VISUAL IMPACT ASSESSMENT FOR THE PROPOSED WEST WITS MINING PROJECT

Prepared for:

SLR Consulting (South Africa)

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EXECUTIVE SUMMARY

Scientific Terrestrial Services (STS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the Environmental Impact Assessment for an application for a Mining Right for the opencast and underground mining for the West Wits Mining Project, located north of Soweto, Gauteng Province.

The proposed Mining Right Area (MRA) is located within the City of Johannesburg Metropolitan Municipality and can be accessed via the R41 (Mainreef road / Randfontein) and the M77, with the R558 immediately west of the proposed MRA, with the R24 (Albertina Sisulu / Hamberg) running along the northern boundary of the proposed MRA (Figures 1 to 3). The proposed MRA partly falls within Roodepoort (northern portion) and partly within Soweto (southern portion).

In broad terms the proposed project would involve the development of five open pit mining areas referred to as the:

1. Mona Lisa Bird Reef Pit;
2. Roodepoort Main Reef Pit;
3. Rugby Club Main Reef Pit;
4. 11 Shaft Main Reef Pit; and
5. Kimberley Reef East Pit.

The proposed project further includes the refurbishment of two existing Infrastructure Complexes (IC), to access the existing underground mine workings. These infrastructure complexes are referred to as the:

1. Bird Reef Central IC, and
2. Kimberley Reef East IC.

The sections below serve to summarise the findings of the assessment.

Description of the receiving environment

The open pit areas and the ICs as well as surrounding areas have been subject to various historic and current legal and illegal mining activities for several years, as well as cultivated agriculture and grazing/browsing activities which have influenced the visual character of the area. Based on the findings from both the desktop and field assessment it is evident that the proposed project is located within a region with gently to moderately undulating terrain dominated by urban built-up and mining activities. Therefore, the most dominant land uses in the surrounding areas are; mining activities, residential areas, and commercial and industrial facilities.

Due to the abovementioned characteristics of the area, the various open pit areas and ICs will have a minimal to high visual impact on the receiving environment. The surrounding landscape is considered to have a moderate Visual Absorption Capacity (VAC), mostly due to the dense urban built-up, the existing mine dumps, slimes dams and tailings facilities. Based on the field assessment it is evident that the impact significance of the 11 Shaft Main Reef Pit, Kimberley Reef East Pit and Kimberley Reef East IC are deemed to be of very low significance. This is due to the location of these open pits and IC situated within heavily disturbed areas surrounded by historic mine dumps and surface infrastructure remnants such as ventilation shafts, which have been allowed to return to a densely vegetated state, which assist in the absorption of the open pits and IC. Furthermore, the well-established vegetation and undulating topography of the area further indicates that the proposed open pits and IC will be screened from receptors within the immediate surrounding environment. Since the impact significance of the 11 Shaft Main Reef Pit, Kimberley Reef East Pit and Kimberley Reef East

IC are deemed to be of very low significance it was not deemed necessary to provide further detail for these areas.

Since the entire proposed MRA has been subject to disturbance and transformation due to mining activities and urban development, significant alien floral species proliferation has occurred, resulting in the area no longer considered representative of the Soweto Highveld Grassland Vegetation Type. Based on the floral assessment undertaken by STS (2018), the IC and open pit areas comprised secondary grassland and transformed grassland areas.

The overall landscape of the Roodepoort Main Reef Pit, Rugby Club Main Reef Pit, Mona Lisa Bird Reef Pit and the Bird Reef Central IC are considered of moderate scenic quality. This is due to unsightly areas such as exposed bare ground, industrial properties, existing historic mine dumps, slimes dams and tailings facilities that weaken the scenic value of the urban built-up area.

The sense of place associated with the ICs and open pit areas are related to the landscape character type of the greater proposed MRA – urban, gently to moderately undulating terrain dominated by urban built-up and mining activities. The sense of place is not unique to the ICs and open pit areas as it is representative of the greater region). The level of movement and activity within the proposed MRA is relatively high due to the commercial and industrial areas as well as active mining taking place in the area, thus it can be described as busy with a lot of vehicular and pedestrian movement.

From the viewshed analysis, the proposed mining activities are expected to be highly visible to receptors present within two km thereof, as these areas fall within the high visibility zone with the proposed infrastructure forming part of the foreground of their viewing experience. Due to the topography of the surrounding environment the proposed mining activities will become less visible the further away the sensitive receptors are from the study areas. However, since the viewshed analysis does not take into account vegetation and existing infrastructure, the field assessment indicated that the proposed mining activities will not be not visible from all the vantage points as provided by the viewshed analysis.

From the elevation profile and line of sight analysis, supported by the findings of the field assessment and Key Observation Point (KOP) analysis, it was evident that the open pits and ICs are located within the foreground and middle ground of receptors within a five km radius thereof.

The lighting environment within the vicinity of the pit areas and ICs are considered to fall within Environmental Zone E4 (Urban) with high district brightness, with various light sources such as street lights, security lighting at commercial and industrial facilities, and lighting associated with the current mining activities. The area therefore contributes significantly to sky glow and light pollution in the greater area. Since the proposed MRA and greater region is considered high district brightness the proposed open pits ICs will therefore not have a significant contribution to lighting impact on the surrounding environment. Since the opencast mining activities will only take place during the daytime the impact of lighting at night will be negligible. The ICs associated with the West Wits Mining Project will however somewhat contribute to the effects of sky glow and artificial lighting.

Impact Assessment

Several potential risks to the receiving aesthetic and visual environment as a result of the proposed project have been identified, relating to impacts on visual character and sense of place, visual intrusion and visual exposure and visibility, as well as night time lighting impacts. The significance of these impacts may be reduced should appropriate and effective mitigation measures be implemented. Mitigation measures that will have to be implemented in order to minimise the visual impact on the local and sub regional area, including dust control and management, prevention of damage to visual

resources, making use of screening opportunities where possible and implementing good housekeeping measures.

It is the opinion of the specialist that the due to location of the Roodepoort Main Reef Pit, the Rugby Club Main Reef Pit and the Mona Lisa Bird Reef Pit will have the most significant visual impact (high) on the receiving environment. Ensuring that vegetation clearance is limited to the proposed mining pit and infrastructure footprint, the safety berm that will be constructed on the periphery of the open pits with topsoil should not be higher than 1.5m, and no opencast mining activities taking place 24-hours 7 days a week (underground mining activities will however take place 24 hours 7 days a week) the significance of the mining impact may be reduced. Concurrent rehabilitation, and the short period of mining at each pit (longest mining period will be 6 months at the Rugby Club Main Reef Pit and the 11 Shaft Main Reef Pit) will reduce the duration of the impact in the area. The landscape character, quality and value have already been altered significantly by historic and current ongoing mining activities.

It should be noted that the visual impacts associated with the proposed open pits are likely to be of higher significance, due to the proximity to residential and other areas. However, the duration of the visual impacts associated with the open pit areas will be of short duration (longest mining operation is 6 months) and once these areas are backfilled and rehabilitated the visual impact of the open pit areas will significantly be reduced.

Even though the visual impact of the proposed ICs are of moderate significance the duration thereof will be longer (20years) since it is associated with the underground mining activities. However, these ICs are situated within more remote areas where the surrounding historic mine dumps, dense and high vegetation and undulating topography assists in screening these areas from potential sensitive receptors.

The proposed West Wits Mining Project will therefore not have a detrimental visual impact on the receiving environment and is thus not fatally flawed from a visual impact perspective. It is recommended that, from a visual impact perspective, the proposed mining activities be taken into consideration on a site-specific basis, and that the recommended mitigation measures for the identified impacts be implemented, ensuring that the relevant authorities are consulted in accordance with the stipulated guidelines.

DOCUMENT GUIDE

The table below provides the NEMA (2017) Requirements for Biodiversity Assessments and also the relevant sections in the reports where these requirements are addressed.

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix J
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix J
b)	A declaration that the specialist is independent	Appendix J
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.3
cA)	An indication of the quality and age of base data used for the specialist report	Appendix I
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.2
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3 Appendices A - H
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4.3 – 4.6
g)	An identification of any areas to be avoided, including buffers	Not applicable
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Not applicable
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.5
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 4 and 5
k)	Any mitigation measures for inclusion in the EMPr	Section 5
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 6
(iA)	Regarding the acceptability of the proposed activity or activities	Section 6
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 5
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	Consultation with interested and affected parties will be undertaken as part of the project
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Comments and responses that are raised by interested and affected parties will be included in the report compiled by the EAP
q)	Any other information requested by the competent authority	No information requested at this time

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GLOSSARY OF TERMS

Best practicable environmental option	This is the alternative/option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.
Characterisation	The process of identifying areas of similar landscape character, classifying and mapping them and describing their character.
Characteristics	An element, or combinations of elements, which make a contribution to landscape character.
Development	Any proposal that results in a change to the landscape and/ or visual environment.
Elements	Individual parts, which make up the landscape, for example trees and buildings.
Feature	Particularly prominent or eye-catching elements in the landscape such as tree clumps, church towers or wooded skylines.
Geographic Information System (GIS)	A system that captures, stores, analyses, manages and presents data linked to location. It links spatial information to a digital database.
Impact (Visual)	A description of the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.
Key characteristics	Those combinations of elements which are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place.
Land cover	The surface cover of the land, usually expressed in terms of vegetation cover or the lack of it. Related to but not the same as Land use.
Land use	What land is used for based on broad categories of functional land cover, such as urban and industrial use and the different types of agriculture and forestry?
Landform	The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.
Landscape	An area, as perceived by people, the character of which is the result of the action and interaction, of natural and/ or human factors.
Landscape character type	These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Landscape integrity	The relative intactness of the existing landscape or townscape, whether natural, rural or urban, and with an absence of intrusions or discordant structures.
Landscape quality	A measure of the physical state of the landscape. It may include the extent to which typical landscape character is represented in individual areas, the intactness of the landscape and the condition of individual elements.
Landscape value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a variety of reasons.

