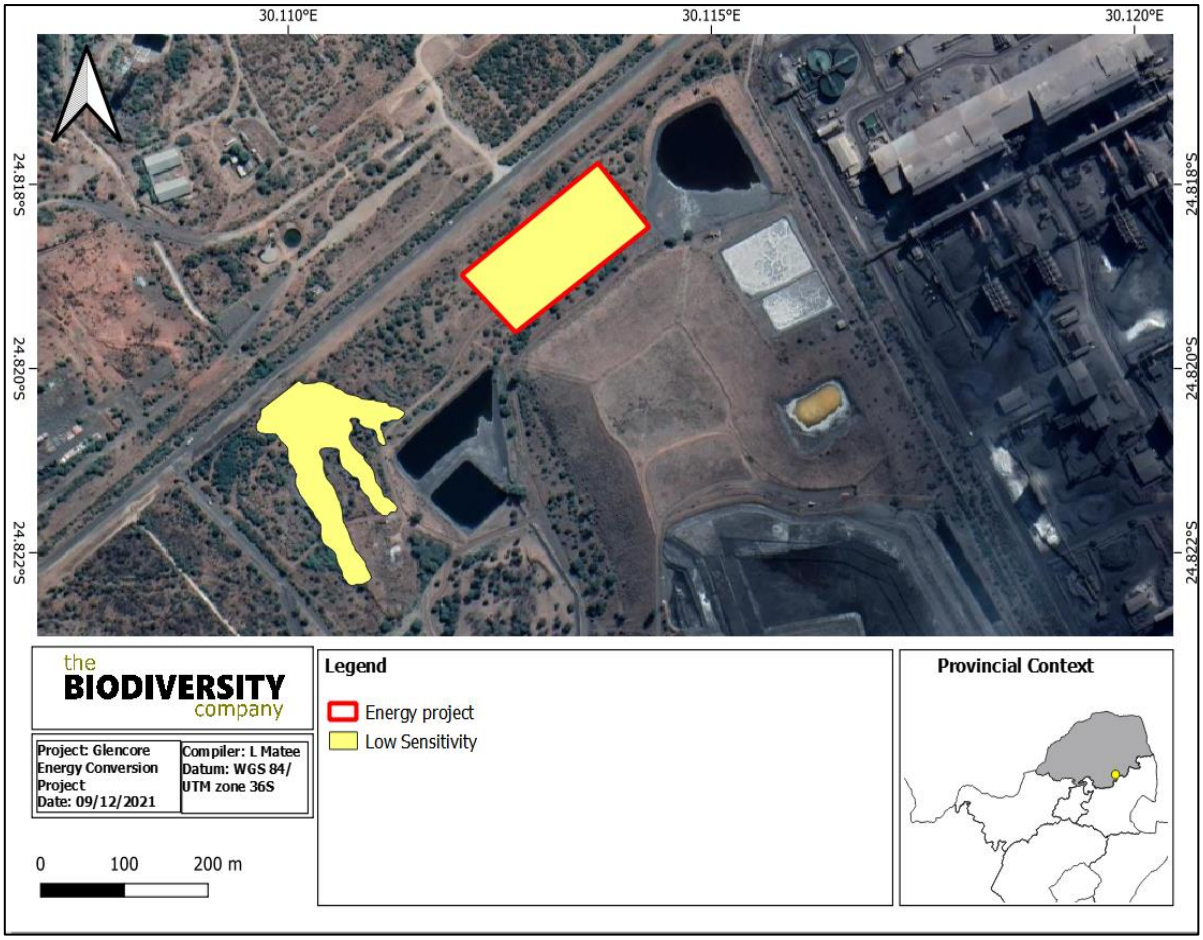


Figure 26:The confirmed sensitivity of the site area of the proposed development

6.5.4 PLAN OF STUDY FOR BASIC ASSESSMENT

Based on the information presented in the previous sections, it is therefore concluded that a "Terrestrial Biodiversity, Plant and Animal Species Compliance Statement" as per the "Protocol for the specialist assessment and minimum report content requirements for environmental impact on terrestrial biodiversity, plant and animal species" will be completed as part of the Basic Assessment (BA) process.

6.6 AQUATIC BIODIVERSITY

6.6.1 DESKTOP ASSESSMENT OUTCOME

The following features describes the general area and habitat, this assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and SANBI.

6.6.1.1 Limpopo Conservation Plan

Figure 27 illustrates the project area overlaps with areas designated as Critical Biodiversity Area (CBA) 2, Ecological Support Area (ESA) 1 and ESA2 which align with the terrestrial conservations plans. No aquatic features fall within the project area, however, a drainage lines falls within 300 m south west of the proposed activities. The drainage line east of the project area no longer exists due to the construction of the smelter and associated infrastructure.

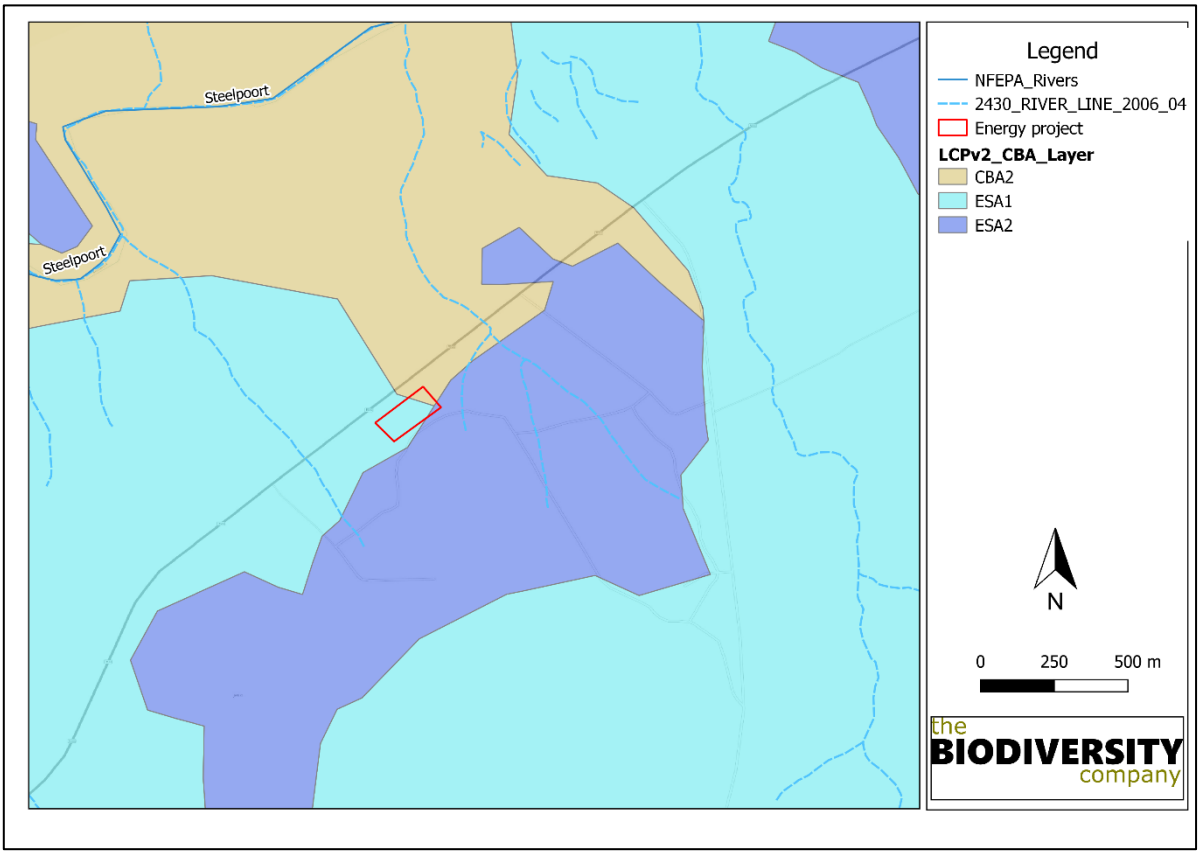


Figure 27: The project area superimposed on the Limpopo Biodiversity Conservation Plans (LCP, 2013)

6.6.1.2 Ecosystem Protection Level and Treat status

Based on Figure 28 and Figure 29 the aquatic ecosystems associated with the development are rated as Poorly Protected. The Threat status of the rivers associated with the proposed project is rated as Endangered (EN).

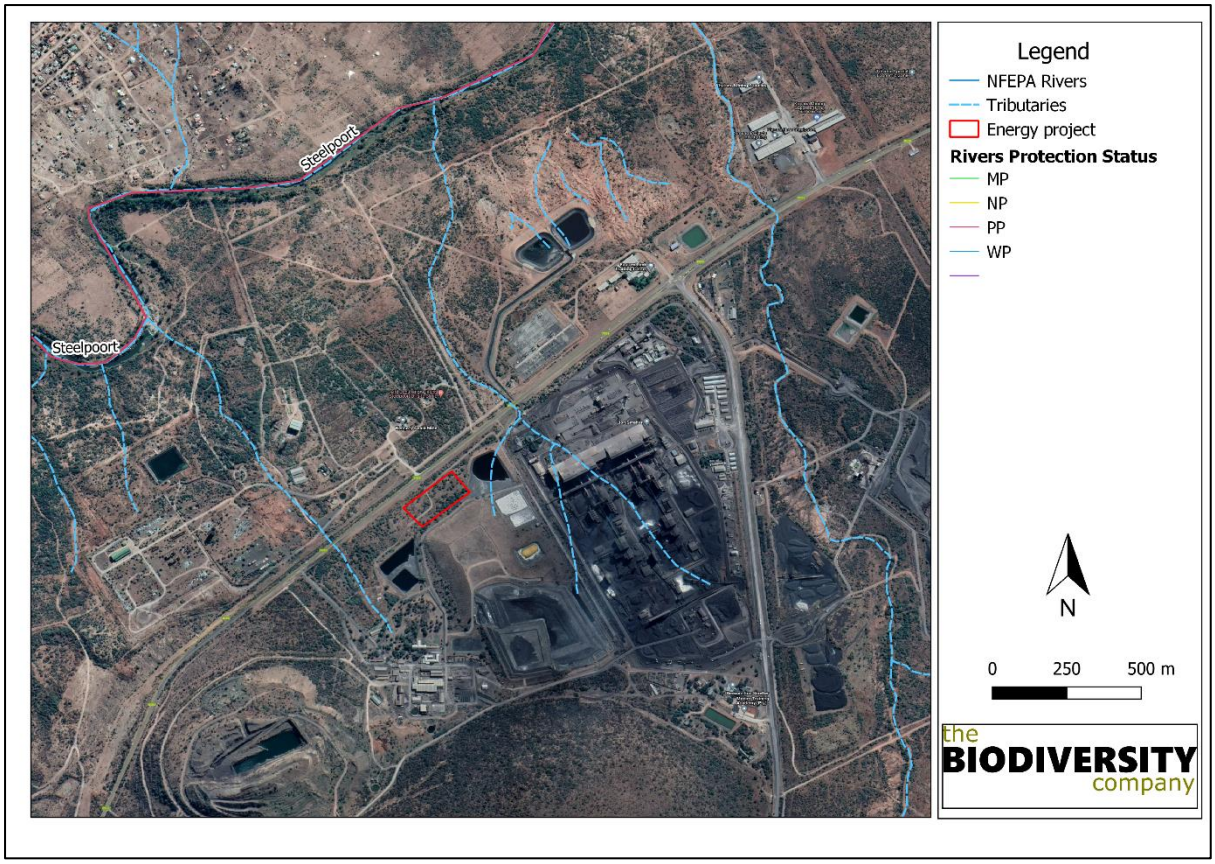


Figure 28: The map highlighting the protection status of aquatic ecosystems within the proposed project area (NBA, 2018)

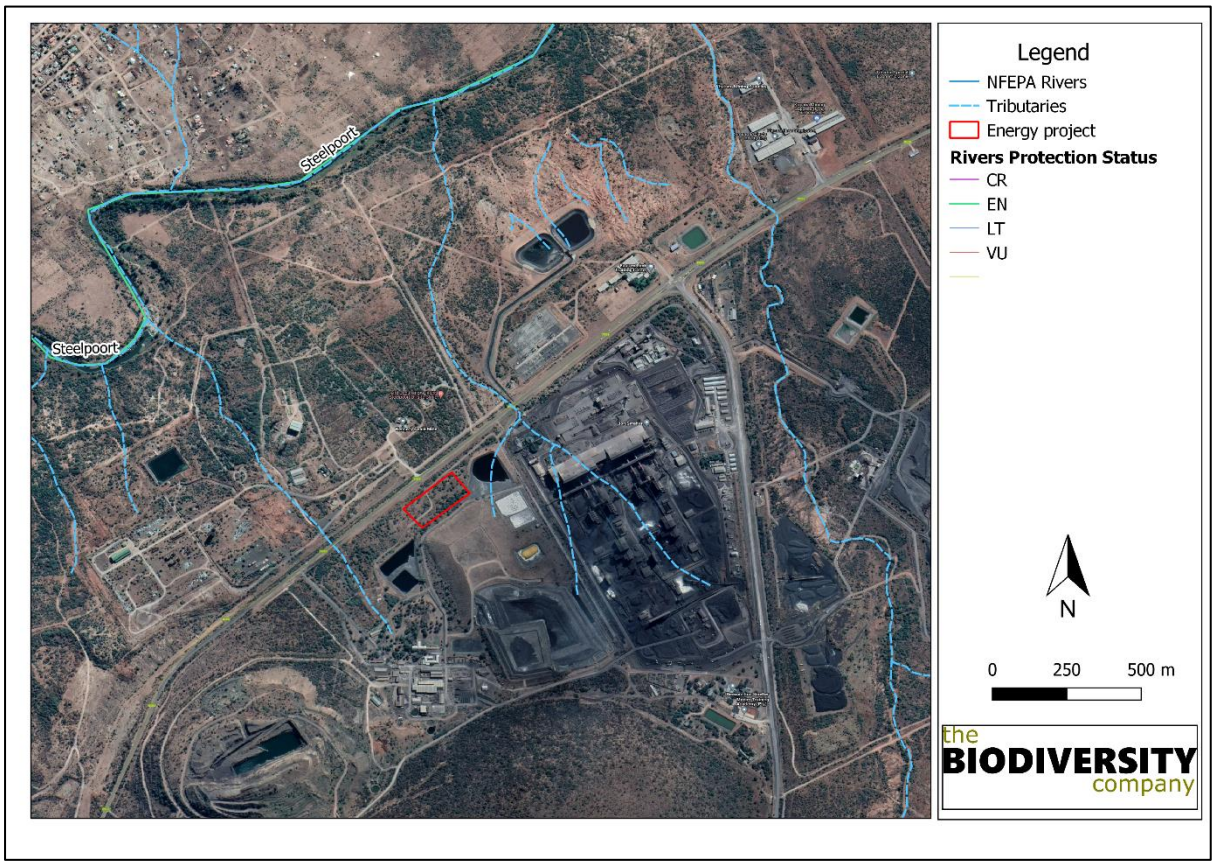


Figure 29: The map highlighting the threat status of aquatic ecosystems within the proposed project area (NBA, 2018)

6.6.1.3 Ecological condition of the Sub - quaternary Catchment (CQR)

The project area is located in the Olifants Water Management Area (WMA2) (NWA, 2016), and the Eastern Bankenveld ecoregion. The project area is located within the quaternary catchments, B41J which drains north into the Steelpoort River (Figure 29). The proposed activities addressed in the study fall adjacent to a tributary off the Steelpoort River. The watercourse associated with the project area is characterised as ephemeral drainage line.

The Steelpoort River reach which is the downstream receiving environment is represented by the B41J-576 Sub-quaternary catchment (SQR). The ecological status and composition of the classified SQR is shown in Table 16, whilst the ecological status of the unclassified drainage line is unknown. The B41J-576 SQR was classified as class D or largely modified ecological classification. Factors contributing to the modified nature of the watercourse includes largely modified instream habitat continuity, moderate flow modifications, and impacts to water quality. The ecological importance and sensitivity of the SQR was found to be high.

Table 16: Desktop data pertaining to the ecological condition of the SQR assessed (DWS, 2018)

	PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE		ECOLOGICAL SENSITIVITY	
B41J-576	D (largely Modified)		High		High	
	VARIABLE	**STATUS**	**VARIABLE**	**STATUS**	**VARIABLE**	**STATUS**
	Modifications to Instream Habitat Continuity	Small	Fish species per sub quaternary catchment	17	Fish Physico-Chemical sensitivity description	Very high
	Modifications to Riparian/ Wetland Zone Continuity	Moderate	Invertebrate taxa per sub quaternary catchment	47	Fish No-flow sensitivity description	Very high
	Potential Instream Habitat Modifications	Large	Habitat Diversity Class	Very Low	Invertebrate Physico-Chemical sensitivity	Very high
	Modifications to Riparian/ Wetland Zones	Large	Instream Migration Link Class	Very High	Invertebrate velocity sensitivity	Very high
	Potential Flow Modifications	Moderate	Riparian-Wetland Zone Migration Link	High	Stream size sensitivity to modified flow/water level changes description	Low
	Potential Physico-Chemical Modifications	Large	Instream Habitat Integrity Class	Moderate	Riparian-Wetland Vegetation intolerance to water level changes description	Low
	ANTHROPOGENIC IMPACTS					
	The following impacts/activities were identified: SMALL: Abstraction (run-of river)/increased flows, Irrigation, Runoff/effluent: Irrigation, MODERATE: Exotic vegetation, Roads, Runoff/effluent: Urban areas, LARGE: Agricultural lands, Erosion, Mining, Runoff/effluent: Mining, Sedimentation, Grazing / trampling, Urbanization, Vegetation removal, SERIOUS: Algal growth,					

6.6.1.4 National Fresh Water Protection Areas

The watercourses considered in this assessment fall within a single river Freshwater Ecosystem Priority Areas (FEPA), including a Fish Support Area and fish sanctuary in the B41J-576 SQR. The watercourses therefore need to be managed in a manner that enables the systems to remain in a good condition to contribute to national biodiversity goals and support sustainable use of water resources.

The B41J-576 SQR is labelled as a fish support area for the fish species Opsaridium peringueyi (Southern barred minnow). According to the IUCN, the species is listed as Least Concern (LC) due to its large distribution range across Southern Africa, however population reductions are associated with habitat loss (IUCN, 2021).

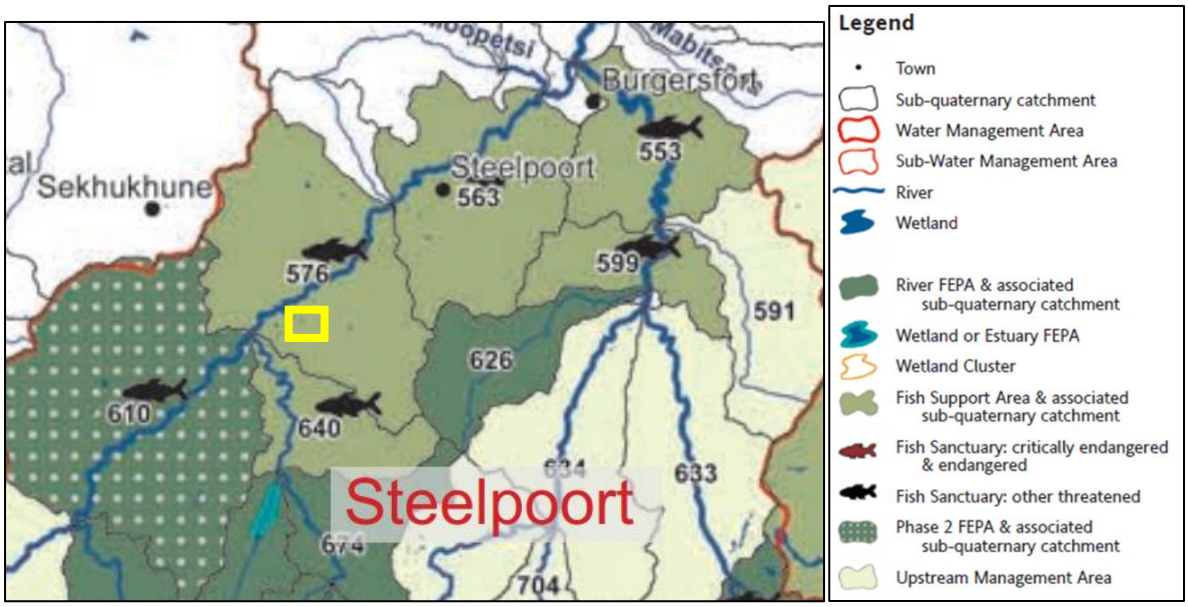


Figure 30: Illustration of NFEPAs associated with the project area (indicated in yellow square)

6.6.1.5 Fish community assessment

Due to the absence of a watercourse within the project area, no fish are expected. However it is stressed that land use activities within the catchment, such as the those associated with the Glencore project, do pose risk to water quality and fish populations within the downslope receiving watercourses (Steelpoort River NFEPA).

6.6.2 FIELD ASSESSMENT

A single high flow survey was conducted on the 14th of December 2021. As the site was dry during the survey, a focus on habitat of the site and reached based assessments were conducted.

The results of the Intermediate Habitat Integrity Assessment (IHIA) for the Steelpoort tributary are provided in Table 17.

The results of the IHIA for the tributary indicated largely modified instream conditions. Instream modifications were largely attributed to channel modification with the construction of a channel below the R555 (Figure 31). Additionally, extensive bed modification occurred within the upper reaches of the tributary, with concrete slabbing observed throughout the upper reaches (Figure 32), and the use of rubber tyres for erosion control, which have been burnt during veld fires resulting in solid waste within the tributary (Figure 33). The riparian zone has been moderately modified from reference conditions (unmodified watercourse), with channel and bed modification and indigenous vegetation removal contributing to the loss of habitat integrity.

Table 17: Results for the habitat assessment in the Steelpoort tributary

INSTREAM	STEELPOORT TRIBUTARY	
	IMPACT SCORE	WEIGHTED SCORE
Water abstraction	7	3,92
Flow modification	10	5,2
Bed modification	20	10,4
Channel modification	25	13
Water quality	8	4,48
Inundation	5	2
Exotic macrophytes	0	0
Exotic fauna	5	1,6
Solid waste disposal	5	1,2
TOTAL INSTREAM		58.2
CATEGORY		D
RIPARIAN	**STEELPOORT TRIBUTARY**	
	IMPACT SCORE	**WEIGHTED SCORE**
Indigenous vegetation removal	15	7,8
Exotic vegetation encroachment	12	5,76
Bank erosion	17	9,52
Channel modification	20	9,6
Water abstraction	2	1,04
Inundation	0	0
Flow modification	5	2,4
Water quality	0	0
TOTAL RIPARIAN		64
CATEGORY		C

Figure 31: Channel modification within the tributary (Google Earth imagery, 2021)

Figure 32: Illustration of concrete within the bed of the tributary

Figure 33: Illustration of tyres used for erosion control

A riparian delineation was conducted using vegetation features along the visible drainage lines observed onsite with results presented in Figure 34. Despite the low sensitivity of the drainage lines, it is recommended that a 32 m buffer be applied to the riparian zone, and that any construction activities or stockpiling occur outside of the applied buffer to limit habitat and water quality impacts within this system and the downstream Steelpoort River NFEPA.

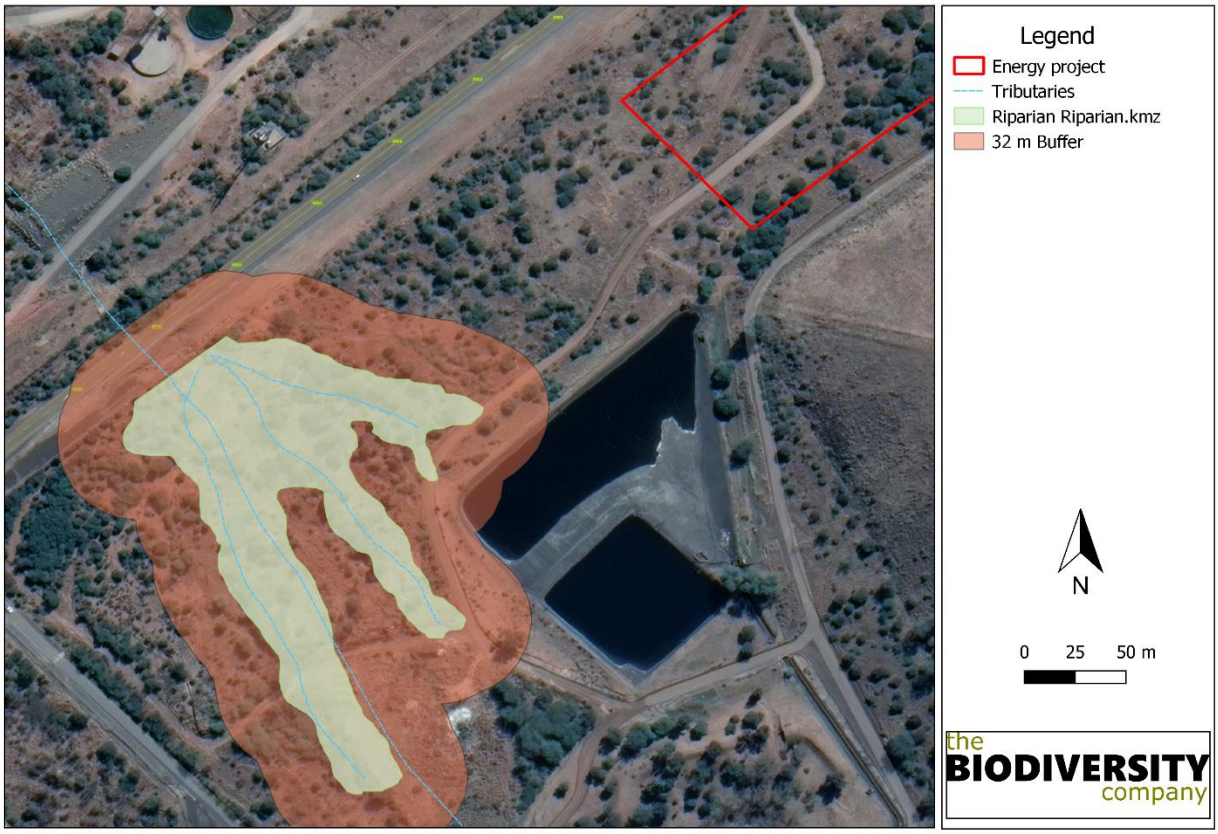


Figure 34: Illustration of the riparian zone and applied 32 m buffer

6.6.3 VERIFICATION OUTCOME

As per section 2.5.3, the screening tool identified the proposed development to fall within an area with a "low sensitivity" in terms of the aquatic biodiversity theme.

According to NBA (2018) the "threat status" of the rivers associated with the proposed project are rated as endangered (EN). The ecological sensitivity and importance is rated "high" with fish and invertebrates sensitivity to changes in physico-chemical properties and velocity are rated as "very high". A single fish species, Oreochromis mossambicus, expected within the greater project area is listed as Near Threatened. The species is threatened due to hybridisation with Oreochromis niloticus, and therefore the proposed activities do not pose a threat to the species. It is highly unlikely that any of the species occurs directly within the project area. The tributary observed during the site visit was found to be dry during the survey. However, the species are expected to occur within the downstream reaches (approximately 1 km downstream).

Due to the unlikeliness of the presence of the identified endangered species within the site boundary of the proposed development, the outcome of the site verification concurred with the "low sensitivity" as identified by the screening tool.

6.6.4 PLAN OF STUDY FOR BASIC ASSESSMENT

Based on the information presented in the previous sections, it is therefore concluded that a "Aquatic Biodiversity Compliance Statement" as per the "Protocol for the specialist assessment and minimum report content requirements for environmental impact on aquatic biodiversity" will be completed as part of the Basic Assessment (BA) process.

6.7 HYDROLOGICAL AND GEOHYDROLOGICAL

As mentioned previously, the project falls within the lower reaches of quaternary catchment B41J of the Olifants Water Management Area (WMA) (DWS, 2016). Elevations on the site typically range from 770 to 840 metres above mean sea level (mamsl).

6.7.1 SUB-CATCHMENTS / HYDROLOGICAL RESPONSE UNITS (HRUS)

Two (2) hydrological response units (HRUs) describe the natural drainage for the study area (using a 1:200 stream count and 15m DTM fill) – refer to Figure 35. The HRUs delineated correspond well to known non-perennial drainage lines associated with the site.

The origin of the non-perennial stream appears to be near the existing tailings facility (TSF) towards the southwest, and the pollution control dam (PCD) towards the northeast from the position of the proposed site. Hence, and based on available elevation data, the area zoned for the proposed ECF (Energy Conversion Facility) Plant is situated on a sub-catchment water divide. Approximately 90% of the proposed layout falls within HRU1, and 10% in HRU2. Hence, drainage from the position of the proposed EFC Plant will primarily be towards the northeast, with some minor runoff towards the northwest.

Drainage from the Lion Smelter site is towards the north-west, via two (2) non-perennial streams (as identified with HRU1 and HRU2) and flow is towards the Steelpoort River, situated approximately 1.14 km northwest of the site. Distance from the site to the nearest drainage lines is recorded as approx. 160 and 272 m.

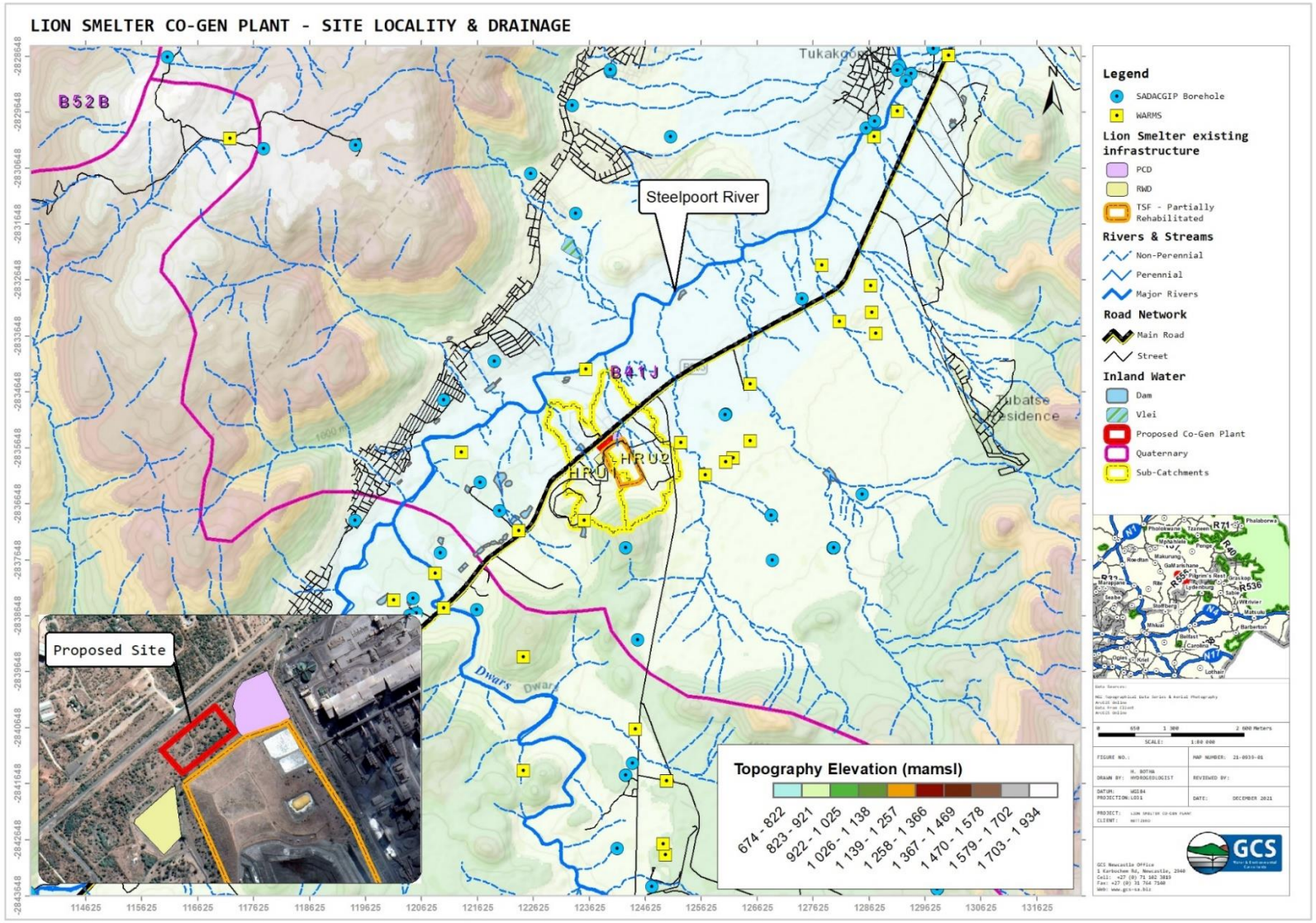


Figure 35: Site locality and drainage

6.7.2 HYDROGEOLOGY

The regional hydrogeological conditions are naturally influenced by the associated geological formations and properties thereof. The hydrogeology data in this section were extracted from JMA (2019) and further supplemented by literature data.

The regional geohydrology at Lion is discussed concerning the available information relevant to the clipped regions of the published 1:500 000 Hydrogeological Map Series of the Republic of South Africa, specifically:

- Sheet 2326 Polokwane, 2003.
- Sheet 2330 Phalaborwa, 1998.
- Sheet 2526 Johannesburg, 1999.
- Sheet 2530 Nelspruit, 1999.

There are two distinctly separate stratigraphic sequences within the larger study area, each with its geohydrological manifestations, summaries of which are given below.

6.7.2.1 Geohydrological Zone 1: Pretoria Group Meta-Sediments

The area to the east of Lion is underlain by predominantly meta-argillaceous and meta-arenaceous rocks of the Pretoria Group - denoted by Vp in Figure 36. Within this zone the groundwater primarily occurs within the joints and fractures of the competent argillaceous (mudstones, siltstones, shales) and arenaceous rocks (sandstones and quartzite), related to tensional or compressional stresses and offloading.

The borehole yielding potential within this geohydrological zone is classified as D3, which implies a median yield that varies between 0.5 l/s to 2.0 l/s and d4, which implies a median yield that varies between 2.0 l/s to 5.0 l/s.

No large scale groundwater abstraction is indicated to occur from these fractured aquifers within the bounds of the study area. The groundwater potential for this area is given as >60%, which indicates the probability of drilling a successful borehole (yield > 0.1 l/s) whilst the probability of obtaining a yield above 2 l/s is given as between 40% and 50% - refer to Figure 37.

The mean annual recharge (MAR) to the groundwater system in the eastern parts of the study area is estimated to be between 25 mm and 37 mm per annum, which relates to between 4% and 6% of the MAP. The groundwater contribution to surface stream base flow is relatively low, indicated at less than 10 mm/annum (DWAF, 2006).

The depths to groundwater levels are estimated to range between 10 m and 20 m below the surface. The aquifer storativity (S) for the fractured aquifers in this part of the study area is indicated to be less than 0.001. The saturated interstice types (storage medium) are fractures that are restricted principally to the zone directly below the groundwater level. The pristine groundwater quality is good with an expected TDS range of between 300 mg/l to 500 mg/l (JMA, 2019).

6.7.2.2 Geohydrological Zone 2: Rustenburg Layered Suite

The groundwater study area at Lion is underlain by ultramafic/mafic intrusive rocks of the Rustenburg Layered Suite - denoted by Vr on Figure 36. The geohydrological properties of this zone are therefore of utmost importance and will be addressed in detail in the sections that follow.

The primary groundwater occurrences within this zone are in the joints and fractures occurring within the contact zones related to the heating and cooling of the country rocks as well as in fractures in the transitional zones between the weathered and un-weathered rocks. Numerous faults are recorded within the Rustenburg Layered Suite within the study area and potentially act as additional preferential groundwater flow zones.

The borehole yielding potential within this geohydrological zone is classified as D3, which implies a median yield that varies between 0.5 l/s to 2.0 l/s and d4, which implies a median yield that varies between 2.0 l/s to 5.0 l/s. The groundwater potential for these aquifers area is given as > 60%, which indicates the probability of drilling a successful borehole (yield > 0.1 l/s) whilst the probability of obtaining a yield over 2 l/s is given as between 20 and 30% - refer to Figure 36.

The MAR to the groundwater system in the central and northern parts of the study area is estimated to be between 15 mm and 25 mm per annum, which relates to between 3% and 5% of the MAP. The aquifer storativity (S) for the fractured aquifers in this part of the study area is indicated to be less than 0.001. The saturated interstice types (storage medium) are fractures that are restricted principally to the zone directly below the groundwater level.

The groundwater contribution to surface stream base flow is relatively low, indicated as negligible (DWAF, 2006).

6.7.2.3 Aquifer Types (Primary, Weathered, Fractured, Karst)

Concerning the local geology of the site, it is regarded that two major aquifer types occur within the study area, namely: 1) a laterally extensive shallow weathered zone aquifer system and 2) a more localized fractured aquifer system (JMA, 2019).

The predominant aquifer type present within the study area is a laterally extensive shallow weathered zone aquifer which occurs within the weathered and weathering related fractured zone, within the predominantly norite host rock matrix. This aquifer extends across the entire study area and has an average vertical thickness of 13.16 m.

This aquifer zone will store and transport the bulk of the groundwater in the study area and will display unconfined to semi-unconfined piezometric conditions. This shallow weathered zone aquifer will, therefore, as a result, be highly susceptible to surface-induced anthropogenic influences on site.

The localized fractured aquifers present within the study area are restricted to the contact zones between the intrusive dolerite dykes and the host rocks as well as along the major fault zones. Although these aquifers may potentially have high yields, high transmissivity values and represent preferential flow paths; they have a limited storage capacity as well as restricted recharge characteristics.

The bulk of the water supplied by the fractured aquifers will be drained laterally from storage within the shallow weathered zone aquifers neighbouring onto them. These aquifers can transmit surface-induced contaminants over great distances, and as such have been identified as potential fatal flaws if their lateral continuation extends beyond the delineated lateral aquifer boundaries.