Receptors	Individuals, groups or communities who are subject to the visual influence of a particular project. Also referred to as viewers, or viewer groups.
Sense of place	The unique quality or character of a place, whether natural, rural or urban, allocated to a place or area through cognitive experience by the user. It relates to uniqueness, distinctiveness or strong identity and is sometimes referred to as genius loci meaning 'spirit of the place'.
Sky glow	Brightening of the night sky caused by outdoor lighting and natural atmospheric and celestial factors.
Skylining	Siting of a structure on or near a ridgeline so that it is silhouetted against the sky.
View catchment area	A geographic area, usually defined by the topography, within which a particular project or other features would generally be visible.
Viewshed	The outer boundary defining a view catchment area, usually along crests and ridgelines.
Visibility	The area from which project components would potentially be visible. Visibility is a function of line of sight and forms the basis of the VIA as only visible structures will influence the visual character of the area. Visibility is determined by conducting a viewshed analysis which calculates the geographical locations from where the proposed project activities might be visible.
Visual absorption capacity	The ability of an area to visually absorb development as a result of screening topography, vegetation or structures in the landscape.
Visual character	The overall impression of a landscape created by the order of the patterns composing it; the visual elements of these patterns are the form, line, colour and texture of the landscape's components. Their interrelationships are described in terms of dominance, scale, diversity and continuity. This characteristic is also associated with land use.
Visual exposure	The relative visibility of a project or feature in the landscape. Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance.
Visual intrusion	The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.
Zone of visual influence	An area subject to the direct visual influence of a particular project.

*Definitions were derived from Oberholzer (2005) and the Institute of Environmental Management and Assessment (2013)

LIST OF ACRONYMS AND ABBREVIATIONS

ARC	Agricultural Research Council
BLM	(United States) Bureau of Land Management
BPEO	Best Practicable Environmental Option
DEM	Digital Elevation Model
DTM	Digital Terrain Model
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
GIS	Geographic Information System
GPS	Global Positioning Systems
Ha	Hectares
IAPs	Interested and Affected Parties
IC	Infrastructure Complex
IEM	Integrated Environmental Management
LI IEMA	Landscape Institute and Institute of Environmental Management and Assessment
IDP	Integrated Development Plan
KOP	Key Observation Point
m.a.m.s.l.	Metres above mean sea level
MRA	Mining Right Area
MAP	Mean Annual Precipitation
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act (No. 108 of 1997)
NGL	Natural Ground Level
NPAES	National Protected Areas Expansion Strategy
ROM	Run of Mine
SANBI	South African National Biodiversity Institute
SAPAD	South Africa Protected Areas Database
STS	Scientific Terrestrial Services
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the Environmental Impact Assessment process for an application for a Mining Right for the opencast and underground mining for the West Wits Mining Project, located north of Soweto, Gauteng.

The proposed Mining Right Area (MRA) is located within the City of Johannesburg Metropolitan Municipality and can be accessed via the R41 (Mainreef road / Randfontein) and the M77, with the R558 immediately west of the proposed MRA, with the R24 (Albertina Sisulu / Hamberg) running along the northern boundary of the proposed MRA (Figures 1 to 3). The proposed MRA partly falls within Roodepoort (northern portion) and partly within Soweto (southern portion).

In broad terms the proposed project would involve the development of five open pit mining areas referred to as the:

1. Mona Lisa Bird Reef Pit;
2. Roodepoort Main Reef Pit;
3. Rugby Club Main Reef Pit;
4. 11 Shaft Main Reef Pit; and
5. Kimberley Reef East Pit.

The proposed project further includes the refurbishment of two existing infrastructure complexes (IC), to access the existing underground mine workings. These infrastructure complexes are referred to as the:

1. Bird Reef Central IC, and
2. Kimberley Reef East IC.

The proposed location for the open pit mining and surface infrastructure complexes investigated are depicted in Figures 2 and 3.

A VIA entails a process of data collection, spatial analysis, visualisation and interpretation to describe the quality of the landscape prior to development taking place and then identifying possible visual impacts after development. Assessing visual impacts are difficult as it is very

subjective due to a person's perception being affected by more than only the immediate environmental factors (Oberholzer, 2005). Visual impacts occurring as a result of the proposed mining activities, will occur during the construction, operational and decommissioning / closure phases of the proposed project, with limited residual visual impact possibly occurring post-closure, provided that efficient rehabilitation of the mining footprint areas take place.

This report, after consideration and description of the visual integrity of the IC and open pit areas and surroundings, must guide the proponent, authorities and Environmental Assessment Practitioner (EAP), by means of recommendations, as to the suitability of the open pit areas and ICs for the intended land use, from a visual and aesthetic point of view. This report must furthermore serve to inform the planning, design and decision-making process as to the layout and nature of the proposed mining activities.

1.2 Description of the Proposed Project

West Wits MLI (Proprietary) Ltd (West Wits) has re-applied for a mining right in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA) as amended, for gold, uranium and silver over various portions of the farms Glen Lea 228 IQ, Roodepoort 236 IQ, Roodepoort 237 IQ, Uitval 677 IQ, Vlakfontein 238 IQ, Witpoortjie 245 IQ, Vogelstruisfontein 231 IQ, Vogelstruisfontein 233 IQ, and Tshekisho 710 IQ.

West Wits currently holds a prospecting right (GP 30/5/1/1/2/10035 PR) over the above farms. The prospecting right (MPT No. 29/2016) was ceded from Mintails SA Soweto Cluster (Proprietary) Limited to West Wits. Consent for the transfer of the prospecting right in terms of Section 11(2) of the MPRDA was granted by the DMR in 2018.

In addition to the IC and open pits the project would also include the establishment of run of mine (ROM) ore stockpiles, topsoil stockpiles and waste rock dumps (WRD) as well as supporting infrastructure including material storage and handling facilities (for fuel, lubricants, general and hazardous substances), general and hazardous waste management facilities, sewage management facilities, water management infrastructure, communication and lighting facilities, centralised and satellite offices, workshops, washbays, stores, change houses, lamprooms, vent fans and security facilities.

The expected life of mine is three (3) to five (5) years for the open pit operations (inclusive of rehabilitation) and 20 years for the underground operations at the Kimberley Reef East

operation and 10 year for the Bird Reef Central operation (see diagram below). The pits would be mined in a phased approach with each pit taking between 6 and 9 months to be mined and rehabilitated. The extent for the proposed open pit mining and surface infrastructure complexes are presented in Table 1 below.

Table 1: Extent of the proposed infrastructure and open pit areas investigated pertaining to the proposed MRA.

Proposed Mining Right Area	Area (ha)	
Proposed MRA	2 076	
Proposed Infrastructure Complexes Investigated		
	IC Size (ha)	Underground Mining Area (ha)
Bird Reef Central	± 2.19	± 53.7
Kimberley Reef East (with associated underground mining)	± 4.74	± 62.7
West Wits Open Pit Areas Investigated		
11 Shaft Main Reef Pit	14	
Kimberley Reef East Pit	9.92	
Mona Liza Bird Reef Pit	19.2	
Roodepoort Main Reef Pit	26.4	
Rugby Club Reef East Pit	2.5	

Construction contractor's site camp areas will be established at the start of the construction phase for the underground mining. These facilities would either be removed after construction phase or it will be incorporated into the layout of the IC. Table 2 below indicates the support facilities that will be present within each respective infrastructure complex.

Table 2: Support facilities proposed at each respective infrastructure complex (IC).

Infrastructure	Bird Reef Central IC	Kimberley Reef East IC
Parking area	X	X
Security office at main gate and drop off zone	X	X
Change house and walkway	X	X
Lamp Room	X	X
Medical Centre	X	X
Headgear, Winder house and Banksmans cabins' and proto room	X	X
Ore storage	X	X
Laydown area and yard store	X	X
Stores, workshop, store yard and offices	X	X
Potable water tanks	X	X
Explosives off-loading facilities	X	X
Access, internal and haul roads	X	X
Perimeter fencing and lighting	X	X
Main centralized office complex and communication facilities	X	
Main office complex		X
Refurbished circular shaft	X	
Laundry	X	X
Donkey adit and pump station		X
Sewage collection and pump station	X	X
Bioremediation	X	X
Waste yard	X	X

The open pit mining areas include topsoil stockpiles, run-of-mine ore stockpiles and crusher areas, waste rock dumps and haul roads. Primarily mineral processing will take place on site, and all run-of mine material will be transported to an existing processing plant off-site for concentrating of materials.

Initially, near surface resources will be targeted through means of open pit methods. The resources at the open pit targets are generally outcropping and production would commence at the onset of mining activities. No construction activities will take place at the open pit sites. Upon near depletion of resources at the open pit targets, underground resources will be targeted. The activities required to enable extraction of these resources include re-establishment of existing incline, circular and vertical shafts and related infrastructure as well as rehabilitation of the existing workings.

Data on the proposed opencast and underground mining operations with specific reference to their location, duration of operation and rehabilitation is provided in Table 2 below. Furthermore, the shafts associated with the underground mining activities will have an approximate height of 40 m.

Table 3: Data on the proposed mining operations.

Features	Details				
Target Commodities	Gold, Uranium, Silver				
Mineable resource	~9000 000 tonnes				
Open pit mining					
Open Pits	Kimberley East	11 Shaft	Rugby Club	Mona Lisa	Roodepoort
Mining Direction	West to East	East to West	East to West	West to East	West to East
Size of mining area	~9.2 ha	~15 ha	~2.6 ha	~20 ha	~26.5 ha
Mining rate (per month)	15 0000 tonnes	15 0000 tonnes	15 0000 tonnes	15 0000 tonnes	15 0000 tonnes
Pit depth	20 to 30m	20 to 30m	7 to 10m	20 to 30m	7 to 10m
Mineable resource (tonnes)	62 917	117 631	30 212	34 351	179 290
Mining duration (including concurrent rehabilitation, season dependent)	~5 months	~6 months	~6 months	~3 months	~6 months
Final rehabilitation duration	~2 months	~2 months	~3 months	~2 months	~2 months
Waste rock dump volume	503 336m^3	1 013 436 m^3	260 288 m^3	295 947 m^3	1 103 323 m^3
Waste rock dump height	20 to 30m	20 to 30m	10m	20 to 30m	10m
Underground mining					
Infrastructure complexes (IC)	Bird Reef Central	Kimberley Reef East			
IC Size	~2.19 ha	3.5 ha			
Size of mining area	~52 ha	~100 ha			
Mining rate (per month)	15 000 tonnes	30 000 tonnes			
Workings depth	100 m to interception of reef (up to 3 km below surface)				
Mining Duration	10 years	20 years			
Waste rock	All waste rock will remain in the underground workings				

For more information regarding the mining activities refer to the Environmental Impact Assessment (EIA) Report for the proposed West Wits Mining Project (2018).