With regards to the two aquifer types present within the study area and subject to the site-specific host matrix physical properties, it is assumed that the bulk of the groundwater zone within the study area will display porous groundwater flow conditions. The “fractured conditions” encountered along with the linear geological features, may, due to their scale and interconnectivity, also be regarded as porous groundwater flow zones within the delineated lateral aquifer boundaries.

6.7.2.4 Aquifer zones

Available hydrogeological investigations information indicate that there are no extensive perched aquifer systems within the study area (JMA, 2019). There are 2 distinct aquifer zones in the study area.

6.7.2.4.1 Unsaturated Zone:

Due to the nature of the shallow weathered zone aquifers at Lion, the top of the unsaturated zone is defined by the land surface, whilst the bottom of the unsaturated zone is defined by the groundwater table/level. The thickness of the unsaturated zone is therefore determined according to the natural groundwater levels recorded. The average thickness of the unsaturated zone at Lion is recorded to range between 2.9 m and 36.2 m with an average thickness of 13.24 m.

6.7.2.4.2 Saturated Zone:

The saturated zone of the shallow weathered zone aquifer at Lion is defined at the top by the groundwater table/level and the bottom by the weathered/fractured and fresh bedrock interface. The saturated aquifer thickness of the shallow weathered zone aquifer at Lion is calculated by subtracting the measured natural groundwater level depth from the weathered or weathering related fractured depth as recorded at the groundwater monitoring boreholes.

The average thickness of the natural saturated zone at Lion varies between 0.11 m and 60.23 m with an average thickness of 13.16 m.

6.7.2.5 Blow yields

Blow yields were obtained from 64 of the geological/geohydrological investigative boreholes during the drilling of the boreholes. The blow yields values range between 0.01 l/s and 7.00 l/s. A calculation of the arithmetic means yields a value of 1.31 l/s (JMA, 2019).

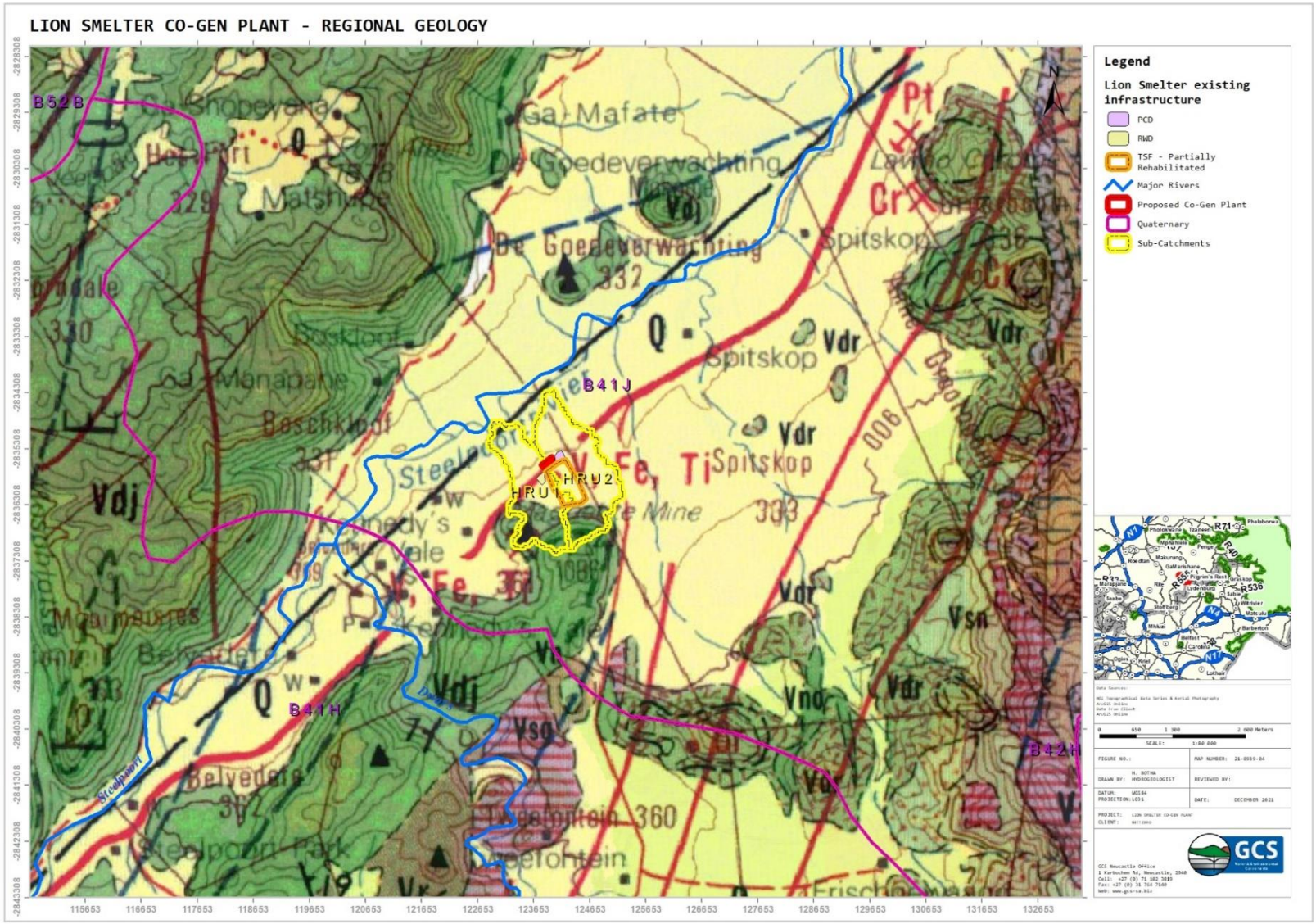


Figure 36: Regional geology

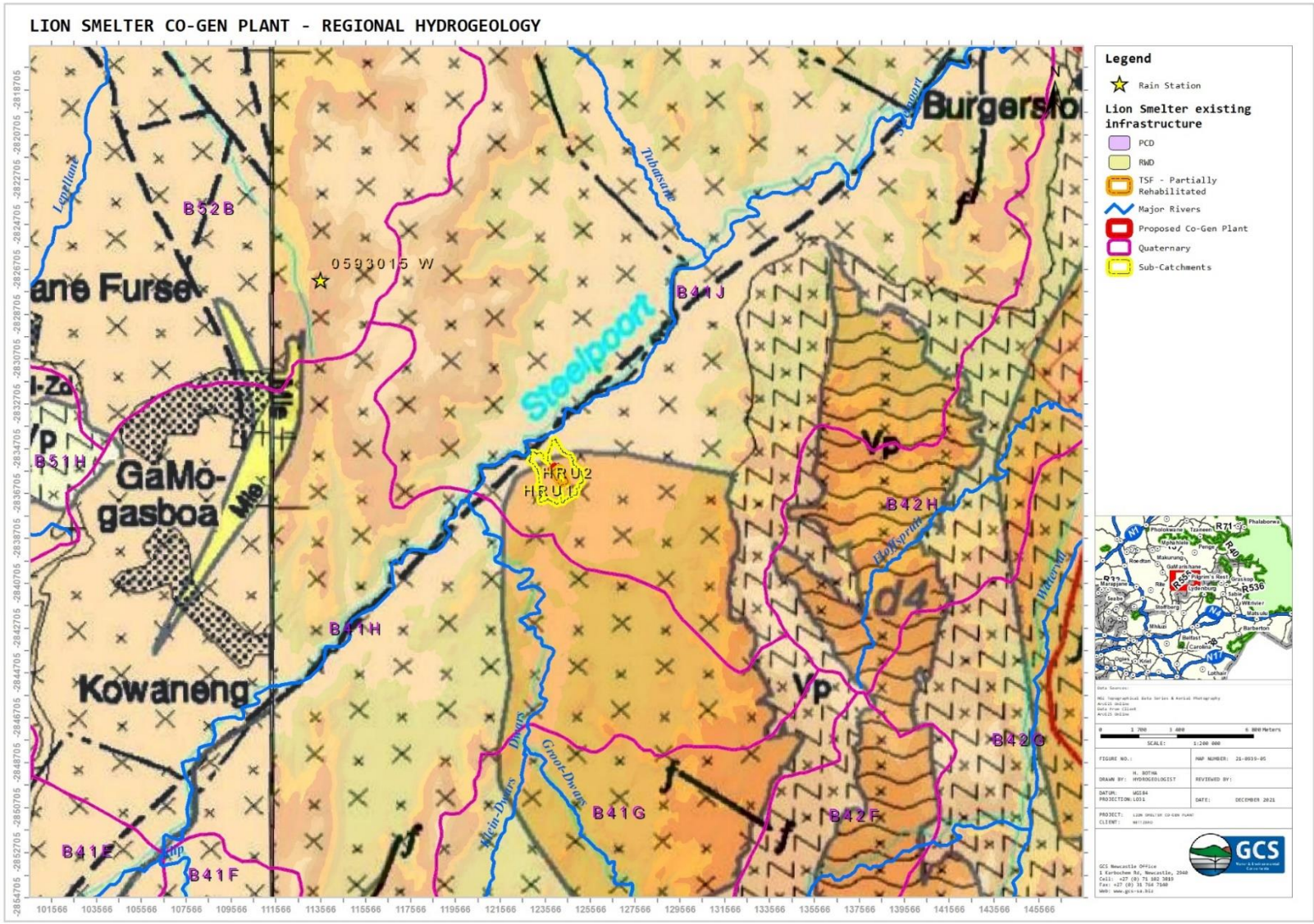


Figure 37: Regional geohydrology

6.7.3 FLOODLINES

A review of the hydrological assessment report compiled by Knight Piésold Consulting (2019) suggests that the site falls well outside the modelled 1:100 year flood lines of the Steelpoort River tributary (refer to Figure 38).

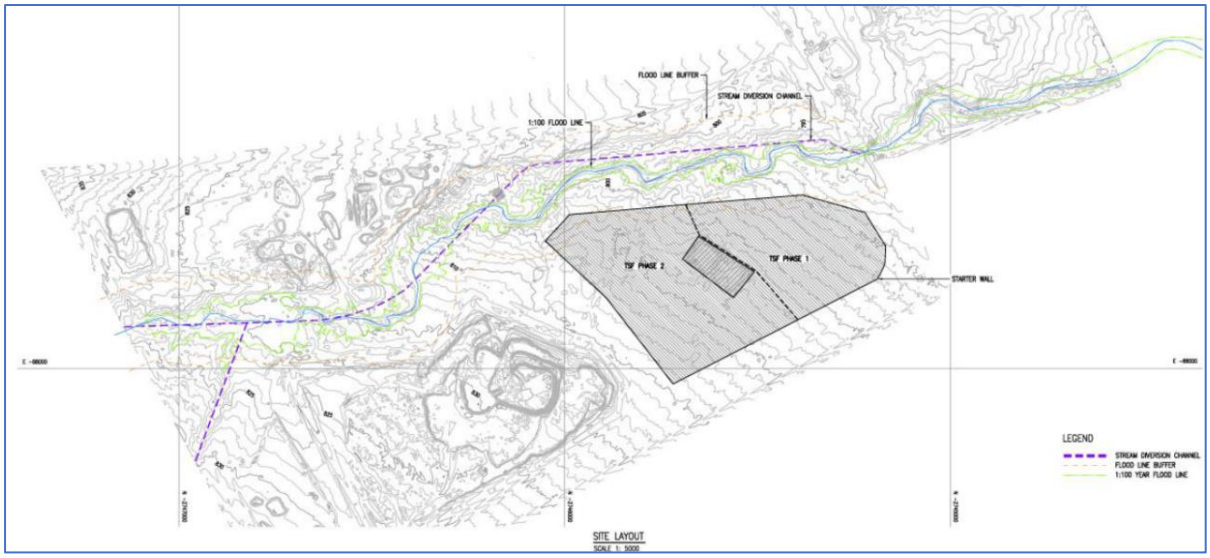


Figure 38: 1:100 year flood line for the Steelpoort River (extracted from Knight Piésold Consulting, 2019)

6.7.4 DEPTH TO GROUNDWATER

According to WR2012 (Bailey & Pitman, 2015) and DWAF GRAII (DWAF, 2006) data, the groundwater level in the study area on average is in the order of 18.8 mbgl (metre below ground level). According to the hydrogeology report compiled by JMA (JMA, 2021), the depths to groundwater levels are also estimated to range between 10 m and 20 m below the surface.

6.7.5 SURFACE WATER USERS WITHIN THE SUB-CATCHMENT ASSOCIATED WITH THE SITE

According to Water Allocation Registration Management System (WARMS) for Section 21(a) and Section 21 (b) water uses, there is one (1) registered water user within HRU1, and one (1) registered water user along the Steelpoort River (2 in total). Both water users are registered as Lion Smelter, one is an abstraction from a borehole along the Steelpoort River (ID: 24009350, 163520 m^3/yr) and the other is for water storage in a dam (ID: 24084090, total storage = 677 929 m^3/yr).

6.7.6 SURFACE WATER QUALITY

A review of the JMA (2021) monitoring reports (Jan 2021 to August 2021) suggest that there are 9 existing surface water monitoring points at Lion Smelter Operations (refer to Table 18).

Table 18: Summary of monitoring points (JMA, 2021)

ID	LATITUDE	LONGITUDE	POSITION
LSWM-S1	-24.79231	30.13089	Steelpoort River Downstream for Lion.
LSWM-S2	-24.80756	30.10963	Steelpoort River Opposite Lion.
LSWM-S3	-24.82850	30.08030	Steelpoort River Upstream from Lion.
LSWM-S4	-24.83303	30.07568	Steelpoort river upstream from Dwars River Confluence.
LSWM-D1	-24.83201	30.07980	Dwars River Upstream from Steelpoort River Confluence.
LSWM-D2	-24.85639	30.09959	Dwars River further Upstream at Irrigation Weir.
LSWM-D3	-24.92841	30.10860	Dwars River further Upstream at Big Bridge.
LSWM-D4	-24.99781	30.13400	Dwars River further Upstream at Small Bridge.
LSWM-D5	-25.04661	30.12080	Dwars River further Upstream at Upstream Weir.

A review of the hydrochemistry data for the sample points suggests that parameters measured (pH, TDS, Ca, Mg, Na, Cl, SO_4, NH_4, PO_4, F, Al, Mn, Cr^{6+} and Zn) generally fall well within regulatory limits, except for Al concentrations which have been observed to be high several times in from January to August 2021 – refer to Table 19 and Table 20 below for snapshots of typical water quality.

Table 19: Summary of hydrochemistry results for March 2021 (JMA, 2019)

	pH	TDS (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	Cl (mg/l)	SO_4 (mg/l)	NH_4 (mg/l)	PO_4 (mg/l)	F* (mg/l)	Al* (mg/l)	Mn* (mg/l)	Cr^{6+}* (mg/l)	Zn* (mg/l)
RQO Olifants Catchment (Steelpoort River)									0.125	2	0.063	0.68	0.068	0.014
LSWM-S1	7.60	116	19.4	9.19	10.5	9.25	7.70	<0.45	<0.03	0.12	0.45	0.01	<0.02	<0.01
LSWM-S2	8.00	122	21.3	9.22	9.06	7.71	16.4	<0.45	<0.03	0.12	0.41	<0.01	<0.02	<0.01
LSWM-S3	7.95	121	19.8	10.6	9.29	8.61	8.30	<0.45	<0.03	0.10	0.51	<0.01	<0.02	<0.01
LSWM-S4	7.96	113	19.3	9.11	9.15	8.13	7.62	<0.45	<0.03	0.12	0.97	0.02	<0.02	<0.01
LSWM-D1	8.13	130	21.2	13.2	6.81	5.63	6.32	<0.45	<0.03	0.09	0.65	<0.01	<0.02	<0.01
LSWM-D2	8.01	141	21.0	12.9	7.21	7.58	18.5	<0.45	<0.03	0.10	0.88	0.01	<0.02	<0.01
LSWM-D3	7.94	108	16.4	11.3	5.04	3.62	6.91	<0.45	<0.03	0.10	1.18	<0.01	<0.02	<0.01
LSWM-D4	7.90	87.2	14.3	8.89	4.53	3.40	7.53	<0.45	<0.03	0.11	0.65	<0.01	<0.02	<0.01
LSWM-D5	7.62	72.1	14.4	6.48	3.84	2.28	5.06	<0.45	<0.03	0.10	0.67	<0.01	<0.02	<0.01

Table 20: Summary of hydrochemistry results for August 2021 (JMA, 2019)

	pH	TDS (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	Cl (mg/l)	SO_4 (mg/l)	NH_4 (mg/l)	PO_4 (mg/l)	F* (mg/l)	Al* (mg/l)	Mn* (mg/l)	Cr^{6+}* (mg/l)	Zn* (mg/l)
RQO Olifants Catchment (Steelpoort River)									0.125	2	0.063	0.68	0.068	0.014
LSWM-S1	7.47	170	24.4	14.2	16.5	20.7	20.9	<0.45	<0.03	0.18	<0.01	<0.01	<0.02	<0.01
LSWM-S2	7.68	164	24.4	14.2	14.3	20.5	17.9	<0.45	<0.03	0.25	<0.01	<0.01	<0.02	<0.01
LSWM-S3	7.60	148	22.3	13.8	12.2	16.7	13.3	<0.45	<0.03	0.15	<0.01	<0.01	<0.02	<0.01
LSWM-S4	7.61	150	24.4	12.8	12.8	16.8	12.9	<0.45	<0.03	0.12	<0.01	<0.01	<0.02	<0.01
LSWM-D1	7.67	231	30.3	25.7	11.0	10.2	24.5	0.54	<0.03	<0.09	<0.01	<0.01	<0.02	<0.01
LSWM-D2	7.82	248	31.5	27.2	10.4	12.1	26.5	<0.45	<0.03	<0.09	<0.01	<0.01	<0.02	<0.01
LSWM-D3	7.78	213	27.7	23.0	7.41	7.70	21.1	<0.45	<0.03	<0.09	0.02	<0.01	<0.02	<0.01
LSWM-D4	7.69	124	20.1	12.9	5.20	5.12	17.9	<0.45	<0.03	<0.09	0.03	<0.01	<0.02	<0.01
LSWM-D5	7.57	82.8	14.9	8.82	3.42	2.63	5.89	<0.45	<0.03	0.12	0.26	<0.01	<0.02	<0.01

6.7.7 SURFACE WATER QUALITY OBJECTIVES

An integrated water quality management plan for the Olifants river system was conducted in August 2017 by the DWS. The study assessed the water quality downstream of the De Hoop Dam in the Steelpoort sub-catchment. Water Planning limits were then set for sub-catchment and are indicated in Table 21. Water Quality assessments for the Lion Smelter should be assessed to align with the Water quality limits set by the Department of Water and Sanitation for the Sub-Catchment, as well as the existing Water Use License (WUL) for the site.