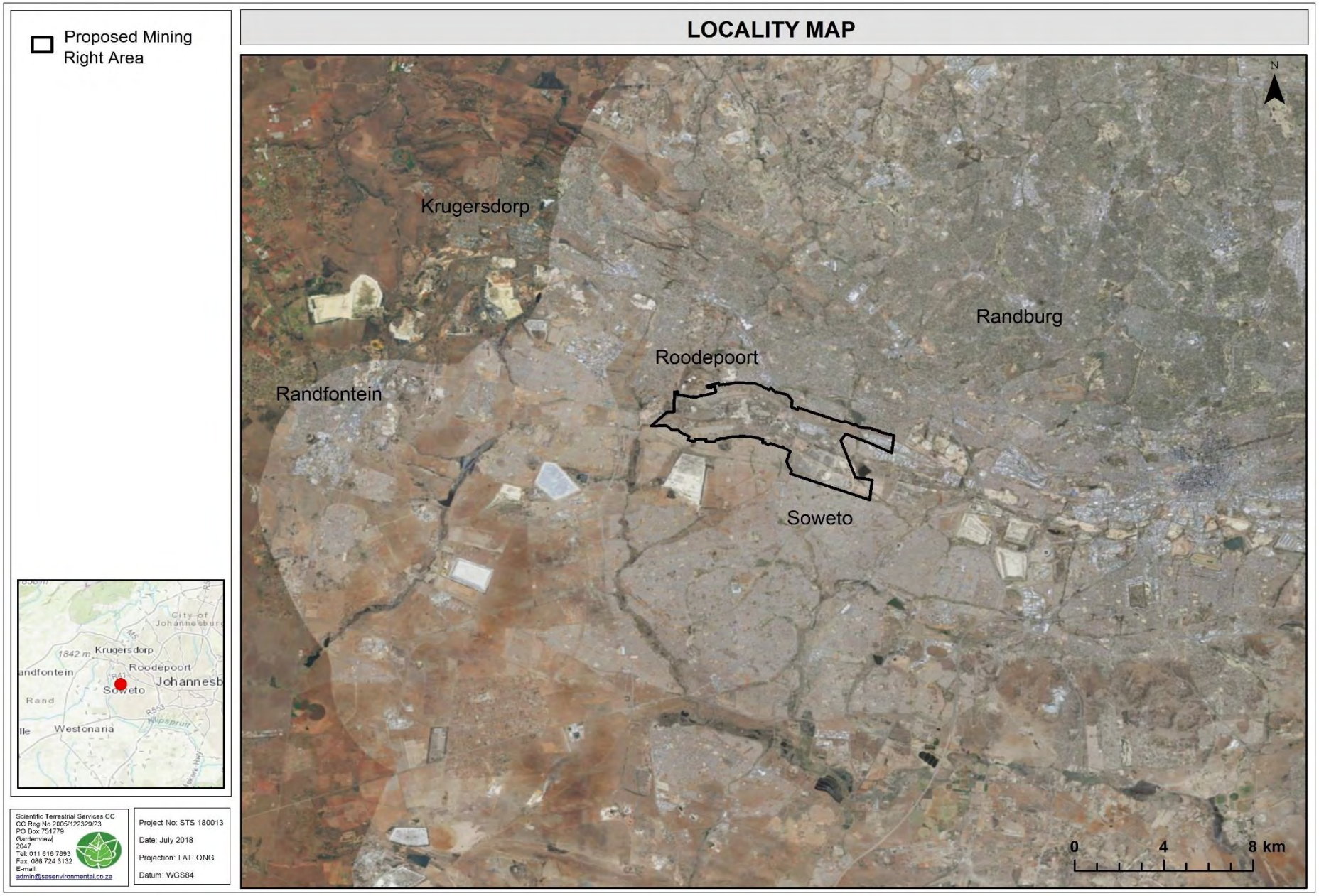


Figure 1: Digital Satellite image depicting the location of the proposed MRA in relation to surrounding areas.

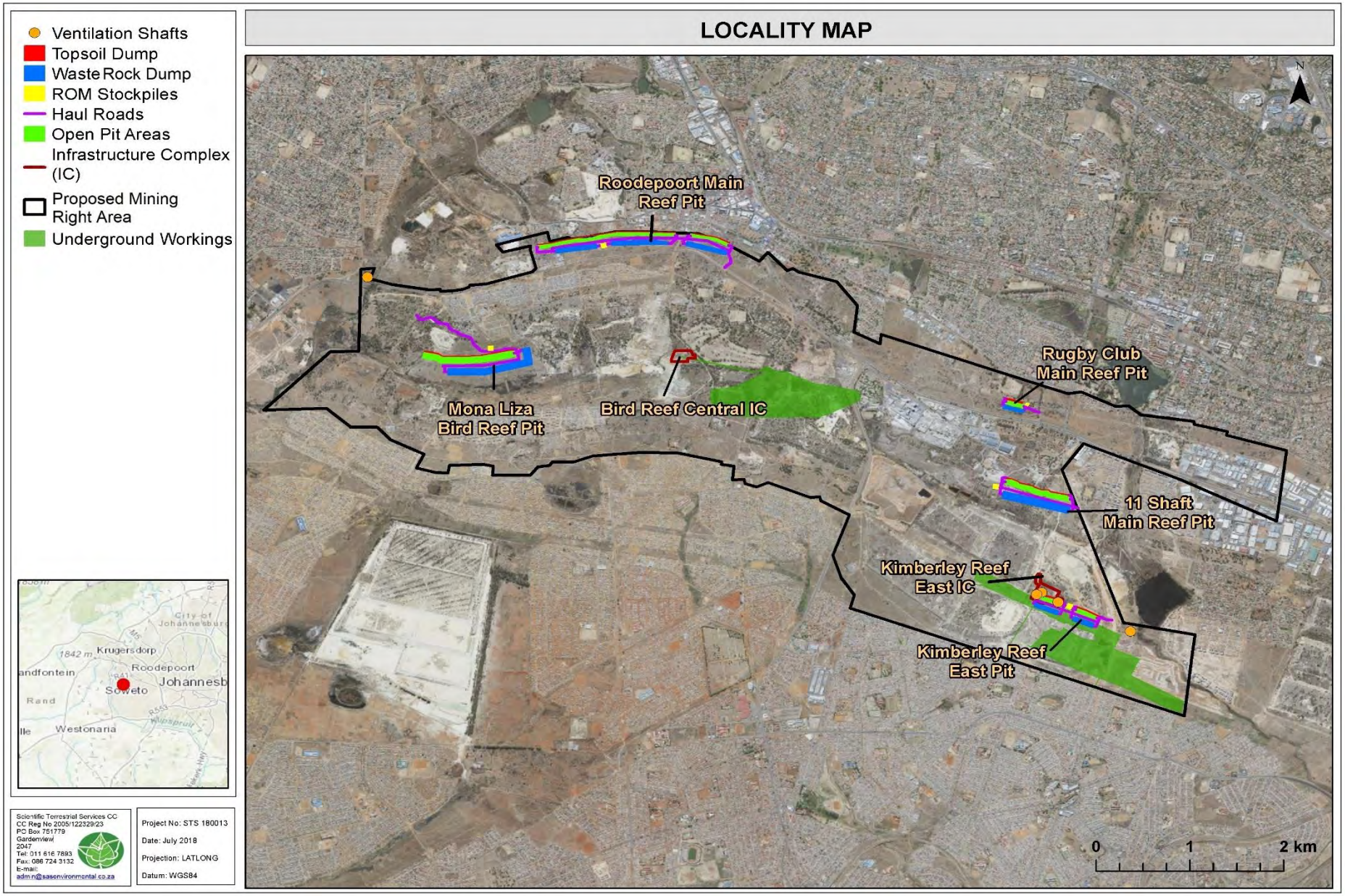


Figure 2: Digital satellite image depicting the location of the open pit areas and infrastructure complexes (IC) associated with the proposed MRA.

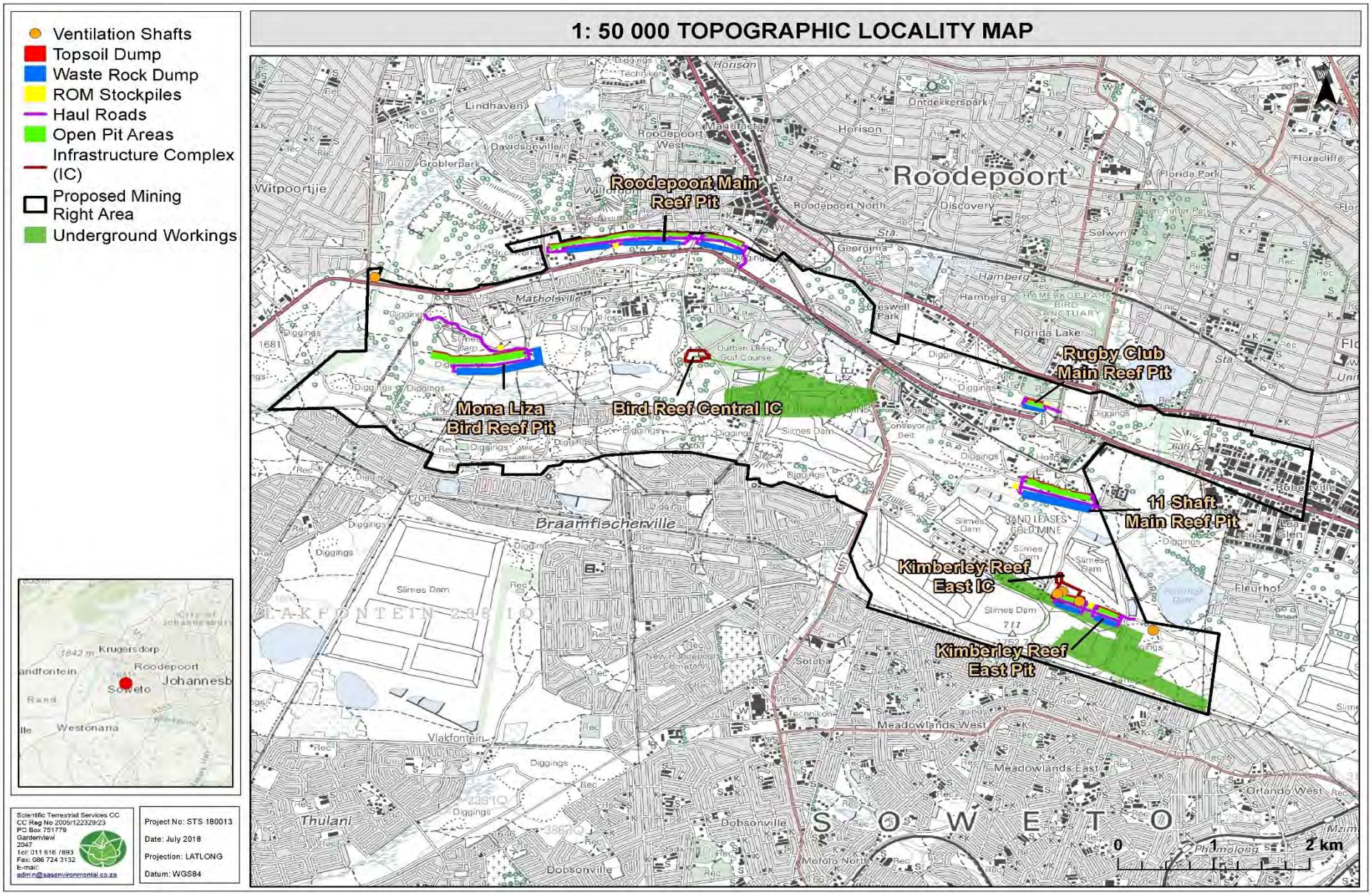


Figure 3: The proposed MRA, open pit areas and infrastructure complexes (IC) depicted on a 1:50 000 topographical map in relation to its surrounding area.

1.3 Project Scope

The scope of this study was to:

- Determine the Category of Development and Level of Assessment as outlined by Oberholzer (2005);
- Describe the receiving environment in terms of regional context, location and environmental and landscape characteristics;
- Describe and characterise the proposed project and the receiving environment in its envisioned future state;
- Identify the main viewsheds through undertaking a view shed analysis, based on the proposed height of infrastructure components and the Digital Elevation Model (DEM), as a mechanism to identify the locations of potential receptors sites and the distance of these receptor sites from the project;
- Identify and describe potential visual receptors residing at or utilising receptor sites;
- Establish receptor sites and identify Key Observation Points (KOPs) from which the proposed project will have a potential visual impact;
- Prepare a photographic study and conceptual visual simulation of the proposed project as the basis for the viewshed identification and analysis;
- Assess the potential visual impact of the proposed project from selected receptors sites in terms of standard procedures and guidelines; and
- Describe mitigation measures in order to minimise any potential visual impacts.

1.4 Principles and Concepts of VIAs

Visual resources have value in terms of the regional economy and inhabitants of the region. Furthermore, these resources are often difficult to place a value on as they normally also have cultural or symbolic values. Therefore, VIAs are to be performed in a logical, holistic, transparent and consistent manner. Oberholzer (2005) identifies the following concepts to form an integral part of the VIA process:

- Visual resources include the visual, aesthetic, cultural and spiritual aspects of the environment, which contribute toward and define an area's sense of place;
- Natural and cultural landscapes are inter-connected and must be considered as such;
- All scenic resources, protected areas and sites of special interest within a region need to be identified and considered as part of the VIA;
- All landscape processes such as geology, topography, vegetation and settlement patterns that characterise the landscape must be considered;

- Both quantitative criteria, such as 'visibility' and qualitative criteria, such as aesthetic value or sense of place has to be included as part of the assessment;
- VIAs must inform the EIA process in terms of visual inputs; and
- Public involvement must form part of the process.

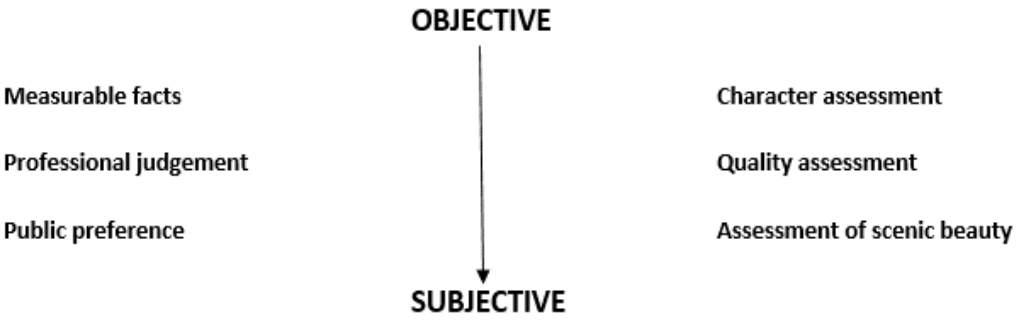
The guideline furthermore recommends that the VIA process identifies the Best Practicable Environmental Option (BPEO) based on the following criteria:

- Long term protection of important scenic resources and heritage sites;
- Minimisation of visual intrusion on scenic resources;
- Retention of wilderness or special areas intact as far as possible; and
- Responsiveness to the area's uniqueness, or sense of place.

1.5 Assumptions and Limitations

- No specific national legal requirements for VIAs currently exist in South Africa. However, the assessment of visual impacts is required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed project indicate that visibility and aesthetics are likely to be significant issues and that visual input is required (Oberholzer, 2005);
- Due to a lack of visual specialist guidelines within the Gauteng Province, the "Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process" (Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs & Development Planning was used;
- All information relating to the proposed project as referred to in this report, inclusive of the proposed infrastructure layout, infrastructure height, mining techniques and sequences, etc., is assumed to be the latest available information. No detailed information about building styles, colours and finishes and lighting types and positioning, etc. were available prior to completion of the assessment, and assumptions, relating to industry standards, have been made regarding these elements, taking industry standard and best practice guidelines into consideration;
- Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable, as outlined in the diagram below (The

Landscape Institute and Institute of Environmental Management and Assessment (LI IEMA, 2002); and



- The viewsheds resulting from the Digital Elevation Model (DEM) and as illustrated in this report, indicate the areas from which the proposed project is likely to be visible and does not take local vegetation cover and man-made structures into account. Potential receptor sites, indicated to fall within the viewsheds have therefore been ground truthed during the field assessment.

2. LEGAL, POLICY AND PLANNING CONTEXT FOR VIAS

Oberholzer (2005) indicates that current South African environmental legislation governing the EIA process, which may include consideration of visual impacts if this is identified as a key issue of concern, is the National Environmental Management Act (NEMA) (Act 107 of 1998). This includes the 2017 amendments to the 2014 NEMA EIA regulations (published in General Notice (GN) No. R.326 as well as R.327 Listing Notice 1, R.325 Listing Notice 2 and R.324 Listing Notice 3).

In addition, the following acts and guidelines are applicable (Oberholzer, 2005):

National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
This act is intended to identify and protect natural landscapes.

National Heritage Resources Act (Act No. 25 of 1999)
This provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

Advertising on Roads and Ribbons Act (Act No. 21 of 1940)

Visual pollution is controlled, to a limited extent, by the Advertising on Roads and Ribbons Act (Act No. 21 of 1940), which deals mainly with signage on public roads.

Municipal Systems Act (Act No. 32 of 2000)

In terms of the Municipal Systems Act (Act No. 32 of 2000), it is compulsory for all municipalities to initiate an Integrated Development Planning (IDP) process in order to prepare a five-year strategic development plan for the area under their control. The IDP process, specifically the spatial component is based in certain areas and provinces on a bioregional planning approach to achieve continuity in the landscape and to maintain important natural areas and ecological processes. The proposed MRA is situated within the City of Johannesburg Metropolitan Municipality, for which the draft IDP of 2018/19 is available. According to the IDP document the growth of the South African economy is accompanied by growth in selected regions such as the Eurozone, and revival of selective sectors such as mining and agriculture.

Spatial Planning and Land Use Management Act (Act No. 16 of 2013)

Land development must be managed in line with the principles and guidelines included in the Spatial Planning and Land Use Management Act (Act No. 16 of 2013).

Other

- Visual and aesthetic resources are also protected by local authorities, where policies and by-laws relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc. have been formulated; and
- Other decision-making authorities such as the Department of Mineral Resources (DMR), or the local authorities, in terms of their particular legislative frameworks, may also require VIAs to support informed decision-making.

3. METHOD OF ASSESSMENT

3.1. Desktop Assessment

The method of assessment for this report is based on a spatial analysis of the open pit areas and infrastructure complexes and the surrounding region, making use of Geographic Information Systems (GIS) such as Planet GIS, ArcGIS, Global Mapper as well as digital satellite imagery, photographs taken on site, various databases and all available information on the planned infrastructure and mining activities. The desktop assessment served to guide

the field assessment through identifying preliminary areas of importance in terms of potential visual impacts.