Table 21: Water Quality limits for the catchment downstream of De Hoop Dam catchments of the Steelpoort Sub-Catchment

VARIABLE	UNITS	VALUE
Calcium	mg/L	15
Chloride	mg/L	25
Total Dissolved Solids	mg/L	260
Electrical Conductivity	µS/m	30
Fluoride	mg/L	0.7
Potassium	mg/L	10
Magnesium	mg/L	30
Sodium	mg/L	20
Ammonium	mg/L	0.05
Nitrate	mg/L	0.5
Total Phosphorus	mg/L	0.25
pH	ph Unit	6.5-8.4
Ortho-phosphate	mg/L	0.01
Sulphate	mg/L	20
Total Alkalinity	mg/L	120
Dissolved Organic Carbon	Carbon	5
Dissolved Oxygen	mg/L	9

VARIABLE	UNITS	VALUE
SAR	Unitless Ratio	2
Suspended Solids	mg/L	25
Chlorophyll	µg/L	1
Escherichia coli	CFU/100mL	130
Faecal coliforms	CFU/100mL	130
Aluminium	mg/L	0.01
Boron	mg/L	0.5
Chromium (V)	µg/L	7
Iron	mg/L	0.1
Manganese	mg/L	0.2

6.7.8 VERIFICATION OUTCOME

The Screening Report (Appendix A) generated using the national web-based screening tool, at this stage do not predetermine sensitivities in terms of Hydrology. Based on the desktop information, however, at the onset, the proposed development falls within a “medium sensitive” environment.

Following the site sensitivity verification, the hydrological risk of the proposed development is deemed to be “low”. This is largely due to the proposed concrete barrier to be installed, the absence of any surface water streams, dedicated stormwater containment proposed for each chimney stack and the fact that the zoned area has already been modified as a result of the existing Lion Smelter activities.

6.7.9 PLAN OF STUDY FOR BASIC ASSESSMENT

There is a basic stormwater system and management plan proposed as part of the development. However, a conceptual stormwater management plan will be compiled to illustrate this spatially for the submission of the BA.

The conceptual stormwater management plan will be incorporated into a dedicated hydrology report.

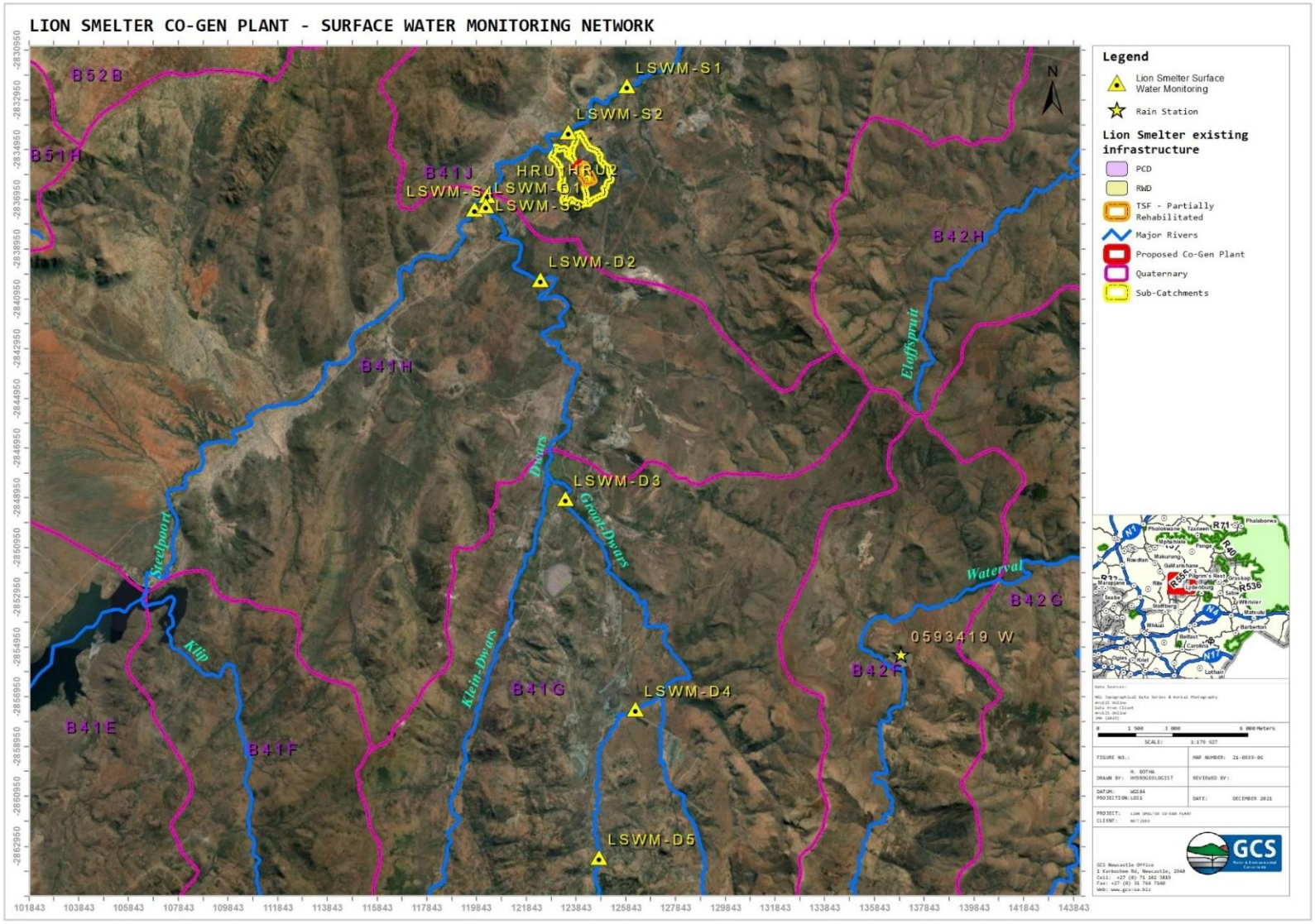


Figure 39: Positions of monitoring points (JMA, 2021)

6.8 NOISE

A baseline measurement was taken during the day and night of 29 November 2021.

6.8.1 FIELD ASSESSMENT

The noise readings were done at the measuring points as per Figure 40. It was only at measuring point 6 (67.3dBA during the day and 66.0dBA during the night) where the boundary noise levels was recorded as high. This measuring point, however, was some distance from where the ECF project will be located.

All other monitoring points where within an acceptable noise level.

Figure 40: Aerial imagery indicating baseline noise sampling points

6.8.2 VERIFICATION OUTCOME

The Screening Report (Appendix A) generated using the national web-based screening tool, at this stage do not predetermine sensitivities in terms of the landscape and/or visual environment.

Based on the information gathered during the site visit, however, the noise sensitivity associated with the proposed development is considered to be “low”.

6.8.3 PLAN OF STUDY FOR BASIC ASSESSMENT

Due to the "low sensitivity" determined, it has been concluded that a "Compliance Statement" as per the "Protocol for the specialist assessment and minimum report content requirements for noise impacts" will be completed as part of the Basic Assessment (BA) process.

6.9 TRAFFIC IMPACT

A Baseline Traffic Study (BTS) took place in order to verify the sensitivity associated with the effect the proposed development will have on the current situation. The main purpose of the BTS and desktop analysis was:

- To determine the status quo of the relevant road network adjacent the proposed project.
- To determine and identify any potential constrains for the proposed project.
- To determine the need for a full Traffic Impact Assessment from a traffic engineering point of view.

Figure 41 provides the locality of the proposed project in relation to other activities in the vicinity, including the location of the potential intersections under investigation as part of this study.

Table 22 provides a summary of information on the proposed project in terms of the planned construction, operations, and timelines. It is important to take note that the anticipated timeline as depicted by the last-mentioned table provides an estimated timeline in terms of months and/or years for the construction and operational phases and does not depict the exact month and/or year that construction and operations are planned.

POINT	INTERSECTION STATUS	INTERSECTION	GPS CO-ORDINATES	
			LATITUDE	LONGITUDE
A	Existing / Proposed Alternative 1	Road R555 and the existing Smelter Access Road (Proposed project Access Alternative 1)	S 24°49'16.05"	E 30° 6'30.98"
B	Existing	Road R555 and Road 1	S 24°49'4.74"	E 30° 6'45.21"
C	Proposed Alternative 2	Road R555 and the proposed project Access Alternative 2	S 24°49'1.57"	E 30° 6'49.63"

Figure 41: Locality of the proposed development and relevant intersections under investigation

Table 22: Summary of the extend of the proposed project for the respective phases

DESCRIPTION	PHASE	
	CONSTRUCTION	OPERATIONAL
Duration of phase	21 months with a 8 month pause in construction between month 9 and 17. Actual month for construction activity = 13 months	± 20 years
Expected number of heavy vehicles delivering consumables and plant materials per day	Max 40 per day	Max 2 per day
Expected percentage of heavy vehicles delivering consumables or plant materials during traffic peak times	20%	50%
Number of construction staff per day	Max 55 at peak	Not relevant
Number of shifts for construction staff per day	1 shift per day	Not relevant
Number of workers per day	Not relevant	9 Technicians 2 Security staff (2 at day, 2 at night) 1 Admin clerk 1 Cleaning staff
Where staff are anticipated to reside	Within the Greater Tubatse and Makhuduthamaga Local Municipalities	
Abnormal vehicles delivering large components	Once-off events	Once-off events
Access road to proposed project	From Road R555 via existing Smelter Access Road (Point A), OR From Road R555 via a new access intersection (Point C)	Same as for Construction Phase
Calculated number of vehicle trips to be generated by the proposed project during AM or PM peak hours	AM Peak: 25 (In: 15, Out: 11) PM Peak: 25 (In: 11, Out: 15)	AM Peak: 8 (In: 6, Out: 2) PM Peak: 8 (In: 2, Out: 6)

6.9.1 OUTCOME OF DATA COLLECTION AND INVESTIGATION

6.9.1.1 Status Quo of Land Use, as well as road network characteristics

The relevant property of the proposed project is currently vacant and borders the existing Lion Ferrochrome Smelter Complex on the western side. For the purpose of this baseline traffic study, it is assumed that the vehicle traffic absorption rate (rate at which existing developments attract vehicular traffic) by all other types of completed developments will maintain the same status for the next ten years.

Figure 42 provides the existing road network layout for the area under investigation.

Table 23 contains information related to the existing and proposed intersections under investigation.

Table 24 provides information concerning the relevant road sections under investigation and includes the following:

- Relevant road section.
- Picture of road section.
- Existing class of road.
- Proposed class of road.
- Road reserve widths.
- Lane widths.
- Median widths (if relevant).

Table 25 and Table 26 provide information on typical road characteristics and access management requirements as per the guideline COTO TRH26 “South African Road Classification and Access Management Manual, Version 1.0, August 2012” Rural areas.

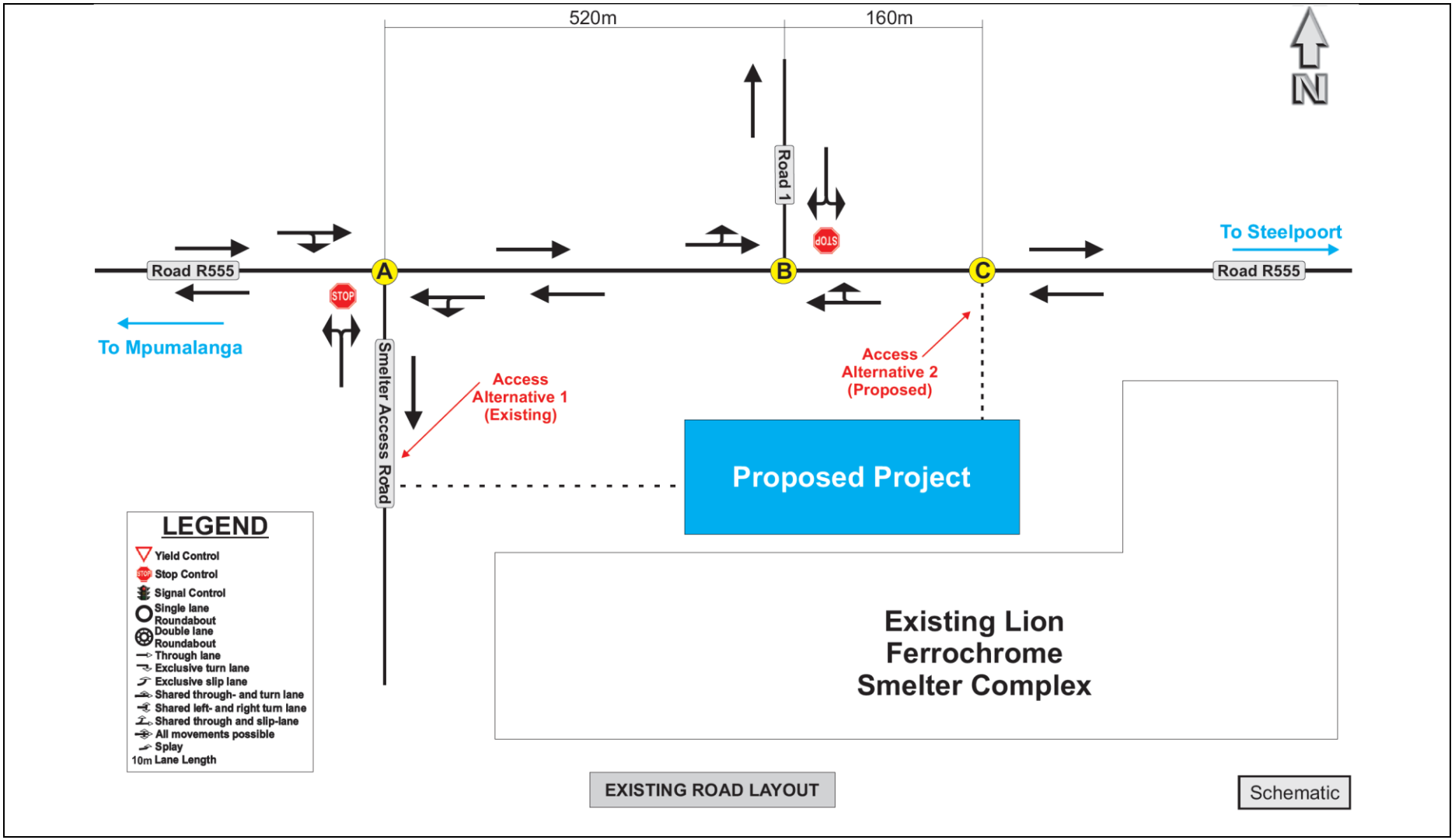


Figure 42: Existing Road network layout

Table 23: Summary of intersection control at existing intersections under investigation

POINT	DESCRIPTION	INTERSECTION CONTROL	PEDESTRIAN ACTIVITIES	INTERSECTION PHOTO
A	Road R555 / Smelter Access Road (Proposed Project Access Alternative 1)	Free flow along Road R555	No Pedestrian activity observed during surveys	
B	Road R555 / Road 1	Free flow along Road R555	No Pedestrian activity observed during surveys	
C	Road R555 / Proposed Project Access Alternative 2	Tentative Intersection		

Table 24: Summary of road characteristics

RELEVANT ROAD SECTION	PICTURE OF ROAD SECTION	ASSUMED EXISTING FUNCTIONAL CLASS OF ROAD	POSSIBLE FUTURE CLASS OF ROAD	Road Authority	Road Reserve (M)	Number of Lanes	Lane Width	Type of Surface	Median	Anticipated Traffic Growth per Annum	Speed Limit
Road Section 1 **Road R555** National Road linking Mpumalanga to Steelpoort and ultimately to Road R37, and Makhuduthamaga Local Municipality at Steel Bridge		**Assumed Primary Function:** Mobility **Class**: Major Arterial; **Class No.**: U2; **Route Number**: R **Description:** Highway **Spacing between Intersections:** 800m ±20%	**Assumed Proposed Function:** Mobility **Class**: Major Arterial; **Class No.**: U2; **Route Number.**: R **Description:** Highway **Spacing between Intersections:** 800m ±20%	SANRAL	±40m	One lane per direction	3.5m wide	Asphalt	None.	3%	60km/h
Road Section 2 **Road 1**		**Assumed Primary Function:** Mobility **Class**: Collector Road; **Class No.**: U4a; **Route Number**: N/a **Description:** Collector **Spacing between Intersections:** > 150m	**Assumed Proposed Function:** Mobility **Class**: Collector Road; **Class No.**: U4a; **Route Number.**: N/a **Description:** Collector **Spacing between Intersections:** > 150m	Undetermined	±20m	One lane per direction	3.5m wide	Gravel	None.	3%	60km/h
Road Section 3 **Smelter Access Road**		**Assumed Primary Function:** Mobility **Class**: Local Road; **Class No.**: U5a; **Route Number**: N/a	**Assumed Proposed Function:** Mobility **Class**: Local Road; **Class No.**: U5a; **Route Number.**: N/a	Private Access Road	±20m	One lane per direction	3.5m wide	Asphalt	None.	N/a	40km/h

RELEVANT ROAD SECTION	PICTURE OF ROAD SECTION	ASSUMED EXISTING FUNCTIONAL CLASS OF ROAD	POSSIBLE FUTURE CLASS OF ROAD	Road Authority	Road Reserve (M)	Number of Lanes	Lane Width	Type of Surface	Median	Anticipated Traffic Growth per Annum	Speed Limit
		**Description:** Commercial Access Street	**Description:** Commercial Access Street								
		Spacing between Intersections: N/a	**Spacing between Intersections:** N/a								

Table 25: Urban functional road classification (COTO TRH26 – South African Road Classification and Access Management Manual Version 1.0 August 2012)

FUNCTION			DESCRIPTION		MOBILITY				TRAFFIC	
BASIC FUNCTION	ALTERNATE FUNCTIONAL DESCRIPTION	DETERMINING FUNCTION	CLASS NO (U_)	CLASS NAME	THROUGH TRAFFIC COMPONANT	DISTANCE BETWEEN PARALLEL ROADS (km)	% OF BUILT KM	REACH OF CONNECTIVITY	EXPECTED RANGE OF ADT (AVERAGE DAILY TRAFFIC)	% OF TRAVEL VEH-KM
Mobility	Vehicle priority, vehicle only, long distance, through, high order, high speed, numbered, commercial, economic, strategic; route, arterial road or highway	Movement is dominant, through traffic is dominant, the majority of traffic does not originate or terminate in the immediate vicinity, the function of the road is to carry high volumes of traffic between urban areas.	U1	Principal arterial (freeway)	Exclusively	5 - 10km	5 - 10% Classes U1 and U2	> 20km	40 000 - 120 000+	40 - 65% Classes U1 and U2
			U2	Major arterial	Predominant	1.5 - 5.0km			20 000 - 60 000	

FUNCTION			DESCRIPTION		MOBILITY				TRAFFIC	
BASIC FUNCTION	ALTERNATE FUNCTIONAL DESCRIPTION	DETERMINING FUNCTION	CLASS NO (U_)	CLASS NAME	THROUGH TRAFFIC COMPONANT	DISTANCE BETWEEN PARALLEL ROADS (km)	% OF BUILT KM	REACH OF CONNECTIVITY	EXPECTED RANGE OF ADT (AVERAGE DAILY TRAFFIC)	% OF TRAVEL VEH-KM
			U3	Minor arterial	Major	0.8 - 2.0km	15 - 25% Classes U1, U2 and U3	> 10km	10 000 - 40 000	65 - 80% Classes U1, U2 and U3
Access / Activity	Access, mixed pedestrian and vehicle traffic, short distance, low order, lower speed, community / farm, road or street.	Access, turning and crossing movements are allowed, the majority of traffic has an origin or destination in the district, the function of the road is to provide a safe environment for vehicles and pedestrians using access points.	U4a	Collector street, commercial	Discourage		5 - 10%	> 2km	< 25 000	5 - 10%
			U4b	Collector street, residential	Discourage			< 2 to 3km	< 10 000	
			U5a	Local street, commercial	Prevent		65 - 80%	< 1km	< 5 000	10 - 30%
			U5b	Local street, residential	Prevent			< 0.5km (1km Max)	< 1 000	
			U6a	Walkway, pedestrian priority	Ban					
			U6b	Walkway, pedestrian only	Ban					