The desktop study included an assessment of the current state of the environment of the proposed MRA including general climatic conditions, local topography, land uses and land cover with data obtained from the websites of the South African National Biodiversity Institute (SANBI) and the Agricultural Research Council (ARC).

During the desktop assessment, which took place prior to and in preparation of the field assessment, 1:50 000 topographical maps and high definition aerial photographs were used to identify dominant landforms and landscape patterns. These resources, together with digital elevation data projected in GIS were utilised to generate a visual context map indicating the proposed MRA, open pit areas and ICs together with the cumulative viewsheds of the proposed project, based on the maximum height of the various infrastructural components being considered.

Detailed assessment methods used to determine the landscape characteristics of the receiving environment and potential visual impacts of the project are outlined in the relevant sections below and Appendices A – H.

3.2. Field Assessment

A field assessment was undertaken on the 6th and 7th of March 2018, which is considered to be a suitable time period during which to conduct the VIA. The natural vegetation is less dense during the autumn and winter period and denser during spring and summer. Due to the late rainfall that the Gauteng Province received, the vegetation at the time of assessment was dense which allowed for seasonal screening effects.

The field assessment included an on-foot survey of the various open pit areas and ICs and a drive-around of these areas and its surrounds, in order to determine the visual context within which the proposed project is to be developed. Focus was placed on assessing areas indicated by the viewshed analysis (Section 4.4) as being potentially important observation points including surrounding settlements/ villages, townships, offices, homesteads, nature reserves and prominent roads within the area. Points from where the proposed open pit areas and ICs were determined to be visible were recorded (making use of a handheld Global Positioning Systems (GPS)) in order to confirm aesthetically sensitive viewpoints and highly and moderately sensitive visual receptors in relation to the proposed project.

High-resolution photographs were taken from areas where the proposed project will have a moderate to high visual impact and these photographs served as the basis from which representative to visual simulations were developed, which will serve to indicate the visibility of the proposed project in relation to identified KOPs. The visual model and photographs were interpreted to provide an accurate indication of the visual impact that the proposed project will have on the aesthetic integrity of the surrounding areas.

4. RESULTS OF INVESTIGATION

4.1. Public Involvement

As is required in terms of the NEMA EIA Regulations, 2014, SLR undertook public participation to inform the EIA process. This provided a detailed understanding of the Interested and Affected Parties (I&AP) groups and related concerns and issues.

4.2. Development Category and Level of Impact Assessment

Through application of the VIA methods of assessment as presented in Appendix A, it was determined that the proposed project can be defined as a Category 5 development, which includes mining activities. According to Oberholzer (2005), a high visual impact is therefore expected, with the proposed project potentially leading to significant changes in the scenic resources and visual character of the area. In line with the method outlined in Appendix A, a Level 4 Assessment is therefore required.

However, based on the outcome of the field assessment it is evident that the proposed MRA and surrounding area have been subject to various historic and current legal and illegal mining activities for several years, which have negatively affected the visual character of the area. Due to the existing mining activities in the area, the proposed West Wits Mining Project will not set a precedent in the area for mining. Additionally, the mine dumps, slimes dams and tailings facilities situated within the area are present within the landscape and form part of the skyline, thus negatively affecting the landscape character and visual quality of the area.

The geographic setting of the proposed open pit areas and ICs would have low to high visual impacts on the receiving visual environment. Table 4 below indicates the expected visual impact (level of assessment) at each open pit area and IC as well as a motivation thereof. It

should be noted that roll-over mining is proposed, hence the open cast areas will be mined in a phased manner with concurrent rehabilitation, thus limiting the duration of visual exposure of the open pit areas to the surrounding potential sensitive receptors. The open pits and underground workings will be mined in the following order:

1. Rugby Club Main Reef Pit;
2. Roodepoort Main Reef Pit;
3. 11 Shaft Main Reef Pit;
4. Mona Lisa Bird Reef Pit;
5. Kimberley Reef East Pit;
6. Kimberley Reef East underground workings; and
7. Bird Reef Central underground workings.

Table 4: Level of assessment applicable to the West Wits Mining Project open pit areas and infrastructure complexes (IC).

Site	Visual Impact	Level of assessment	Motivation
Open Pit Areas			
Roodepoort Main Reef Pit	High	4	These open pit areas will have the most significant visual impact on the receiving visual environment due to the close proximity (from approximately 116 m to 320 m) of the R41 roadway, other local roads, residential areas, formal and informal settlements and business areas. It should be noted that existing buildings, walls and vegetation from the open veld areas and houses serve to obscure the view from some viewpoints within the surrounding area.
Rugby Club Main Reef Pit	High	4	
Mona Lisa Bird Reef Pit	High	4	The Mona Lisa Bird Reef Pit will have a moderately high visual impact on the receiving environment, due to Solplaatje residential area having a direct view of the proposed pit. The visual character of the area is negatively impacted on by the current mining activities, powerlines and a power substation present within close proximity to the proposed Mona Lisa Bird Reef Pit. Therefore, the above-mentioned activities and anthropogenic structures are likely to some extent detract visual attention from the proposed mining activities. The proposed pit will also not have a significant negative impact on the sense of place of the area.
11 Shaft Main Reef Pit	Minimal	2	The proposed 11 Shaft Main Reef Pit is situated within a heavily disturbed isolated area, in between mine dumps and rubbish dumps, where historic mining took place, thus the visual intrusion on the sensitive receptors will be minimal. Remains of old mining surface infrastructure are present within this area. Additionally, the dense vegetation of the surrounds will aid in screening the pit from the receiving environment.
Kimberley Reef East Pit	Negligible	1	The proposed Kimberley Reef East Pit is also situated within a heavily disturbed isolated area, where historic mining activities took place and the remains of ventilation shafts and other surface infrastructure are present. Furthermore, the proposed pit is surrounded by mine dumps and dense vegetation, screening the pit area from sensitive receptors in the receiving environment. The visual intrusion of the proposed pit will therefore be minimal to negligible on the receiving environment.
Infrastructure Complexes			
Bird Reef Central	Moderate	3	The IC is situated within an area where historic mining infrastructure such as the shaft and remnants of the foundations and walls of buildings are present, thus the residual impact from historic mining remains. The vegetation in the surrounds is well established (dense and tall), partially obscuring the infrastructure from motorists utilising the unpaved road situated directly adjacent to the IC as well as the Durban Deep Golf Course immediately northeast of the IC. Aside from the above-mentioned receptor sites, there are no other receptors in the area that will observe the IC. However, according to IEMA (2002) users at recreational facilities are considered as highly sensitive receptors thus the Bird Reef Central IC has a moderate visual intrusion.
Kimberley Reef East	Negligible	1	The IC has a low to negligible visual intrusion on the receiving environment, due to it being situated between mine dumps and within an area where mining activities took place. Thus, the IC is completely screened from sensitive receptors due to the mine dumps, well established vegetation and undulating topography of the area.

Level 2 = Minimal visual impact expected; Level 3 = Moderate visual impact expected; Level 4 = High visual impact expected

Based on Table 4 above it is evident that the impact significance of the 11 Shaft Main Reef Pit, Kimberley Reef East Pit and Kimberley Reef East IC are deemed to be of very low significance. This is due to the location of these open pits and IC situated within heavily disturbed areas surrounded by historic mine dumps and surface infrastructure remnants such as ventilation shafts, which have been allowed to return to a densely vegetated state, which assist in the absorption of the open pits and IC. Furthermore, the well-established vegetation and undulating topography of the area further indicates that the proposed open pits and IC will be screened from receptors within the immediate surrounding environment. Since the impact significance of the 11 Shaft Main Reef Pit, Kimberley Reef East Pit and Kimberley Reef East IC are deemed to be of very low significance it was not deemed necessary to provide further detail for these areas.

4.3. Description of the Receiving Environment

In order to holistically describe the receiving environment, this section of the report aims to determine the intrinsic value of the receiving landscape including aspects of the natural, cultural and scenic landscape, taking both tangible and intangible factors into consideration. This section furthermore aims to describe the particular character, uniqueness, intactness, rarity, vulnerability and representability of the open pit areas and ICs within its existing context. Please refer to Appendix I for detail on the vegetation type (climate, altitude, geology and soils and floral species) associated with the open pit areas and ICs only.

General views of the landscape associated with the open pit areas and ICs and surrounds are indicated in the figures below.

Figure 4: Representative photographs of the proposed Roodepoort Main Reef Pit indicating the open veld dominated by alien species and the close proximity to houses and businesses.

Figure 5: Representative photographs of the Mona Lisa Bird Reef Pit indicating the Solplaatje housing area with a mine dump in the left hand corner of the photo (top), the overall view of openveld with adjacent mine dumps (red oval) (left) and the Eskom Princess CNC Substation north of the proposed open pit area (right).

Figure 6: Representative photograph of the Rugby Club Main Reef Pit indicating current illegal mining activities taking place, as indicated in the red circle (top), as well as the close proximity to the houses (bottom).

Figure 7: General view of the Kimberley Reef East Pit, indicating mine dumps in the surrounding area, rubble and remains of historic mining surface infrastructure within the proposed pit area (left) as well as dense vegetation and prospecting that occurred in the pit area (right).

Figure 8: General view of the 11 Shaft Main Reef Pit indicating alien floral proliferation within the area, the mine dumps in the surrounds (top left and right), rubble within the area (top right) and remnants of surface infrastructure from historic mining activities (bottom).

Figure 9: General view of the Bird Reef Central Infrastructure Complex (IC) indicating a shaft, remnants of historic mining infrastructure and dense vegetation of the area.

Figure 10: General view of the Kimberley Reef East Infrastructure Complex (IC) indicating remains of a loading bin, rubble, tall trees (left) and a ventilation shaft (right).

4.3.1. Climate

As a result of climate variations throughout the year, the appearance and perception of the landscape within and surrounding the open pit areas and ICs changes with the seasons. Seasonal variation may have some effect on the area from where project components would potentially be visible, with visibility expected to be higher during the winter months when seasonal screening effects from vegetation is somewhat lowered. However, during the dry winter months dust is higher due to drier soil conditions and lower rainfall, resulting in atmospheric haziness, which will somewhat limit visibility of the surrounding landscape.

4.3.2. Land Use and Visual Receptors

The open pit areas and the ICs as well as surrounding areas have been subject to various historic and current legal and illegal mining activities for several years, as well as cultivated agriculture and grazing/browsing activities which have influenced the visual character of the area. Therefore, the most dominant land uses in the surrounding areas are; mining activities, residential areas, and commercial and industrial facilities.

In addition to the above, several dominant land uses have been identified in the vicinity of the open pit areas and ICs, namely (Figure 11):

- Residential in form of town of Roodepoort, residential areas such as Soweto, Solplaatje, Bram Fischerville, and Matholesville, Witpoortjie, Lindhaven, Davidsonville, Grobler Park, Creswell Park, Fleurhof, Meadowlands, and Florida

within and surrounding the proposed MRA. Additionally, there are numerous schools, shopping malls, hospitals and clinics and churches within these areas;

- Industrial, commercial and business facilities are also present within the vicinity of the open pit areas and ICs;
- The recreational facilities within a 5 km radius including but not limited to the Durban Deep Golf Course situated roughly directly adjacent to the Bird Reef Central IC, Mofolo Park, sportsgrounds, golf courses, and Orlando Soccer Stadium;
- Graveyards are also present within the 5 km radius; and
- The National Biodiversity Assessment (2011), National Protected Areas Expansions Strategy (NPAES, 2009), the South African Conservation Areas (SACAD, 2018) and the South African Protected Areas Database (SAPAD, 2018) indicate the following protected areas within a 10 km radius of the open pit areas: Walter Sisulu National Botanical Garden, Magaliesberg Biosphere Reserve, Melville Koppies Nature Reserve (NR), Olifantsvlei NR, Kloofendal Municipal Nature Reserve (MNR), Ruimsig MNR, and Boschkop MNR. Due to the density of the above mentioned residential areas, the undulating topography of the area and existing mine dumps in the area, the proposed open pit areas and ICs will not be visible from these protected areas.

Various roads are present in the vicinity of the open pit areas and ICs, including:

- The R41 roadway (otherwise known as Main Reef Road or Randfontein Road) which runs in an east west direction, is situated approximately 60 – 120 m south and 70 m south of the Roodepoort Main Reef Pit and Rugby Club Main Reef Pit respectively;
- The following streets are within close proximity to the Roodepoort Main Reef Pit;
  - Iridium Street approximately 50 m west;
  - Van Wyk Street approximately 140 m north;
  - Mare Street approximately 88 m north;
  - Goud Street approximately 30 m north;
  - Gustaf Street traversing a portion of the pit area; and
  - Roodeberg Avenue / Miles Stokker Road approximately 170 m northeast.
- Reid Road is situated approximately 175 m east and the R24 roadway is situated approximately 270 m north of the Rugby Club Main Reef Pit respectively; and
- Various local named and unnamed roads within the residential areas and mining areas.

There are various existing anthropogenic structures such as powerlines, substations, junkyards, commercial and industrial facilities, mine dumps, remains of surface mining infrastructure, road signs, fences, walls, and houses (formal and informal) present in the landscape which has a negative visual impact on the receiving environment.

4.3.3. Topography

The local topography of the proposed MRA in general is characterised by relatively flat to moderately undulating terrain, with the mine dumps, slimes dams and tailings facilities present within the landscape forming part of the skyline in some areas, thus negatively affecting the landscape character and visual quality of the area. Aside from the mine dumps and tailings facilities there are no distinguishing topographical features in the form of prominent hills or outcrops present within the proposed MRA. The elevation and general relief as occurring within the region associated with the proposed MRA is indicated in Figures 12 & 13 below.

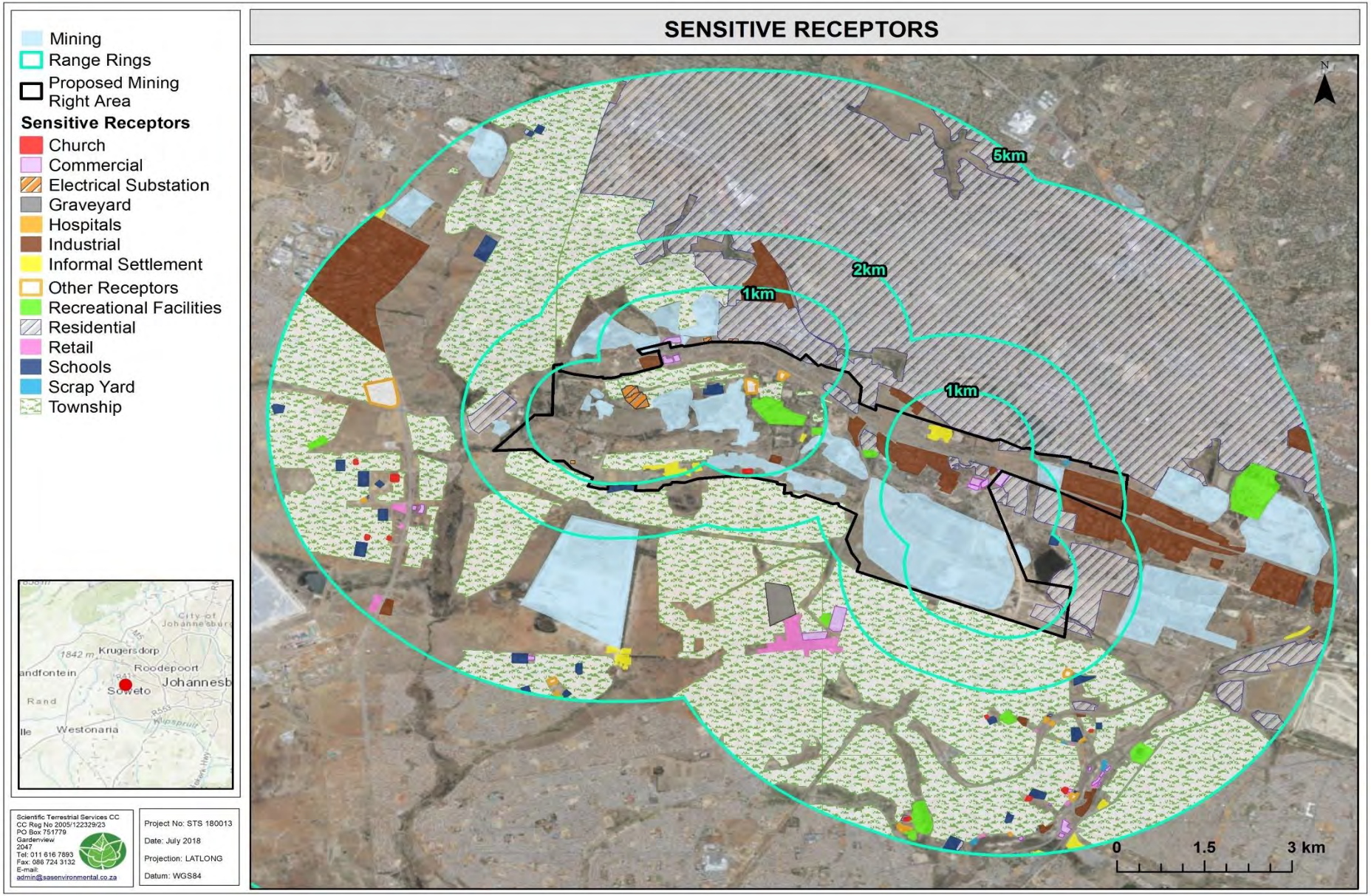


Figure 11: Map indicating identified receptor sites, comprising townships, informal settlements, industrial and commercial parks, in relation to the proposed Mining Right Area.