Table 26: Urban access management requirements and features (COTO TRH26 - South African road classification and access management manual version 1.0 August 2012)

BASIC FUNCTION	DESCRIPTION		REQUIREMENTS					TYPICAL FEATURES (Use appropriate context sensitive standards for design)								
	CLASS NO (U_)	CLASS NAME	DESIGN TOPOLOGY	ROUTE NO,	INTERSECTION SPACING	ACCESS TO PROPERTY	PARKING	SPEED km/h	INTERSECTION CONTROL	TYPICAL CROSS SECTION	ROADWAY / LANE WIDTH	ROAD RESERVE WIDTH	PUBLIC TRANSPORT AND PEDESTRIAN CROSSINGS	PEDESTRIAN FOOTWAYS (CONSTRUCTED)	CYCLE LANES	TRAFFIC CALMING
Mobility	U1	Principal arterial	Expressway	Yes (M/R/N)	2,4km (1.6km - 3.6km)	Not allowed */**	No	100 - 120	Interchange	4/6/8 lane freeway	3.3 - 3.7m lanes	60 - 120m (60m)	No	No	No	No
	U2	Major arterial	Highway	Yes (M/R)	800m (±15%)	Not allowed */**	No	80	Co-ordinated traffic signal, interchange	4/6 lane divided. Kerbed	3.3 - 3.6m lanes	38 - 62m (40m)	Yes at intersections	Off road	Yes - widen roadway	No
	U3	Minor arterial	Main road	Yes (M)	600m (±20%)	Not allowed */**	No	70	Co-ordinated traffic signal, roundabout	4 lane divided or undivided, kerbed	3.3 - 3.5m lanes	25 - 40m (30m)	Yes at intersections	Yes	Yes - widen roadway	No
Access / Activity	U4 a	Collector Street, commercial	Commercial major collector	No (A for temp. Routing)	> 150m	Yes (larger properties)	Yes if conditional allow	60	Traffic signal, roundabout or priority	4 lane , median at pedestrian crossings, boulevard , CBD one-way		20 - 40m (25m)	Yes at intersections or midblock	Yes	Yes, widen roadway or on verge	Median for pedestrians, curved roadway

	U4b	Collector street, residentail	Residential minor collector	No	> 150m	Yes	Yes if appropriate	50	Roundabout, mini-circle or priority	2/3 lane undivided	6-9m roadway, < 3.3m lanes	16 - 30m (20m)	Yes anywhere	Yes	Yes, on road or verge	Raised pedestrian, median, narrow lanes
	U5a	Local street, commercial	Commercial access street	No		Yes	Yes if conditions allow	40	Priority	2 lane plus parking		15 - 25m (22m)	If applicable, anywhere	Normally yes	Use roadway	Raised pedestrian crossing
	U5b	Local street, residential	Local residential street	No		Yes	Yes on verge	40	Mini-circle, priority or none	1/2 lane mountable kerb	3.0 - 5.5m roadway (two way)	10 - 16m (14m)	If applicable, anywhere	Not normally, pedestrians can use roadway	Use roadway	Yes, ut should not be necessary
	U6a	Walkway, non-motorized priority	Pedestrian priority	No	500m maximum	Yes	Yes if parking lot on woonerf	15	None, pedestrians have right of way	Surfaced			If applicable, anywhere	Yes or use roadway	Rare	Yes
	U6b	Walkway, non-motorized priority	Pedestrian only	No	500m maximum	Yes	No vehicles	peds. 80m / minute	None, pedestrian signal	Block paving		6m		Yes	Yes	

* Access to properties sufficiently large to warrant a private intersection / interchange can be considered if access spacing requirements met and there is no future need for public road.

** Partial and marginal access at reduced spacing allowed to relieve congestion, reduce excessive travel distance or remove the need for full intersections.

** Low volume farm gate and tourist access (less than 10 vehicles per day) can be considered if no alternative exists.

6.9.1.2 Traffic Count

To gain a better understanding of the existing traffic patterns and movements adjacent to the proposed project, a 12-hour manual traffic count was conducted at the relevant intersections under investigation. It is standard traffic engineering practice to conduct at least 12-hour manual traffic counts, as close as possible to a month-end Friday when traffic movement is expected to be at its highest.

The relevant 12-hour manual traffic count was conducted on Friday 26 November 2021 at the following points:

- **Point A**: Intersection of Road R555 and Smelter Access Road.
- **Point B**: Intersection of Road R555 and Road 1.

The combined hourly totals of all the vehicle types for the traffic survey conducted on Friday 26 November 2021 between 06:00 and 18:00.

The respective peak-hour flows for the traffic count at the relevant intersections were identified as indicated in Table 27 below.

Table 27: Peak hour periods at the relevant intersections

POINT	INTERSECTION	AM PEAK		PM PEAK	
		TIME INTERVAL	NUMBER OF VEHICLES	TIME INTERVAL	NUMBER OF VEHICLES
A	Road R555 and Smelter Access Road	06:45 to 07:45	432	14:15 to 15:15	602
B	Road R555 and Road 1	06:45 to 07:45	435	14:15 to 15:15	601

Figure 43 indicates the hourly traffic pattern, per 15-minute interval, for all modes of vehicles at the relevant intersection between 06:00 and 18:00 on 26 November 2021.

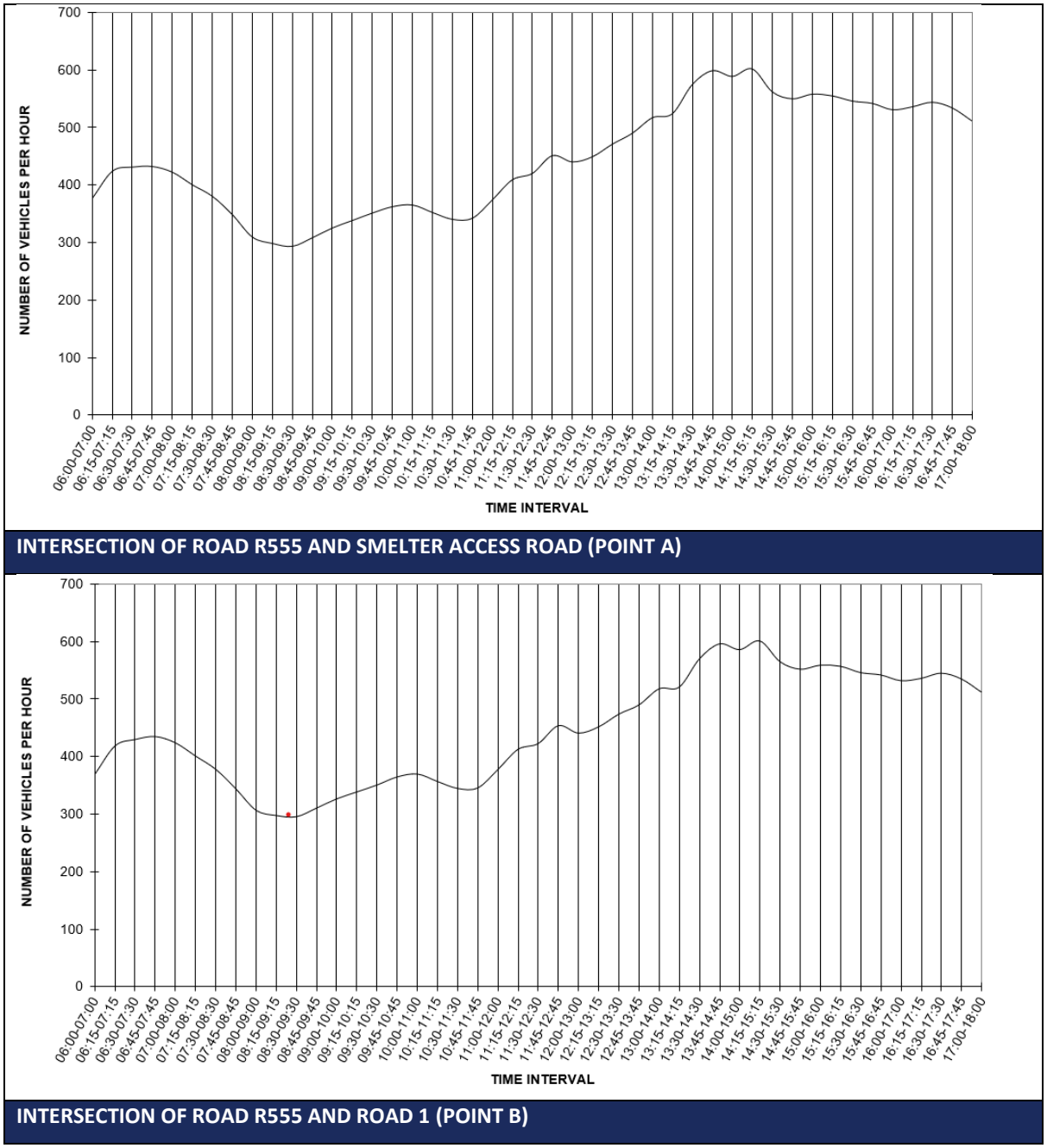


Figure 43: Hourly traffic pattern per 15 – minute interval for all modes of vehicles (06:00 to 18:00) at the relevant intersections

6.9.1.3 Future Land Use and Road Characteristics

At the time of conducting this study, there were no known approved latent developments within the area under investigation that would have a significant impact on the relevant road network adjacent to the proposed project.

Table 29 indicate the trip generation rates and the number of vehicle trips which are expected to be generated due to the proposed activities of the proposed project for the construction phase, while Table 30 provide the same for the operational phase.

The trip generation rates are based on the "*COTO TMH17, South African Trip Data Manual Version 1.01, September 2013*", information provided by the project team and assumptions made based on professional experience where information was not available.

6.9.2 ACCESS TO AND FROM THE PROPOSED PROJECT

Vehicle access to and from the proposed project would be required from Road R555. The following two access options were identified:

- **Access Option 1**: Access from and to the existing Smelter Access Road which currently intersects with Road R555 at the intersection of Road R555 and Smelter Access Road (Point A).
- **Access Option 2**: Access from and to Road R555 by means of a new intersection (Point C).

Table 28 provides information on the last-mentioned access options in terms of existing status and requirements to assist in the decision-making process as part of the detail input and design phases, while Figure 44 provides a graphical presentation of the identified proposed access options.

Table 28: Existing status and requirements of access options

Access Option 1 Intersection of Road R555 and Smelter Access Road (**Point A**)	a) Existing access intersection, where the proposed project can gain access via this point as a shared access with the Lion Ferrochrome Smelter. b) Does not require approval from SANRAL for the location of the access point as it is an existing intersection. Approval does need to be obtained for any geometric upgrading. c) Upgrading the existing access point in terms of road safety with reference to dedicated right-turn lane and left turn deceleration lane would have lower costs than constructing a new intersection.
Access Option 2 Proposed Intersection of Road R555 and Proposed Project Access Road (**Point C**)	a) Requires approval from SANRAL which entails an application process. Access approval cannot be guaranteed. b) Adjacent access intersection Point B would need to be realigned to the proposed project access road (Alternative 2) in order to maintain acceptable intersection spacing distances. c) The access location would need to be at least 600 meters from the existing Smelter Access Road (Point A). d) Higher costs for road safety upgrades with reference to dedicated right-turn lanes and left turn deceleration lanes due to construction of a new intersection.

	e) Additional costs related to the realignment of Road 1 (Pont B) to be perpendicular to the Proposed Access Option 2 (Point C). f) Ownership of Road 1 and whether Point B is an approved intersection could not be confirmed during the time of preparing this study. g) SANRAL would need to provide assistance and instructions for the relocation of Road 1 to be perpendicular to the proposed Point C, and additional collaboration with all developments who currently gain access from Point B would be required.

The proposed Access Options 1 and 2 are deemed suitable for access points from Road R555 based on intersection stopping and decision sight distance requirements guided by the "*Committee of Transport Official TMH 16 Volume 2 South African Traffic Impact and Site Traffic Assessment Standards and Requirements Guideline version 1.01 February 2014*" as well as from a road geometry perspective. Table 31 and Table 32 respectively provides sight distance information on the identified potential access points.

Table 29: Trip generation rates and expected number of vehicles trips to be generated due to the proposed project and the distribution of vehicle trips (construction phase)

ITEM	COMPONENT	NUM WORKERS PER DAY	% WORKERS ACTIVE DURING PEAK HOUR	NUM WORKERS ACTIVE PER PEAK HOUR	NUM TRUCKS PER DAY	% TRUCKS ACTIVE DURING PEAK HOUR	NUM TRUCKS ACTIVE DURING PEAK HOUR	ASSUMED AVE. NUM PERSONS PER VEH	COMMENTS	TRIP GENERATION CALCULATIONS FOR PEAK HOUR						FINAL TRIP INFORMATION FOR TRAFFIC ENGINEERING CALCULATIONS			
										IF INWARD MOVEMENT IS RELEVANT VALUE = 1	NUM VEH TRIPS FOR INWARDS DIRECTION	IF OUTWARD MOVEMENT IS RELEVANT VALUE = 1	NUM VEH TRIPS FOR OUTWARDS DIRECTION	TOTAL NUM VEH TRIPS GENERATED DURING PEAK HOUR (IN & OUT)	CALCULATED TRIP GENERATION RATE PER VEH DURING PEAK HOUR	TRIP DIST. %		TRIP GENERATION	
																In	Out	In	Out
AM Peak Hour																			
1.	Construction workers (using private transport = **20%**)	17	100%	17				4,0	Trips per Worker (4 Persons per Vehicle)	1	4	0	0	4	**0,25**	100%	0%	4	0
2.	Construction workers (Tranasported via hired transport = **70%**)	39	100%	39				15,0	15 persons per vehicle (Vehicle deliver workers and leave site empty)	1	3	1	3	5	**0,13**	50%	50%	3	3
3.	Heavy vehicles delivering consumables and plant materials per day (Worst Case Scenario)				40	20%	8	1,0	Delivery vehicles expected during peak periods as worst case	1	8	1	8	16	**2,00**	50%	50%	8	8
													TOTAL	25				15	11
PM Peak Hour																			
1.	Construction workers (using private transport = **20%**)	17	100%	17				4,0	Trips per Worker (4 Persons per Vehicle)	0	0	1	4	4	**0,25**	0%	100%	0	4
2.	Construction workers (Tranasported via hired transport = **70%**)	39	100%	39				15,0	15 persons per vehicle (Vehicle collect workers and leave site full)	1	3	1	3	5	**0,13**	50%	50%	3	3
3.	Heavy vehicles delivering consumables and plant materials per day (Worst Case Scenario)				40	20%	8	1,0	Delivery vehicles expected during peak periods as worst case	1	8	1	8	16	**2,00**	50%	50%	8	8

Table 30: Trip generation rates and expected number of vehicle trips to be generated due to the proposed project distribution of vehicle trips (operational phase)

Item	Component	Num Workers per Day	% Workers active during Peak Hour	Num Workers Active per Peak Hour	Num Trucks Per Day	% Trucks active during Peak Hour	Num Trucks active during Peak Hour	Calc Column	Assumed Ave. Num Persons per Veh	Comments	Trip Generation Calculations for Peak Hour						Final Trip Information for Traffic Engineering Calculations			
											If Inward Movement is relevant Value = 1	Num Veh Trips for Inwards Direction	If Outward Movement is relevant Value = 1	Num Veh Trips for Outwards Direction	Total Num Veh Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per Veh during Peak Hour	Trip Dist. %		Trip Generation	
																	In	Out	In	Out
AM Peak Hour																				
1.	Technicians	6	100%	6				6	4,0	Trips per Worker (4 Persons per Vehicle).	1	2	0	0	2	**0,25**	100%	0%	2	0
2.	Security Staff	2	100%	2				2	4,0	Trips per Worker (4 Persons per Vehicle). Day shift in, night shift out)	1	1	1	1	2	**1,00**	50%	50%	1	1
3.	Admin Clerck	1	100%	1				1	4,0	Trips per Worker (4 Persons per Vehicle).	1	1	0	0	1	**1,00**	100%	0%	1	0
4.	Cleaning Staff	1	100%	1				1	4,0	Trips per Worker (4 Persons per Vehicle).	1	1	0	0	1	**1,00**	100%	0%	1	0

Item	Component	Num Workers per Day	% Workers active during Peak Hour	Num Workers Active per Peak Hour		Num Trucks Per Day	% Trucks active during Peak Hour	Num Trucks active during Peak Hour	Calc Column		Assumed Ave. Num Persons per Veh	Comments		Trip Generation Calculations for Peak Hour							Final Trip Information for Traffic Engineering Calculations			
														If Inward Movement is relevant Value = 1	Num Veh Trips for Inwards Direction	If Outward Movement is relevant Value = 1	Num Veh Trips for Outwards Direction	Total Num Veh Trips Generated during Peak Hour (In & Out)	Calculated Trip Generation Rate per Veh during Peak Hour		Trip Dist. %		Trip Generation	
																					In	Out	In	Out
5.	Heavy vehicles delivering consumables					2	50%	1	1		1,0	Delivery vehicles expected during peak periods as worst case scenario		1	1	1	1	2	**2,00**		50%	50%	1	1
																	TOTAL	8					6	2
												PM Peak Hour												
1.	Technicians	6	100%	6					6		4,0	Trips per Worker (4 Persons per Vehicle).		0	0	1	2	2	**0,25**		0%	100%	0	2
2.	Security Staff	2	100%	2					2		4,0	Trips per Worker (4 Persons per Vehicle). Day shift in, night shift out)		1	1	1	1	2	**1,00**		50%	50%	1	1
3.	Admin Clerck	1	100%	1					1		4,0	Trips per Worker (4 Persons per Vehicle).		0	0	1	1	1	**1,00**		0%	100%	0	1
4.	Cleaning Staff	1	100%	1					1		4,0	Trips per Worker (4 Persons per Vehicle).		0	0	1	1	1	**1,00**		0%	100%	0	1
5.	Heavy vehicles delivering consumables					2	50%	1	1		1,0	Delivery vehicles expected during peak periods as worst case scenario		1	1	1	1	2	**2,00**		50%	50%	1	1
																	TOTAL	8					2	6

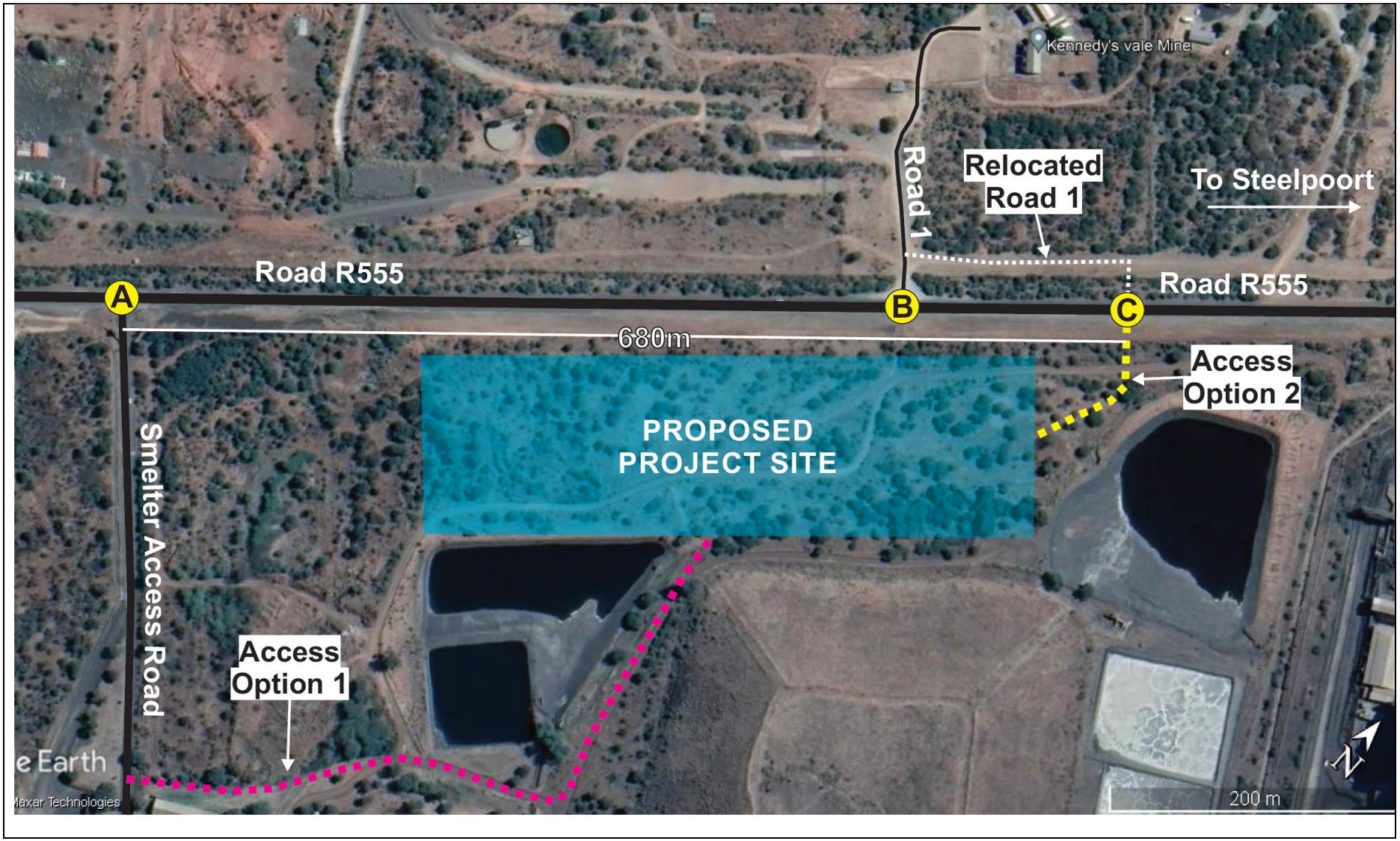


Figure 44: Graphical presentation of the proposed access options

Table 31: Available intersection stopping and decision sight distance at the existing intersection of road R555 and Smelter access road (point A) (access option 1)

RELEVANT PICTURE		
	Eastbound	Westbound
COORDINATES	S 24°49'16.05"	E 30° 6'30.98"
REQUIRED STOPPING SIGHT DISTANCE AT RECOMMENDED 60 KM/H	85m	85m
AVAILABLE STOPPING SIGHT DISTANCE	More than 85m	More than 85m
REQUIRED DECISION SIGHT DISTANCE AT 60 KM/H	170m	170m
AVAILABLE DECISION SIGHT DISTANCE	More than 170m	More than 170m

Table 32: Available intersection stopping and decision sight distance at the proposed intersection of road R555 and access options 2 (point C)

RELEVANT PICTURE		
	Eastbound	Westbound
COORDINATES	S 24°49'2.21"	E 30° 6'48.56"
REQUIRED STOPPING SIGHT DISTANCE AT	85m	85m

RECOMMENDED 80 KM/H		
AVAILABLE STOPPING SIGHT DISTANCE	More than 85m	More than 85m
REQUIRED DECISION SIGHT DISTANCE AT RECOMMENDED 80 KM/H	170m	170m
AVAILABLE DECISION SIGHT DISTANCE	More than 170m	More than 170m

6.9.3 DETERMINATION OF THE LEVELS OF SERVICE AT THE RELEVANT INTERSECTIONS

The ***SIDRA Intersection*** software was used as an aid for the design and evaluation of the relevant intersections. The evaluations determine the intersection levels of service (LOS) which qualitatively describe the operating conditions of a roadway based on factors such as speed, travel time, manoeuvrability, delay, and safety.

The following intersections were evaluated as part of this investigation:

- **Point A**: Intersection of Road R555 and Smelter Access Road.
- **Point B**: Intersection of Road R555 and Road 1.

Table 33 provide a summary of the available reserve capacity on the various sections of roads that were investigated.

Table 33: Available reserve capacity for relevant road section without the proposed project

POINT	INTERSECTION	DIRECTION OF ROAD SECTION	CAPACITY PER LANE	NUMBER OF LANES	TOTAL CAPACITY	ACTUAL NUMBER OF VEHICLES		RESERVE CAPACITY AVAILABLE		ACTUAL NUMBER OF VEHICLES		RESERVE CAPACITY AVAILABLE	
						2021 EXISTING		2021 EXISTING		PROJECTED 2026 WITHOUT PROPOSED PROJECT		PROJECTED 2026 WITHOUT PROPOSED PROJECT	
						AM	PM	AM	PM	AM	PM	AM	PM
A	Intersection of Road R555 and Smelter Access Road	East (Road R555)	1100	1	1100	230	377	870	723	267	437	833	663
		South (Smelter Access)	Not applicable. Access Road.										
		West (Road R555)	1100	1	1100	180	318	920	782	209	369	891	731
B	Intersection of Road R555 and Road 1	North (Road 1)	700	1	700	6	0	694	700	7	0	693	700

		East (Road R555)	1100	1	1100	230	278	870	822	267	322	833	778
		West (Road R555)	1100	1	1100	199	323	901	777	231	374	869	726

Table 34: Summary of other traffic-related matters

DESCRIPTION OF ELEMENT	GENERAL COMMENTS	SPECIFIC ISSUES	ACTIONS REQUIRED
ROAD SAFETY MATTERS			

DESCRIPTION OF ELEMENT	GENERAL COMMENTS	SPECIFIC ISSUES	ACTIONS REQUIRED
General road safety	The following are typical elements related to the road network, which cause road safety problems in rural and urban areas, and which need to be addressed on a continuous basis: a) Intersection layout, with specific reference to dedicated right-turn lanes, where there is heavy vehicle movement. b) Pedestrian movements (road crossings). c) Intersection alignment, such as staggered intersections. d) Insufficient public transport facilities. e) Access control for vehicle movement. f) Fencing to control animal movement. g) Lack of or deterioration of reflective road studs for visibility during the night at strategic points. h) Lack of pedestrian walkways to separate pedestrian and vehicle movements at strategic points. i) Lack of provision and quality of road markings. j) Lack of provision and quality of road signs. and k) Improper road safety training for workers as well as adjacent communities.	a) Points A and B does not have any dedicated right-turn or left-turn deceleration lanes and is a road safety concern.	a) As part of existing road conditions at Points A and B without the proposed projects, provision of dedicated right-turn and left-turn deceleration lanes is recommended from a road safety perspective.
NON-MOTORISED TRANSPORT			

DESCRIPTION OF ELEMENT	GENERAL COMMENTS	SPECIFIC ISSUES	ACTIONS REQUIRED
Non-motorised transport	a) No pedestrian activity was observed during a site visit at the relevant intersections under investigation.	a) No issues without the proposed project.	a) None.
PUBLIC TRANSPORT			
Public transport	a) Two types of public transport commuters are relevant to the area under investigation: i) Firstly, workers who travel to and from the area. ii) Secondly, visitors to the area. In general, public transport loading and off-loading within the area under investigation is established with dedicated areas for loading and off-loading passengers further west around the Lion Ferrochrome Smelter. Providing loading and off-loading laybys along Road R555 near Points A, B and C would be possible if required.	a) None.	a) None.

6.9.4 VERIFICATION OUTCOME

The Screening Report (Appendix A) generated using the national web-based screening tool, at this stage do not predetermine sensitivities in terms of traffic.

Based on a site inspection of the existing road network adjacent to the site under investigation, traffic surveys, calculations and reference to the relevant traffic engineering guideline documents, the following findings and recommendations were made:

- Access to and from the proposed project would be required from Road R555 which is a national road. Two access options were identified which are:
    - Firstly, access from the exiting intersection of Road R555 and Smelter Access Road (Point A). or
    - Secondly, access by means of a new access intersection along Road R555 (Point C).
- The existing intersections investigated with specific reference to the intersection of Road R555 and Smelter Access Road (Point A) does not have dedicated right-turn lanes nor left-turn deceleration lanes which is not in line with SANRAL standards.
- Intersection performance evaluations concluded that the relevant existing intersections with existing vehicle traffic volumes are currently operating at acceptable levels of service and would remain relevant for at least the next five years with an anticipated background vehicle traffic growth of 3% per annum.
- Reserve vehicle capacity along Road R555 is available and is anticipated to remain relevant for the next five years.
- The proposed project is anticipated to generate a low number of vehicle trips during the construction and operational phases

6.9.5 PLAN OF STUDY FOR BASIC ASSESSMENT

The “COTO, TMH 16 Volume 1 South African Traffic Impact and Site Traffic Assessment Manual Version 1.0 August 2012” (Traffic Assessment Manual) requires a Traffic Impact Assessment (TIA) when an application is made for a change in land use and when the highest total additional hourly vehicular trip generation (including pass-by and diverted trips) as a result of the application exceeds 50 trips per hour. since the number of additional vehicle trips to be generated by the proposed project is envisaged to be less than 50 vehicles per hour for the construction and operational phases, during the AM and PM peak a TIA is not required.

However, a Site Traffic Assessment (STA) will be undertaken as an application will be required for the erection of a building or other structure (roads and other) on a site for which a [1]Site Development Plan (SDP) is required.

The STA will be completed as per Appendix A of the TIA manual.

6.10 HEALTH ASSESSMENT

Atmospheric emissions from the Glencore Lion Smelter Complex are regulated under Atmospheric Emission Licence Number SK17/1/8/5/AEL//GLENCORE/1 issued on 31 December 2020. Stack emission limits have been set for particular matter (PM), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and carbon monoxide (CO) (the criteria pollutants). Community health risks are not determined directly by stack emission concentrations of the pollutants, but by the atmospheric concentrations at receptor locations (exposed communities).

6.10.1 VERIFICATION OUTCOME

The Screening Report (Appendix A) generated using the national web-based screening tool, at this stage do not predetermine sensitivities in terms of health for the specific area.

As the outcome of the health assessment (see section 5.1) will be based on the outcome of the Air Emissions Dispersion Model (AEDP currently underway), the risk assessment approach and sensitivities will be defined during the BA process.

6.10.2 PLAN OF STUDY FOR BASIC ASSESSMENT

The mathematical AEDP of current emissions from the pollutant source, and post-installation emissions from the power generation facility that will be near the smelter, are currently underway. For the Health Assessment, the ambient air concentrations of the pollutants at receptor locations for particular matter ($PM_{2.5}$) and the other criterial pollutants (listed above) for averaging times , will be required.

A comparative health risk assessment will be conducted between the current (baseline) scenario and the post-installation emissions scenario from the power generation facility. It will then be determined whether there would be an increase in relative risks to community receptors between the two scenarios, based on the outcome data of the AEDP for the respective two scenarios.

[1] A plan that the Municipality requires of a landowner intending to erect or alter any building or structure on site.

Note that the assessment will not refer to particular health outcomes associated with exposure to the criteria pollutants in the respective situations, and the assessment will also not consider the background health status of the communities, as the focus will be on a comparison between two defined exposure scenarios with other health-risk factors being the same.

6.11 SOCIO-ECONOMIC

The study area was visited on 1 December 2021 with the aim of obtaining more information on the site characteristics and site sensitivity, local settlements and communities, and the social setting of the proposed project, and to acquire an overview of the socio-economic features of the study area and infrastructure proposed as part of the activities.

6.11.1 GENERAL DESCRIPTION OF STUDY AREA FROM A SOCIAL PERSPECTIVE

The proposed site is located in the Limpopo Province of South Africa, approximately 240 km northeast of Johannesburg and 15 km southwest of Steelpoort adjacent the Glencore Lion Smelter Complex and just south of the R555. This road links Middelburg, Roossenekal, Steelpoort, and Burgersfort.

The study area falls within the Sekhukhune District Municipality and the Fetakgomo Tubatse Local Municipality. Large sections of land within the FTLM falls under the jurisdiction of Traditional Authorities, although the project site does not fall within tribal land.

6.11.1.1 Sekhukhune District

The Sekhukhune District Municipality (SDM) was established in December 2000. It consists of five Local Municipalities, namely Elias Motsoaledi, Ephraim Mogale, Greater Tubatse, Fetakgomo, and Makhuduthamaga Local Municipalities. The district is situated in the Limpopo province, to the northwest of Mpumalanga and within the southern section of the Limpopo Province. The SDM covers an area of approximately 13 264 m^2. Most of the area is typical rural as only 5% of the Sekhukhune District's population lives in urban areas.

The main urban centres are Groblersdal, Marble Hall, Burgersfort, Jane Furse, Ohrigstad, Steelpoort and Driekop. Outside these major towns, one finds almost 605 villages which are generally sparsely populated and dispersed throughout the district (www.sekhukhunedistrict.gov.za).

Mining is a key contributor to the GGP of the district and the sector is seen as having tremendous potential for the immediate future.

6.11.1.2 Fetakgomo Tubatse Local Municipality

In 2016, the Fetakgomo Tubatse Local Municipality (FTLM) was formed as an amalgamation between the former Fetakgomo Local Municipality and the former Greater Tubatse Municipality. The area falls under the jurisdiction of the Sekhukhune District as indicated above.

According to the recent official demographic survey results (2016), the FTLM has a total population of 490 381 people (Statistics South Africa Community Survey, 2016).

The municipality comprises approximately 342 villages and is largely dominated by a rural landscape with only 6 (six) proclaimed townships. Like most rural municipalities in South Africa, the FTLM is characterised by a weak economic base, inadequate infrastructure, major service backlogs, dispersed human settlements and high poverty levels (FTLM: IDP: 2021).

The main economic sectors within FTLM include agriculture, mining and quarrying, trade, tourism, manufacturing, general government, community, social and personal services, catering and accommodation (FTLM: IDP: 2021).

6.11.1.3 The local study area

The Glencore Lion Smelter and proposed project site falls within Wards 27 of the Fetakgomo Tubatse Local Municipality within the Steelpoort Valley. The proposed site for the Energy Conversion project is directly south of the R555 and directly west of the Glencore Lion Smelter Complex and access road.

Steelpoort town is approximately 15 km from the proposed site to the northeast along the R555. Infrastructure associated with the Kennedy's Vale Mine is directly to the north of the site location and the R555. Other infrastructure in close proximity to the study area include roads, shafts, pipelines, conveyors, an electrical substation, transmission line servitudes and sewage plant (water care works).

The area and land-uses surrounding the proposed site is thus characterised by mining related acvitivies and infrastructure, as well as mining associated activities. Various settlements are situated to the north of the proposed site, the R555 and the Steelpoort River.

The closest residential settlement of Ga-Manapane is between 1.75 to 2 km to the north of the proposed site. Various settlements were formed to the north of the Steelpoort River and to the south of the mountain range. These include Ga-Mampuru, Ga-Nkgetheng, Ga-Matate, Ga-Malekana and Ga-Masha. The R555 and Steelpoort River separate the homesteads from the mining complex and Energy Conversion Facility project area.

The location of the local settlements and towns within the area are listed in the following table:

Table 35: Local Settlements within the study area

FETAKGOMO TUBATSE LOCAL MUNICIPALITY	
SETTLEMENT / TOWNS	**DIRECTION RELATED TO PROJECT SITE**
Ga-Manapane	Northwest of site: ± 2-3 km
Ga-Mampuru	West: ± 5-6 km
Steelpoort	Northeast: ± 15 km
Ga-Matate	North: ± 4-5 km
De Goedeverwachting	North: ± 4 km
Ga-Nkgetheng	Northwest: ± 3 km
Nokaneng	Southwest: ± 8 km
Ga-Malekana	Southwest: ±13 km
Ga-Masha	Southwest: ± 15 km

Other settlements further north and north-east include Ga-Mapodila, Ga-Moela, Ga-Sopanyana, Tukakgomo, Matshupe and Maputla. Thaba Moshate is further to the southwest and Dithamaga to the south.

Refer to Figure 45 below for more information on the settlements, the location of the proposed site (indicated in red) and land-uses.

Figure 45: Settlements within the study area

6.11.2 SOCIAL PROFILE

6.11.2.1 Population Figures

The following table provides an outline of the population figures in the local study area compared to those of the affected municipality, district and province.

Table 36: Population figures

POPULATION FIGURES					
AREA	***POPULATION***	***PEOPLE PER KM²***	***NUMBER OF HOUSEHOLDS***	***% UNDER 20 YEARS AGE GROUP***	***GENDER***
Limpopo	5 799 990	46.1 km²	1 601 083	44%	53% Female
Sekhukhune District	1 169 762	85.7 km²	290 526	45%	53% Female
FTLM	489 902	85.9 km²	125 363	42%	51% Female
Ward 27	12 527	18.9 km²	2 727	48%	48% Female

Source: StatsSA: Community Survey 2016 and Census 2011 for ward based information

The population figures indicate a study area (Ward 27) which is not as densely populated compared to the rest of the FTLM. This can change in the future as Steelpoort and the surrounding area has been identified as a District Growth Point (FTLM: IDP: 2021). There is statistical evidence that the population within the FTLM is growing at an exponential rate, but that the growth is mainly concentrated around larger towns and settlements.

The percentage of youth under the age of 20 years comprises approximately half of the population sector within the affected ward. The provision of education, health and social services as well as employment creation within the municipality and especially within Ward 27, is thus critical over the long term.

The gender ratio in the province and local municipality indicates a situation where there is a large sector of migrant workers moving out of the area in search of employment. In Ward 27 this is slightly lower compared to the municipal and district statistics.

6.11.2.2 Population Stability

From the table below it is clear that the study area has a relative stable population with the majority of residents born in South Africa and having citizenship, even though the figures are a bit lower compared to the FTLM and District.