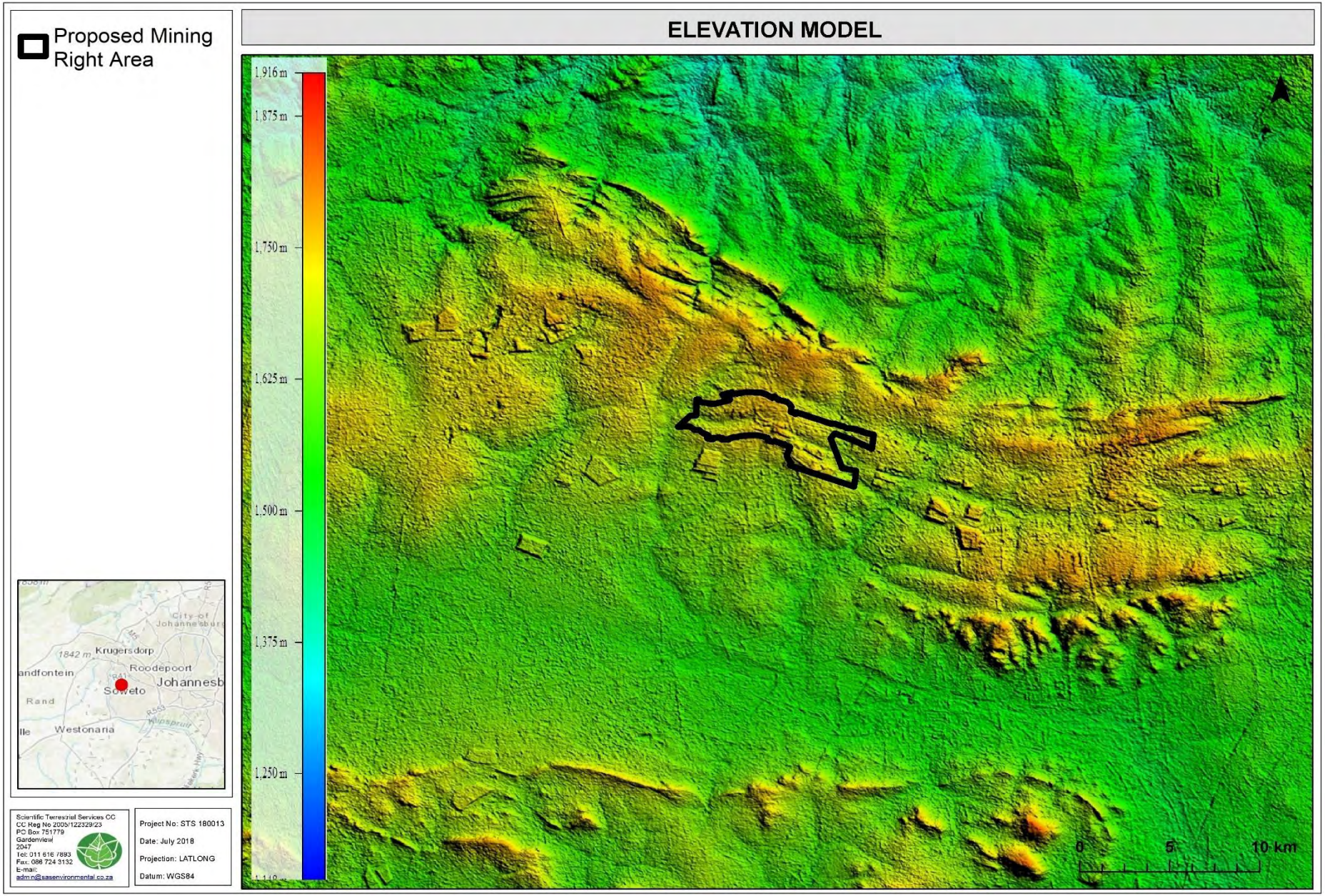


Figure 12: Elevation rendering depicting the topographical character of the proposed Mining Right Area.

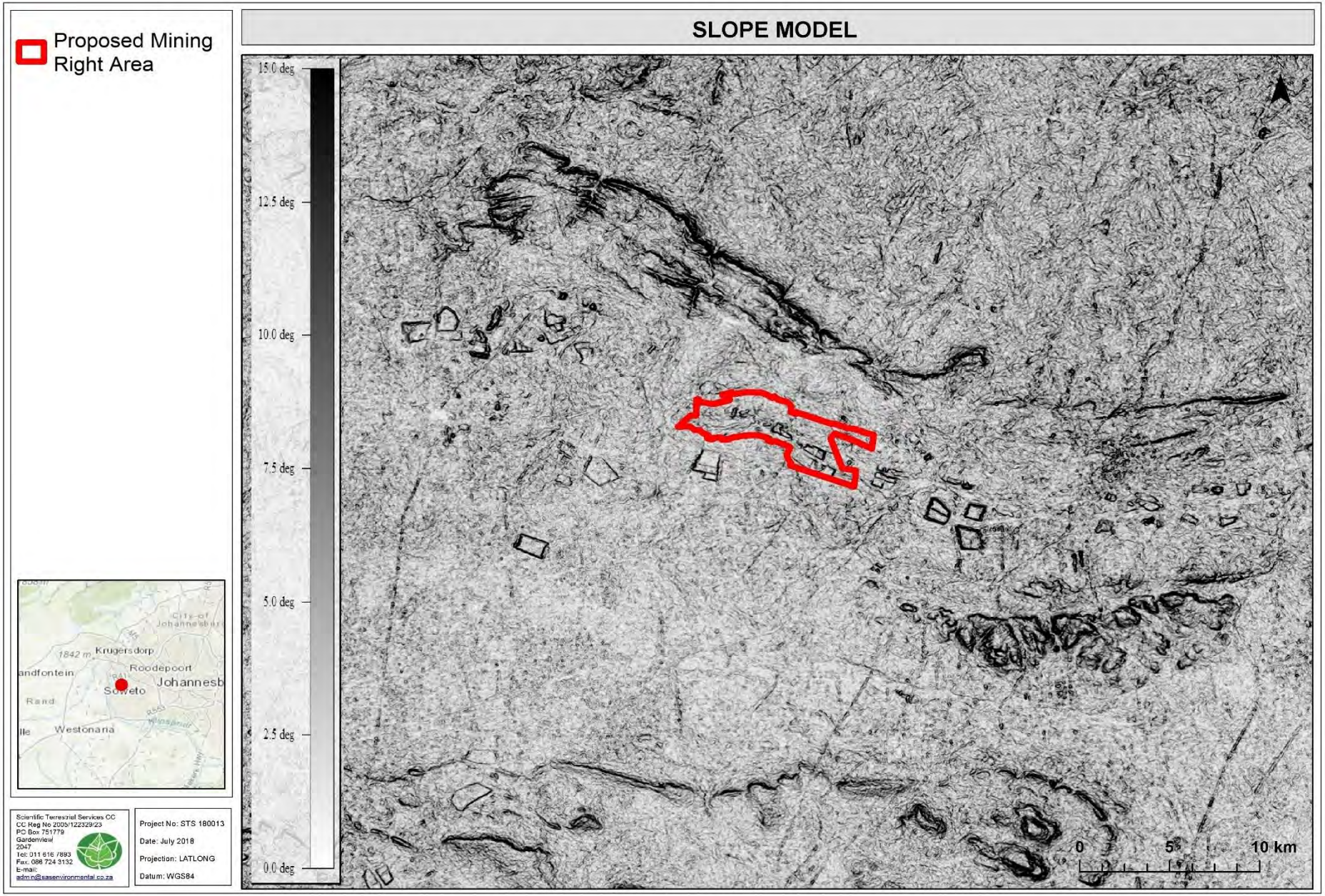


Figure 13: Map indicating the general relief associated with the proposed Mining Right Area.

4.3.4. Vegetation Cover

The open pit areas and ICs fall within a single biome and bioregion according to Mucina & Rutherford (2012), namely the Grassland Biome, and the Mesic Highveld Grassland Bioregion. The open pit areas and ICs fall within the Soweto Highveld Grassland Vegetation Type. Refer to the Terrestrial Impact Assessment undertaken by STS (2018) for further detail on the conservation status, altitude and dominant floral species expected within the vegetation type.

Since the entire proposed MRA has been subject to disturbance and transformation due to mining activities and urban development, significant alien floral species proliferation has occurred, resulting in the area no longer considered representative of the Soweto Highveld Grassland Vegetation Type. Based on the floral assessment undertaken by STS (2018), the open pit areas and ICs comprised secondary grassland and transformed grassland areas (Refer to Figure 14).

4.3.5. Landscape Character and Visual Absorption Capacity (VAC)

Key aesthetic aspects of the landscape associated with the open pit areas and ICs are described in Table 5 and in Appendix C. Through applying the scoring categories as outlined in Appendix D, Table 6 below indicates the scores that have been calculated for the VAC for the open pit areas and ICs.

The geographic setting, existing vegetation and anthropogenic structures associated with the proposed open pit areas and ICs will have low to high visual impact on the receiving environment.

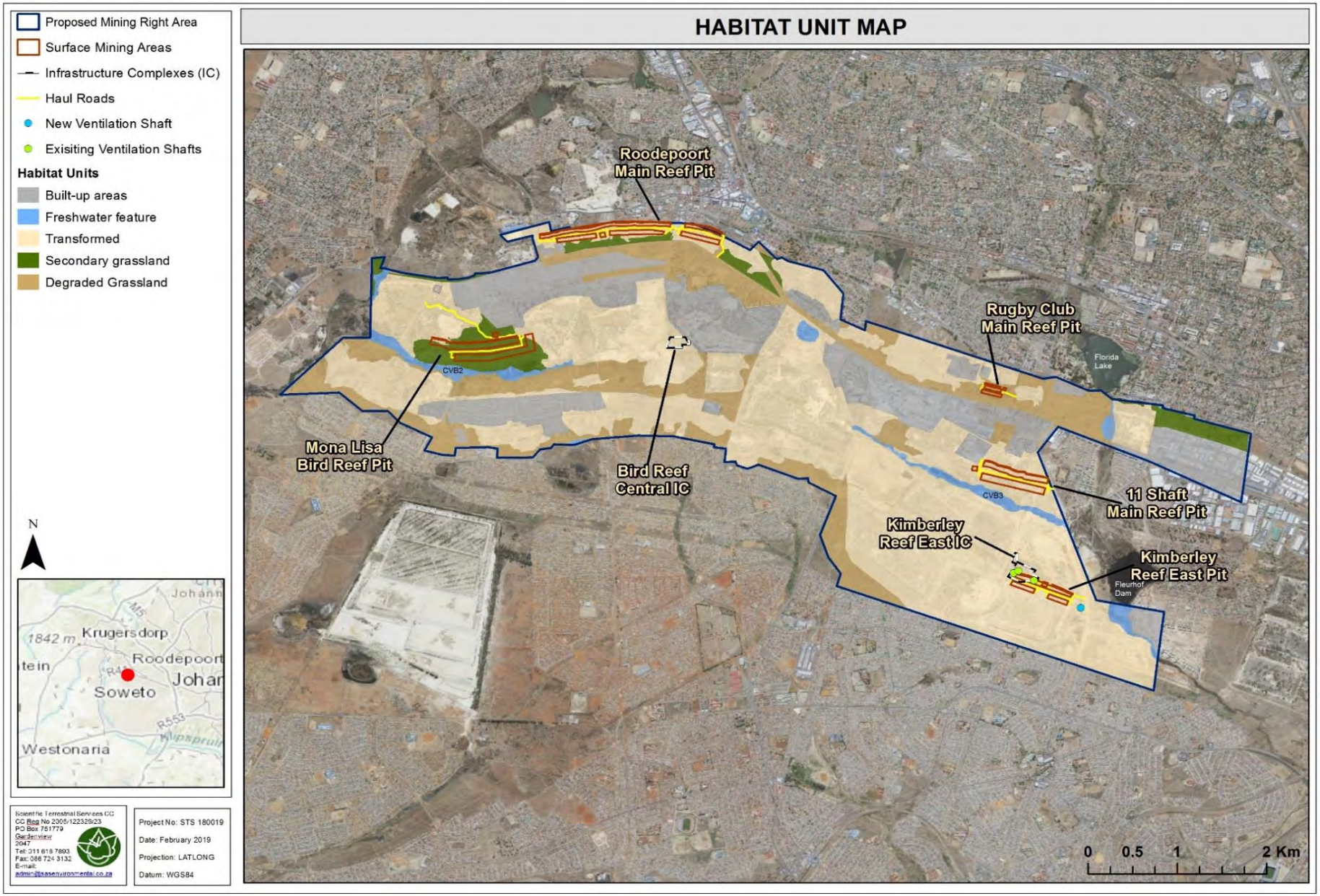


Figure 14: Conceptual illustration of the habitat units within the proposed Mining Right Area.