Table 37: Population Stability

POPULATION STABILITY		
AREA	**BORN IN SOUTH AFRICA**	**CITIZENSHIP**
Limpopo	97.6%	98%
Sekhukhune District	99%	99%
FTLM	98.8%	99%
Ward 27	91.1%	93%

Source: StatsSA: Community Survey 2016 and Census 2011 for ward based information

6.11.2.3 Education and Skills Levels

The table below provides an outline of the education levels within the study area.

Table 38: Education Levels

EDUCATION LEVELS				
AREA	**NO SCHOOLING**	**SOME PRIMARY**	**GRADE 12**	**HIGHER EDUCATION**
Limpopo	14%	9%	28%	6%
Sekhukhune District	16%	8%	26%	4%
FTLM	16%	7%	26%	4%
Ward 27	16%	7%	19%	1%

Source: StatsSA: Community Survey 2016 and Census 2011 for ward based information

Based on information above, the percentages of those achieving matric within the district and municipal areas are more or less similar. In Ward 27, however, there are lower levels of individuals that completed Grade 12 and significantly lower levels of individuals that have a higher education. Overall, the high levels of people with no schooling remain a concern, as well as the limited number of learners that completed their school education.

The high teacher/student ratios of 1:40 for primary schools and 1:35 for secondary schools are in line with the guidelines of the Department of Education, but does not necessarily assist with avoiding school drop-outs. A lack of sufficient higher education institutions within the local municipality can also be a contributing factor to the low number of graduates in the FTLM.

Although overall skills levels have increased over the years, a lack of relevant skills among locals can result in employers still recruiting outside the local municipal areas. This hampers the municipality's job creation efforts. Skills shortages are thus a challenge that needs to be overcome (FTLM: IDP: 2021).

6.11.2.4 Employment and Income

The table below indicates the employment and income levels within the area.

Table 39: Employment Profile

EMPLOYMENT AND INCOME LEVELS					
AREA	**EMPLOYED**	**UNEMPLOYED**	**DISCOURAGED WORK-SEEKER**	**OTHER NON-ECONOMICALLY ACTIVE**	**ANNUAL HOUSEHOLD INCOME BELOW R40K**
Limpopo	27.4%	17%	6%	49%	70%
Sekhukhune District	20.9%	22%	7%	50%	70%
FTLM	23%	25%	5%	47%	71%
Ward 27	22.1%	32%	3%	43%	65%

Source: StatsSA: Community Survey 2016 and Census 2011 for ward based information

The table shows the average income levels in the province, district, municipal area and affected ward. It must be noted that Ward 27 of the FTLM indicated a lower level of annual household income compared to the Sekhukhune District and the FTLM, even though there are different mining activities and associated employment opportunities within this area for select individuals.

The number of households without any form of income or very low levels of income remain of concern. The poverty levels within the province, municipal areas and study area therefore remain a significant socio-economic challenge.

Unemployment is a further source of concern, especially if the categories of "discouraged work-seekers" and "other non-economically active" are considered. Those falling within the "other"

category can include individuals that are being supported by breadwinners working elsewhere or some relying on social grants, or some could be subsistence farmers or include women running the households and looking after dependants. These sectors of the population will still rely on the employed sections of the population.

The negative impact of Covid-19 on poorer households must also be considered. In addition, the state of the economy in South Africa could have contributed to an increase in the unemployment figures provided and could have significantly increased the poverty profile within the study area since the statistical surveys were conducted.

6.11.2.5 Safety, Security and Health

The nearest police stations within the larger study area include the following: Burgersfort, Sekhukhune, Maartenshoop, Driekop and Tubatse. Types of crime that must be dealt with include burglaries, thefts, car hijackings, sexual crimes, assaults and murder. As part of the public participation process for the IDP, car hijackings and robberies were listed as a major concern in Ward 27 (FTLM: IDP: 2021).

The FTLM has hospitals in Burgersfort, namely Dilokong and Mecklenberg hospitals. Various primary health care clinics are located throughout the municipality. In Ward 27, the Malekane and Kutullo areas receive a weekly mobile clinic, but all the villages required this service. During the IDP public participation processes, however, there were numerous requests for additional clinics that also operate at longer hours, as well as mobile clinics throughout the FTLM area (FTLM: IDP: 2020).

The health of local residents is further impacted on by air quality impacts associated with various mining activities, the illegal burning of waste, irregular waste removal, as well as illegal dumping.

In terms of the Covid-19 Pandemic, the Limpopo Department of Health, in cooperation with mining companies and NGO's, has implemented numerous programmes for setting up various accessible vaccine sites, mobile vaccine centres and undertaking campaigns in high densities areas and at mining areas.

6.11.2.6 Housing and Related Infrastructure

The infrastructure in the larger study area and within the FTLM is fairly poor, with major service backlogs that cannot meet the needs of the dispersed human settlements and high poverty levels. Large sections of the population, however, lives in formal dwellings, with limited land invasions and informal settlements. The latter are mainly concentrated around larger towns and settlements.

The majority of residents within the FTLM live in formal dwellings, which is approximately on par within the Sekhukhune District. The area where the proposed development is situated, have higher levels of households living within informal dwellings compared to the municipality and district.

Although most wards in FTLM have previously benefited from the RDP housing implementation, the overall housing backlog are approximately 16 755 units. Urbanisation, mainly in search of employment opportunities, as well as mining activities continue to put pressure on the need for housing within the Municipality (FTLM: IDP: 2021).

This need is increasing at an alarming rate due to the influx of people into the Burgersfort and Steelpoort areas. It can thus be assumed that there is a need for housing infrastructure in the study area. The IDP also noted that there is still an incomplete RDP Housing project in Ward 27 (FTLM: IDP: 2021).

The following table provides an outline of the percentage of households living in formal dwellings.

Table 40: Households and housing infrastructure

HOUSEHOLDS				
AREA	**NO OF HOUSEHOLDS**	**HOUSEHOLDS IN FORMAL DWELLINGS**	**HOUSEHOLDS IN INFORMAL DWELLINGS**	**OTHER**
Limpopo	1 601 083	80%	4.8%	15.2%
Sekhukhune District	290 526	77%	6.1%	16.9%
FTLM	125 363	76%	6.3%	17.7%
Ward 27	2 727	67%	22%	11%

Source: StatsSA: Community Survey 2016 and Census 2011 for ward based information

6.11.3 BASIC SERVICE DELIVERY

6.11.3.1 Water

FTLM can be seen as a water stressed municipality. According to the community survey of 2016, 62.7% of households received their water from a regional or local service provider. Only 22% of households have access to piped water in their yard and 23% used piped water on community stands. It was further indicated that only 62.7% of households have access to safe drinking water supply services.

Almost all the villages in the FTLM source water from boreholes, rivers, dams and tanks. The main reason for this situation is illegal water connections, limited communal and ageing infrastructure,

drought, lack of financial resources, the topography of the area, as well as the number of informal and scattered settlements through the municipal area (FTLM: IDP: 2021).

Within Ward 27, 62% of the residents still received their water for household use from the river. Only 19,5% received their water from a regional service provider (StatsSA: Census 2011). It should be noted that progress has been made in terms of water provision in FTLM, but that 35,4% of households in FTLM still did not have access to safe drinking water supply service in 2016. The IDP further indicated that there are still severe challenges and water shortages within Ward 27 (FTLM: IDP: 2021)

6.11.3.2 Sanitation

Within Ward 27, 78% of the households still make use of pit latrines, with only 4% of these being Ventilated Improved Pit (VIP) latrines. Those without access to any sanitation type facility totals 11% which are almost double the rate compared to the Sekhukhune District. The FTLM also has a huge backlog in sanitation provision. In the FTLM, 84% of households still rely on the pit toilet system (Community Survey 2016). It should thus be noted that various improvements could have been made since the survey results of 2011 and 2016 were published.

Challenges with regards to sanitation provision include, inter alia, the following:

- There is an insufficient basic level of sanitation services creating health and environmental challenges;
- There is a need for the upgrading of the existing sewage plants in the municipality;
- No adequate monitoring of sanitation projects is undertaken; and
- Water borne ablution facilities in all municipal and community facilities need to be attended to (FTLM: IDP: 2021).

6.11.3.3 Electricity

ESKOM is the electricity service provider to the FTLM. According to the Community Survey of 2016, 82% of households in the FTLM had access to in-house prepaid meters with 10% that had no access to any type of formal electricity provision. These households still rely on candles and paraffin (FTLM: IDP 2021).

A large section of the rural population thus has no, to very limited access, to electricity which impacts negatively on local economic development and community projects (FTLM: IDP: 2021).

6.11.3.4 Waste Collection

In FTLM only 10% of the population received a service from the municipality or private company. The majority of households rely on their own dumps. The widespread inadequacy of formal refuse removal services in the municipal area poses a health hazard to the rural communities and is particularly problematic to businesses (FTLM: IDP: 2020).

6.11.4 LOCAL ECONOMIC PROFILE

The FTLM economy is driven by mining and agriculture. Mining still presents the largest opportunity in the area and the mining activities and natural resources available in the area have created a definite potential to develop tourism and thereby to diversify the economic base of the municipality (FTLM: IDP: 2020).

The mining industry is furthermore the municipality's leading job creator and key economic growth driver. With all major mining houses fully represented in the municipality, locals pin their hopes for jobs and income security in this sector. The mining sector accounts for 34% of the Municipality's total GVA and 54% of the total labour force in the formal sector. The job absorption patterns during a 12-year review period in the sector shows that year 2012 witnessed the highest number of jobs (1833) created.

It is feared that the Covid-19 lockdown, which has already devastated rural communities, could have an even more dire effect on mine-affected communities. The Quarterly Labour Force Survey by Statistics SA revealed that Limpopo lost 236 000 jobs due to the Covid-19 pandemic and that all sectors of the economy suffered job losses with the exception of the agriculture sector, in which 16 000 jobs were created (www.mg.co.za).

The provincial government has set aside R3.5-billion to mitigate against the impact of Covid-19 on the economy and the population. Various projects are aimed at attracting investment into the agricultural sector. A project within the larger study area is the implementation of the Lebowakgomo Chicken Abattoir, which will, among other things, result in revitalisation of several broiler production projects. This will create 500 direct jobs within the value chain (www.mg.co.za).

The Limpopo Provincial Government identified the Fetakgomo-Tubatse area in Steelpoort for a Special Economic Zone (SEZ) development, which is proposed to the established at Dithamaga Trust in Ward 27. The initiative started as a joint venture between mining operators in the area, in which Glencore played a major role. The establishment of the SEZ is driven by the projected mining and beneficiation forecasts of the Platinum Group of Metals (PGM). Such a zone can change the socio-economic

characteristics in the region by accelerating the manufacturing base, promoting industrialisation and attracting investments. According to the Limpopo Economic Development Agency (LEDA), the Tubatse Special Economic Zone will impact positively on more than a million people in the province due to improved economic activities within the Dilokong Spatial Economic Initiative as well as improving economic progress within other districts and municipalities (FTLM: IDP: 2021).

The agriculture sector in the FTLM is still emerging and heavily under-invested. Lack of mechanisation makes smallholder farming one of the smallest contributors to the municipality's economic growth.

The manufacturing sector covers the manufacturing of goods, products and beverages. It also comprises the production, processing and preservation of meat, fish, fruit, vegetables, oils and dairy products; grain mill, starches and tobacco products; textile products; spinning, weaving; and petroleum products and nuclear fuel. This sector has a vast potential as job creator but is still in its infancy.

With regards to the tourism sector, it was noted that the unique selling benefits of local heritage sites and other tourism facilities in the municipality are not effectively profiled and marketed. The tourism sector is further being overshadowed by mining to the extent that more strategic focus is unevenly invested in the latter at its expense.

Investment opportunities in the FTLM include:

- mining investment;
- land availability;
- tourism;
- funding source from private sector; and
- job creation from infrastructure investment.

6.11.5 ANTICIPATED SOCIO-ECONOMIC IMPACTS

The following table outlines the potential impacts and possible risks associated with the proposed Energy Conversion Facility. These impacts and risks are based on existing baseline information. There is thus always an uncertainty with regards to the anticipated impact actually occurring, as well as the intensity thereof. Impact predictions have been made as accurately as possible based on the information available at the time of the study. Further studies would be required as part of the detailed phase of the project.

Table 41: Anticipated socio-economic impacts and risks associated with the proposed ECF

POTENTIAL IMPACT			
IMPACT / RISK	**NATURE OF IMPACT**	**MANAGEMENT OBJECTIVE**	**MITIGATION EFFECT**
SOCIO-ECONOMIC INTRUSIONS			
Mining related land-uses or similar land-uses are found in the immediate area. No negative land-use impacts are foreseen	Neutral	Environmental management of site and detailed designs of containers can limit any possible negative impacts.	Can be avoided, managed or mitigated
Increase in nuisance factors (possible noise and dust) during the construction phase.	Negative	Limit negative impacts of nuisance factors (intrusions, noise and dust). Pollution prevention of construction site.	Can be avoided, managed or mitigated
Limited impact on sense of place due to existing visual character and land-uses and proximity of residential settlements to the site	Possibly negative	Minimise negative impact of infrastructure and related impacts (visual impact and lighting).	Can be avoided, managed or mitigated
POPULATION CHANGES			
No formal influx of people and increase in households anticipated due to limited or no new direct employment opportunities created by the project, as well as the location of settlements to the site.	Neutral	Minimise any possible negative impacts through information sharing processes.	Can be avoided, managed or mitigated
No potential informal influx of large groupings, such as jobseekers in search of employment, is foreseen due to limited extent of project construction and operation, as well as the proximity of settlements to the project site.	Possibly negative	Minimise any possible negative impacts related to informal population influx as a direct result of the proposed project in coordination with FTLM e.g. through information sharing processes.	Can be avoided, managed or mitigated

POTENTIAL IMPACT			
IMPACT / RISK	**NATURE OF IMPACT**	**MANAGEMENT OBJECTIVE**	**MITIGATION EFFECT**
Possible lack of available skills due to implementation of new international technology resulting in continued outsourcing of skills during construction phase and possibly operational phase.	Negative	Source and maximise local skills and local procurement if and where possible.	Can be mitigated.
No change foreseen in the social fabric of the community as a result of the proposed project.	Neutral	None proposed	Can be avoided.
Possible increase in criminal activities associated with the proposed project are not anticipated as no increased population profile and movement of people are expected due to the implementation of the proposed ECF.	Neutral	None proposed	Can be avoided.
EMPLOYMENT AND PROCUREMENT			
Possible social dissatisfaction with regards to no or limited job opportunities and local procurement associated with the proposed ECF.	Negative	Source and maximise local skills and local procurement if and where possible	Can be managed or mitigated
Unfulfilled community expectations in terms of employment creation could result in social conflict	Negative	Avoid creation of unrealistic expectations; implement transparent communication processes	Can be avoided, managed or mitigated
SOCIO-ENVIRONMENTAL IMPACTS AND RISKS			

POTENTIAL IMPACT			
IMPACT / RISK	**NATURE OF IMPACT**	**MANAGEMENT OBJECTIVE**	**MITIGATION EFFECT**
The resource efficiency of the project can have positive impacts	Positive	Improvement in pollution prevention targets	Impact can be enhanced.
Potential decrease in health-related risks as the energy conversion can lessen the CO_2 emissions that are currently impacting on the air quality in the area.	Positive	Implementation of project and environmental management will lessen any current negative impacts.	Impact can be enhanced.
Emissions and possible pollutants will be less and will result in fewer negative impacts on sensitive receptors and settlements.	Positive	Implementation of project and environmental management will lessen any current negative impacts.	Impact can be enhanced.
Informal influx of people as a result of the ECF is not expected, resulting in none to very limited potential increase in health-related risks such as transmission of diseases.	Neutral	None proposed	Can be avoided.
Increased community safety risks due to additional mining related infrastructure	Possibly Negative	Limit safety and health risks through design considerations, location of infrastructure and precautionary construction and operational management principles.	Can be avoided, managed or mitigated
SOCIO-ECONOMIC IMPACTS			
Limited to no positive impacts on local and regional economy as a result of very limited employment opportunities created.	Positive	Maximise local employment opportunities and procurement if and where possible	Can be enhanced

POTENTIAL IMPACT			
IMPACT / RISK	**NATURE OF IMPACT**	**MANAGEMENT OBJECTIVE**	**MITIGATION EFFECT**
Reduction in electricity required and purchased from the national electricity grid thereby relieving some pressure on the national electricity grid, and lessening the dependency on the grid, while lowering operational costs.	Positive	Limit dependency on the grid while lowering operational costs	Can be enhanced
Positive long-term impacts in reaching the reduction in total emissions footprint	Positive	Limit dependency on the grid while lowering operational costs Implementation of project and environmental management will lessen carbon emissions	Can be enhanced
Positive long-term impacts on local and regional economy as a result of continuation of the life of the smelter with subsequent indirect employment opportunities and downstream economic opportunities	Positive	Maximise local employment opportunities and procurement	Can be enhanced
Continued potential positive impact on local businesses already established in the area or region	Positive	Support the local businesses	Can be enhanced
Continued distribution of social funds	Positive	Maximise social fund related to the project to benefit locals	Can be enhanced
A decrease/termination in employment and community funds during and after decommissioning could	Negative	Minimise the negative impacts associated with decommissioning of smelter and ECF in the long term	Can be avoided, managed or mitigated

POTENTIAL IMPACT			
IMPACT / RISK	**NATURE OF IMPACT**	**MANAGEMENT OBJECTIVE**	**MITIGATION EFFECT**
negatively impact former beneficiaries			
INFRASTRUCTURE AND SERVICE DELIVERY			
Road infrastructure is available to access the project site.	Neutral	Environmental management of site and detailed project designs can limit any possible negative impacts.	Can be avoided, managed or mitigated
Limited short-term risk of traffic accidents due to increased construction traffic flow on local roads in close proximity to the site.	Negative	Limit safety risks during transportation of personnel and construction material	Can be avoided, managed or mitigated
No additional pressure on existing health facilities and infrastructure (e.g. clinics, housing, water, electricity, roads) anticipated as no population increase is expected.	Neutral	None proposed	Can be avoided.

6.11.6 VERIFICATION OUTCOME

Based on the desktop analysis, site visit, social screening, site sensitivity verification and analysis of the current socio-economic status of the area and the receiving socio-economic environment, the following concluding remarks should be noted:

- The Glencore Lion Smelter and proposed project site falls within Wards 27 of the Fetakgomo Tubatse Local Municipality within the Steelpoort Valley. The proposed site for the Energy Conversion project is directly south of the R555 and directly west of the Glencore Lion Smelter Complex and access road. The development footprint of the Lion ECF is relative small and is anticipated to be between 300 m² and 1 hectare. Various mining related infrastructure are located adjacent the proposed site. These include roads, shafts, pipelines,

conveyors, an electrical substation, transmission line servitudes and sewage plant (water care works).

- The area and land-uses surrounding the proposed site is thus characterised by mining related acvitivies and infrastructure, as well as mining associated activities.
- Various settlements are situated to the north of the proposed site, the R555 and the Steelpoort River. The closest residential settlement of Ga-Manapane is between 1.75 to 2 km to the north of the proposed site. Various settlements were formed to the north of the Steelpoort River and to the south of the mountain range. These include Ga-Mampuru, Ga-Nkgetheng, Ga-Matate, Ga-Malekana and Ga-Masha. The R555 and Steelpoort River separate the homesteads from the mining complex and Energy Conversion Facility project area.
- Possible social impacts refer to the socio-economic intrusions, population change, employment and procurement, scoio-environmental impacts and risks as well as possible impacts on infrastructure and services.
- The site sensitivity is deemed “low” from a socio-economic perspective, mainly based on the extent of the development, the location of the site in proximity to other mining related infrastructure and activities, the land-uses in the area and the proximity of the nearest settlements to the site (Table 41)
- The social risks associated with the proposed ECF are also deemed low as the anticipated negative impacts associated with the project can be avoided, mitigated and/or managed (Table 41).
- Social sensitive receptors and/or areas are mainly located to the north of the proposed site. The R555, undeveloped areas as well as the river can be seen as buffers. Based on the baseline assessment, the proposed ECF will not have direct socio-economic impacts on these communities.
- The ECF and associated infrastructure will not introduce new social risks and hazards to the area currently characterised by mining activities.
- The ECF and associated infrastructure can result in positive impacts on the environment with flow-on positive impacts on the socio-economic environment.
- The socio-economic benefits associated with the ECF in the form of job creation and procurement are limited and at this stage no direct benefits to those currently faced with high rates of unemployment and poverty are foreseen.

- No negative social impacts of a high significance have been identified and there are also no impacts expected to result in such high significance that they could prevent the project from continuing.
- The significance and intensity of impacts will be further assessed during the detailed phase of the assessment, in order to prepare a Social Compliance Statement.

6.11.7 PLAN OF STUDY FOR BASIC ASSESSMENT

Based on the outcome of the baseline assessment, site verification and social screening, it is recommended that a Social Compliance Statement be compiled during the detailed phase of the Environmental Authorisation process.

The Social Compliance Statement will provide an outline of the main anticipated socio-economic impacts and will indicate how these can be mitigated as part of a Social Management Plan. It can include inter alia:

- Recommendations for the enhancement of positive social impacts;
- Recommendations for the avoidance, mitigation and management of negative social impacts;
- Compliance measures to assist in limiting any possible social risks to the communities;
- Note any possible social attitude formation;
- Recommendations for future communication efforts and strategies with regards to the implementation of the proposed project.

6.12 AIR QUALITY

6.12.1 LEGISLATIVE REQUIREMENTS

In terms of Section 53(f) of the National Environmental Management: Air Quality Act (NEM:AQA), 2004 (Act No. 39 of 2004), the Department of Environmental Affairs (DEA) has developed and published a "Code of practice for air dispersion modelling in air quality management in South Africa" under GN533, "Regulations regarding air dispersion modelling, 2014" in Government Gazette No. 37804 on 11 July 2014. The Code of Practice is prescribed as the technical Code of Practice for air dispersion modelling which provides technical standards on the application of air dispersion models as contained in Appendix A of the aforementioned regulation. The Code of Practice for air dispersion modelling is applicable:

a. in the development of an air quality management plan, as contemplated in Chapter 3 of the Act;

b. in the development of a priority area air quality management plan, as contemplated in Section 19 of the Act;
c. in the development of an atmospheric impact report, as contemplated in Section 30 of the Act; and
d. in the development of a specialist air quality impact assessment study, as contemplated in Section 37(2)(b) of the Act;

In accordance with the application of the Code of Practice to an atmospheric impact report or a specialist air quality impact assessment study, the assessment will be submitted in accordance with the prescribed format of an atmospheric impact report, as published by DEA on 11 October 2013 in Government Gazette No. 36904 under GN747 as the "Regulations prescribing the format of the atmospheric impact report" in terms of Section 53(o) read with Section 30 of the Act.

6.12.2 EXPECTED EMISSIONS SOURCES

Lion Smelter (Lion) currently operates two dryers, four kilns and four closed submerged arc furnaces to produce ferrochrome. Several villages (residential areas) are located within 5km from Lion in various directions, which includes Ga-Mampuru, Ga-Phasa, Ga-Malikane, Eerste Geluk, Booysendal Camp, Matlala and Tubatse. Commercial/Industrial activities located within 5km include Spitskop Readymix and Eastern Chrome Mine.

Raw materials are dried and fed to the kilns for pre-treatment of the materials before it is fed into the furnaces. Carbon monoxide (CO) gas from the furnaces is used to supplement fuel requirements at the dryers and kilns where possible. Liquid metal is tapped and separated into hot ferrochrome metal slag at the furnaces. Final product is stockpiled and processed through the crushing and screening plant according to customer specifications.

In light of specific products produced, raw materials consumed and or specific process, with respect to ferrochrome, Lion is currently licenced to operate the following Listed Activities in terms of Section 21 of NEM:AQA:

- Drying (Subcategory 4.1);
- Sinter Plants (Subcategory 4.5);
- Ferro-alloy Production (Subcategory 4.9);

The proposed ECF project are considered to be reciprocating engines and it is anticipated that the heat input will be greater than 10 MW thermal energy. This implies that Lion needs to obtain Environmental Authorisation for the proposed development and requires to be licenced for

Subcategory 1.5 (Reciprocating Engines) in terms of Section 21 of NEM:AQA in order to operate such an energy conversion facility. This project does, however, not refer to an increase in production in terms of the existing operation.

Emission sources of the existing operation are primary point and potential fugitive sources from the processes referred to, with secondary sources from material processing, storage areas, handling and roads. Therefore, the primary pollutants from the emission sources considered relevant for the proposed development are listed in Table 42.

Table 42: Primary pollutants identified that will be applicable to the proposed development

POLLUTANTS CONSIDERED		NOTES	APPLICABILITY	CONSIDERED	MODELLED
PM	Classical air pollutant	Total Particulate Matter	Yes	Yes	PM_{10} & $PM_{2.5}$
PM_{10}	Classical air pollutant	PM with an aerodynamic diameter of equal to or less than 10µm	Yes	Yes	Yes
$PM_{2.5}$	Classical air pollutant	PM with an aerodynamic diameter of equal to or less than 2.5µm	Yes	Yes	Yes
SO_2	Classical air pollutant		Yes	Yes	Yes
NO_x (as NO_2)	Classical air pollutant		Yes	Yes	Yes
CO	Organic air pollutant	Not a classical pollutant	Yes	Yes	Yes
Cr(VI)	Inorganic air pollutant	Not a classical pollutant	Yes	Yes	Yes

6.12.3 VERIFICATION OUTCOME

The Screening Report (Appendix A) generated using the national web-based screening tool, at this stage do not predetermine sensitivities in terms of air quality.

In addition, no protocol has been published for air quality impact assessment, however as per section 6.12.1, the air quality assessment will be conducted as per the required legislation in terms of NEMAQA.

6.12.4 PLAN OF STUDY FOR BASIC ASSESSMENT & AIR EMISSIONS LICENCE

The purpose / objective of this investigation is to identify and quantify the expected effect of Lion's current impact, emanating from atmospheric emissions on the surrounding ambient air quality as well as that which could be expected with the implementation of the ECF project.

This study will assess the expected contribution of the existing operation to the ambient air quality for the following scenarios:

a) *Scenario 1: Baseline Conditions* - Impact assessment is done per the emissions of all primary pollutants at expected/actual concentrations against current full production capacity (AEL emission limits or achievable emissions); includes no modifications or improvements made to the current process / additional abatement of secondary fugitive emissions and includes the new secondary sources as defined with the 2019 authorisation application.
b) *Scenario 2: Future Conditions* - Scenario 2 is an extension on Scenario 1 with the ECP facility added to assess the expected combined effect.

6.12.4.1 Assessment level

Direction to the choice of the level of assessment and the choice of model is obtained through the scope of the study.

CALPUFF is a non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation, and removal and can be applied for long-range transport (50 to 300km). CALPUFF is considered less conservative than AERMOD.

AERMOD is the preferred regulatory model for the US Environmental Protection Agency (US EPA). AERMOD is an advanced new-generation refined steady-state Gaussian plume dispersion model, for multiple sources, multiples source types, both simple and complex terrain and within 50km transport. Although AERMOD could over-estimate impact regions under calm conditions, it is considered to be conservatively safer to do so for most applications.

AERMOD is the recommended model for more sophisticated near-source applications in all terrain types, where near-source is defined as less than 50km from source.

Accordingly Level 2 with AERMOD is deemed appropriate for the study. In view of:

- the greatest impacts to be within/less than 50km downwind;
- multiple sources and source types;
- all terrain, both simple and complex;

Where available, ambient air quality monitoring data from monitoring locations within the investigation's domain will also inform the study.

7 MOTIVATION AND OUTCOME STATEMENT

Section 6 of this report highlighted the verification outcomes and plan of study for the Basic Assessment (BA) process. Table 43 summarises the outcome statements and motivation for the confirmation or disputes of the sensitivities (where applicable) as defined by the screening tool (Appendix A – Screening Report).

Table 43: Summary of verification outcome statement and motivation for plan of study

PRE-DETERMINED SENSITIVITY	VERIFIED SENSITIVITY	MOTIVATION SUMMARY	OUTCOME STATEMENT/PLAN OF STUDY	SECTION REFERENCE
AGRICULTURAL IMPACT ASSESSMENT				
High	**Low**	The site consists of land which is subject to severe permanent limitations including the pedocutanic horizon as well as hard rock, therefore only suitable for occasional row cropping in long ley rotations, or for use under grazing.	Compliance Statement	6.2
LANDSCAPE AND VISUAL IMPACT ASSESSMENT				
ND	**Low – Potentially Moderate** - visual impact at a local and/or regional scale	It is clear that the relatively constrained dimensions of the ECF would amount to a fairly limited core area of potential visual exposure. The shorter distance visual exposure would largely be contained within a 1.5 km radius of the proposed development site, with the predominant long-distance exposure to the north-west, especially along the south-east facing slopes of the Sekhukhune Mountain. The fact that some components of the proposed Lion ECF and associated infrastructure may be visible does not necessarily imply a high visual impact. It is, however, envisaged that the issues identified during the verification process may potentially constitute a low to potentially moderate visual impact at a local and/or regional scale. Sensitive visual receptors within (but potentially not restricted to) a 1.5km buffer zone from the facility need to be identified and the severity of the visual impact assessed during the BA.	Visual Impact Assessment (VIA)	6.3
ARCHAEOLOGICAL AND PALAEONTOLOGY IMPACT ASSESSMENT				

PRE-DETERMINED SENSITIVITY	VERIFIED SENSITIVITY	MOTIVATION SUMMARY	OUTCOME STATEMENT/PLAN OF STUDY	SECTION REFERENCE
Low	Low	The study area has been subjected to cultivation from the 1970's and impacted on by road developments as well as mining activities. These developments would have impacted on heritage resources if any were present in the area. No surface features were noted associated with these ceramics and the ceramics are likely out of context and are of low significance. Although no surface sites are impacted on, there is a chance that completely buried sites would still be impacted on, but this cannot be quantified.	Phase 1 Heritage Impact Assessment (HIA)	6.4
TERRESTRIAL BIODIVERSITY, PLANT AND ANIMAL SPECIES IMPACT ASSESSMENT				
Low terrestrial biodiversity Medium plant species High animal species	Low terrestrial biodiversity Low plant species Low animal species	The vegetation structure and species composition of the two habitats have been completely altered and, as such, has a very low conservation value and ecological sensitivity from both a faunal and floral perspective.	Compliance Statement	6.5
AQUATIC BIODIVERSITY IMPACT ASSESSMENT				
Low	Low	Due to the unlikeliness of the presence of the identified endangered species within the site boundary of the proposed development, the outcome of the site verification concurred with the "low sensitivity" as identified by the screening tool.	Compliance Statement	6.6
HYDROLOGICAL AND GEOHYDROLOGICAL ASSESSMENT				

PRE-DETERMINED SENSITIVITY	VERIFIED SENSITIVITY	MOTIVATION SUMMARY	OUTCOME STATEMENT/PLAN OF STUDY	SECTION REFERENCE
ND	Low	Due to the proposed concrete barrier to be installed, the absence of any surface water streams, dedicated stormwater containment proposed for each chimney stack and the fact that the zoned area has already been modified as a result of the existing Lion Smelter activities, the hydrological risk of the proposed development is deemed to be "low"	Conceptual Storm Water Management Plan (CSWMP)	6.7
NOISE IMPACT ASSESSMENT				
ND	Low	Based on the baseline information gathered during the on-site verification, all baseline measurements, except for one (situated some distance from the proposed development), were within an acceptable noise level.	Compliance Statement	6.8
TRAFFIC IMPACT ASSESSMENT				
ND				6.9
HEALTH IMPACT ASSESSMENT				
ND	TBA	The mathematical AEDP of current emissions from the pollutant source, and post-installation emissions from the power generation facility that will be near the smelter, are currently underway. For the Health Assessment, the ambient air concentrations of the pollutants at receptor locations for particular matter ($PM_{2.5}$) and the other criterial pollutants (listed above) for averaging times, will be required. A comparative health risk assessment will be conducted between the current (baseline) scenario and the post-installation emissions scenario from the power generation facility. It will then be determined whether there would be an increase in relative risks to community receptors between the two scenarios, based on the outcome data of the AEDP for the respective two scenarios.	Health Risk Assessment	6.10
SOCIO-ECONOMIC IMPACT ASSESSMENT				

PRE-DETERMINED SENSITIVITY	VERIFIED SENSITIVITY	MOTIVATION SUMMARY	OUTCOME STATEMENT/PLAN OF STUDY	SECTION REFERENCE
ND	Low	The site sensitivity is deemed "low" from a socio-economic perspective, mainly based on the extent of the development, the location of the site in proximity to other mining related infrastructure and activities, the land-uses in the area and the proximity of the nearest settlements to the site	Social Compliance Statement	6.11
AIR QUALITY IMPACT ASSESSMENT				
ND	TBA	A Level 2 assessment with AERMOD is deemed appropriate for the study based on the view that the greatest impacts will be within/less than 50km downwind, the multiple sources and source types, and the terrain being both simple and complex.	Level 2 Air Quality Impact Assessment	6.12

* ND – Not Defined; TBA – to be assessed during the BA process

8 GAPS AND ASSUMPTIONS

Verification outcomes represented in this report at this stage of the Basic Assessment (BA) process is based on the following:

- Information provided by the proponent (Lion Smelter);
- Desktop information available; and
- Visual observations made during the site inspection.

At this stage no participation with the potential Interested and Affected (I&AP) has been initiated and will form part of the BA process.

9 CONCLUSION

A Screening Report, using the national web-based screening tool, was generated on 18 August 2021 by Nettzero (Pty) Ltd in the following application category: "Activity requiring permit or licence in terms of National or Provincial legislation governing the release or generation of emissions".

Various specialist assessments were identified by the screening tool. The purpose of this document was to confirm or dispute the current use of land and the environmental sensitivities as predetermined by the screening tool.

Section 6 of the report provides the verification outcomes following the required desktop analysis and preliminary on-site inspection, with the motivation confirming or disputing the predetermined sensitivities (where applicable).

Section 7 of the report summarises the plan of study for the specialist assessments as part of the BA process.

The information presented in this report, at this stage of the process, is based on the available information and expertise of the EAP and specialists.

This report will be submitted as part of the application for Environmental Authorisation (EA), following the required pre-application phase with the relevant competent authorities.

10 EAP AND SPECIALIST DECLARATION

10.1 EAP DECLARATION

I, ***Anandi Alers the appointed EAP (registration no. 2019/1514)***, hereby confirm that the verification information provided in this document is based on the input from the appointed independent specialists.

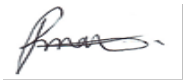
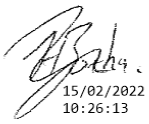
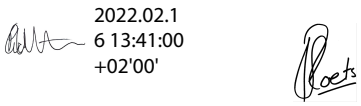
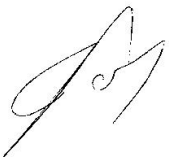
All information provided associated to the predetermined impact assessment process required is based on the expertise and interpretation of the relevant legislation of the EAP in compliance with Regulation 13 of the EIA regulations (GNR. 982 of 2014, as amended).

NAME	DECLARATION SIGNATURE	DATE
Anandi Alers		10 February 2022

10.2 SPECIALIST DECLARATION

We, ***the appointed specialist, and signees of this document***, hereby confirms that the information represented in this report by the appointed EAP, is a true and accurate reflection of the outcome of our data analysis and site inspection, in our professional capacity.

NAME	DECLARATION SIGNATURE	DATE
AGRICULTURAL IMPACT ASSESSMENT – LAND MATTERS ENVIRONMENTAL CONSULTING (PTY) LTD		
Rowena Harrison		10 February 2022
LANDSCAPE/VISUAL IMPACT ASSESSMENT - LOGIS		
Lourens du Plessis		10 February 2022
ARCHAEOLOGICAL, CULTURAL HERITAGE AND PALAEONTOLOGY IMPACT ASSESSMENT – BEYOND HERITAGE		
Jaco van der Walt		10 February 2022
TERRESTRIAL BIODIVERSITY, PLANT AND ANIMAL SPECIES IMPACT ASSESSMENT – THE BIODIVERSITY COMPANY		
Andrew Husted		10 February 2022

Lusanda Matee		10 February 2022
AQUATIC BIODIVERSITY IMPACT ASSESSMENT – THE BIODIVERSITY COMPANY		
Christian Fry		10 February 2022
Dale Kindler		10 February 2022
HYDROLOGY - GCS		
Hendrik Botha		10 February 2022
NOISE IMPACT ASSESSMENT - DBACOUSTICS		
Barend van der Merwe		10 February 2022
TRAFFIC IMPACT ASSESSMENT - SIYAZI		
Paul van der Westhuizen Leon Roets		10 February 2022
HEALTH IMPACT ASSESSMENT – INFOTOX (PTY) LTD		
Dr. Willie van Niekerk		10 February 2022
SOCIO-ECONOMIC ASSESSMENT – BATHO EARTH		
Ingrid Snyman		10 February 2022
AIR QUALITY – ENVIRONGAKA (PTY) LTD		
Jan Potgieter		10 February 2022

APPENDIX A – SCREENING REPORT

APPENDIX B – PHOTOGRAPHIC EVIDENCE OF SITE VISIT

	View from centre of site towards the Lion Smelter (looking southeast from the site).
	Existing access roads (looking southwest from the site).

	View from centre of site towards the R 555 (looking northwest from the site).
	Existing access roads towards the R 555 (looking southwest from the site).

	Disturbed non-perennial southwest from the site (more than 300 m away)
	Concrete bed of historic activities within the non-perennial tributary.

Culvert of non-perennial crossing with the R 555 (more than 300 m away).

Site	Upslope view	Downslope view
S1		
GPS	24°49'14.26"S 30° 6'35.05"E	

	View from the R 555 with the proposed ECF project located to the left of the road when driving towards Steelpoort.
	The general environment near the site with Ga-Mampuru and Ga-Mpuru in the background (northwest from the site).

Photographs illustrating some of the flora recorded within the assessment area. A) Dichrostachys cinerea subsp. africana, B) Vachellia tortilis., C) Euphorbia ingens., D) Aloe globuligemma., and E) Solanum lichtensteinii Willd.

APPENDIX C - REFERENCES