Table 5: Aesthetic and perceptual aspects of landscape character.

Aspect	Bird Reef Central IC	Mona Lisa Bird Reef Pit	Roodepoort Main Reef Pit and Rugby Club Main Reef Pit
Scale	The scale of the landscape is considered to be small since the IC is situated in an area with well-established vegetation and historic mining infrastructure (shaft) is present. The IC may be partially or seasonally visible from the Durban Deep Golf Course, situated east of the IC, due to the roadside vegetation varying in density during winter and summer months.	The scale of the landscape is considered to be large due to the Open Pit situated in open veld on a hill approximately 440 m north of Solplaatje residential area. There are active mining activities taking place within the immediate vicinity of the proposed open pit and existing anthropogenic structures which will serve to lessen the visual intrusion of the proposed open pit.	The scale of the landscape is considered to be small since the open pits are situated within open veld adjacent to an urban built-up area (north and south of the proposed open pits). Furthermore, the urban development, undulating topography of the surrounds as well as vegetation obscures views across significant distances.
Enclosure	The proposed IC is enclosed within existing mine dumps and dense vegetation.	Even though the open pits areas area situated within open veld, the moderately undulating terrain, existing mine dumps and associated infrastructure and urban development in the surrounding environment results in the open pits being enclosed within an urban area.	
Diversity	Although the vegetation is not highly complex, the overall topography of the ICs and open pit areas, the mine dumps, mining activities, various anthropogenic structures and surrounding urban development results in the area being diverse.		
Texture	The texture associated with the landscape is rough due to the coarse vegetation structure (grass and tree species) and the various anthropogenic structures (powerlines, remnants of mining infrastructure, active mining activities and fences).	The texture associated with the landscape is textured due to the dominance of grassland coupled with isolated trees. The active mining activities, old mine dumps and Eskom Princess CNC Substation within the surrounding area, results in the texture of the greater area considered rough.	The texture associated with the landscape is rough due to the grassland coupled with isolated trees, current illegal mining activities, bare ground, roads, and buildings and informal settlement within close proximity to the open pit areas.
Form	The dominant form of the landscape associated with the IC is horizontal and rolling with the IC situated in an area that is relatively flat to gently to moderately undulating landscape in the surrounding area.	The open pit area is situated on a gently to moderately undulating terrain, thus the dominant form for the open pit area is rolling.	The open pit areas are situated in a relatively flat area, thus the dominant form for the open pit areas are horizontal.
Line	When considering the larger area, the line landscape element is curved and angular, with the undulating topography of the area and the vegetation forming the curved element and the various anthropogenic structures such as mine dumps, powerlines, buildings, and mining infrastructure forming the angular element of the landscape.		
Colour	The colours associated with the landscape are muted, with vegetation, mine dumps and bare ground forming the dominant colour palette of shades of green and brown. Some seasonal colour is however expected. The housing, industrial and commercial element associated with surrounding areas are painted in muted/ natural tones – light yellow, ochre, and red-brown, although white is also present.		
Balance	The landscape is considered to be discordant in terms of the relationship between the vertical and horizontal landscape elements. The proposed MRA comprises predominantly of urban built-up areas, historic and active mining activities and associated structures and to a lesser extent degraded openveld and watercourses, thus vertical elements are more prominent in the area.		
Pattern	The landscape pattern is random, with mining activities and mine dumps interspersed between the urban built-up areas.		
Movement	The level of movement within the IC is calm, with relatively low levels of pedestrian and vehicular movement within the IC itself. Moderately high levels of vehicular movement are however present on the unnamed road north of the IC.	The level of movement within the open pit area is calm, with relatively low levels of pedestrian movement within the open pit area. Moderately high levels of vehicular and pedestrian movement are however present in the surrounding area (mining activities and the substation north of the open pit).	The level of movement within the open pit areas are busy with high levels of pedestrian movement in the area, especially the illegal miners mining in these areas and people going to their place of work in the surrounding area.

Table 6: Visual Absorption Capacity (VAC) Scores achieved for the infrastructure complex (IC) and open pit areas.

Factor	Bird Reef Central IC	Mona Lisa Bird Reef Pit	Roodepoort Main Reef Pit and Rugby Club Main Reef Pit
Vegetation	Score 3: The IC area has a dense vegetation composition, with vegetation heights varying from <1 m to >6 m, with limited bare ground present. The vegetation component therefore provides good screening abilities, however the head gear of the existing shaft which will be refurbished for the proposed project is visible above the trees, from the unnamed road adjacent to the IC area.	Score 2: Even though there is continuous vegetative cover within the open pit area, the grassland layer is of moderately low height, which will not provide significant screening ability to the receiving environment for the proposed mining activities.	Score 2: Vegetation is considered to be of moderate height (1-2 m) with continuous vegetative cover, except in the areas where active illegal mining activities area taking place (exposing bare ground) and trees adjacent to the built-up area. Vegetation therefore provides limited screening abilities. The vegetation (trees) associated with the built-up area provides screening ability to sensitive receptors north of the open pit areas, partially obscuring their view.
Soil contrast	Score 3: Since bare soils are present in the surrounding area and the existing shaft is to be refurbished, disturbance of soil is not likely to be significant. Furthermore, due to the dense vegetative cover, potential sensitive receptors in the receiving environment are unlikely to see the soil contrast associated with the proposed construction of mining infrastructure.	Score 2: Even though historic mine dumps and active mining activities are present within the immediate surroundings, the surface disturbance brought about by the proposed open pit mining activities will create moderate soil contrast in relation to the surrounding grassland and watercourse feature.	Score 2: Since the open pit areas are transformed with exposed areas of bare soil due to current illegal mining activities, surface disturbance will not create significant contrast in relation to the surrounding area or detract from the current state.
Visual variety	Score 2: The vegetation within the IC has a moderately high diversity (although no longer representative of the Soweto Highveld Grassland Vegetation Type), and when viewed from a distance, visual variety is present due to mining activities, the golf course and other anthropogenic structures such as roads and powerlines.	Score 2: The vegetation within the open pit area is largely homogeneous when viewed from a distance, but visual variety is present due to natural features, such as watercourses in the vicinity of the open pit area. Other elements within the landscape also serve to create visual variety in terms of lines, colour and texture.	Score 2: The vegetation within the open pit areas are largely homogeneous when viewed from a distance, but visual variety is present due to anthropogenic structures such as the built-up area, powerlines and roads creating visual variety in terms of lines, colour and texture.
Topographical diversity	Score 2: Even though there is limited natural topographical diversity in the greater Roodepoort and Soweto area, the historic mine dumps and active mining activities in the area have altered the topography of the area, thus in conjunction with the urban built-up areas, the area displays some form of topographical diversity.		
Recovery time	Score 1: Since the IC is situated within an area dominated by woody tree species the recovery time is expected to be long term (longer than 5 years)	Score 2: Recovery time of the area is expected to be moderate due to the open pit area comprising grassland with isolated woody tree species.	Score 2: Due to the dominant vegetation within the open pit areas comprising grassland and scattered woody tree species, recovery time is expected to be moderate.
Total	Medium	Medium	Medium

4.3.6. Landscape Quality

Through applying the scoring categories as outlined in Appendix E, the scores have been calculated for the various open pit and IC areas and are tabulated below (Table 7).

4.3.7. Landscape Value

With reference to Appendix F, the areas associated with the open pit areas and ICs are likely to be most valued by local residents residing in the area such as (but not limited to) Soweto, Roodepoort, Solplaatje, Witpoortjie, Grobler Park, and Davidsonville residential areas, and people at their place of work in area. Additionally, property developers and investors that have envisioned to develop low cost housing, complexes and estates in the near future, within the surrounding areas are most likely to value these areas. During the Scoping Phase of the West Wits Mining Project it was stressed that Copper Moon Trading 631 (Pty) Ltd (the proponent) proposes to develop the Spitz Land Mixed Use Housing Development in the vicinity of the Mona Lisa Bird Reef Pit, thus the surrounding area is most valued by the proponent. Furthermore, Calgro M3 is the developer of the extensive Witpoortjie residential development on Portion 1 of the Farm Witpoortjie 245 IQ for which development has been approved, and ANSEC has been granted the rights to develop affordable housing on land portions situated within the proposed MRA. Therefore, the proposed MRA is most valued by property developers and investors for their future developments in the area.

Due to the current legal and illegal mining activities and old mine dumps present within the proposed MRA and within close proximity to residential areas, it is unlikely that the proposed mining activities and mining infrastructure will significantly lower the landscape value of the area.

Table 7: Landscape Quality – Results and motivation for the infrastructure complex (IC) and open pit areas.

Factor	Bird Reef Central IC	Mona Lisa Bird Reef Pit	Roodepoort Main Reef Pit and Rugby Club Main Reef Pit
Landform	Score 1: Even though the IC is surrounded by an active mining area southwest and northwest and the Durban Deep Golf Course situated to the east, the IC is situated on relatively flat terrain thus in the area displays limited topographical variety.	Score 3: The open pit area displays topographical variety in the form of the moderately undulating terrain, a watercourse located to the south and various anthropogenic structures leading to increased visual interest.	Score 1: The open pit areas are situated on relatively flat terrain and within close proximity to urban built-up areas thus these areas display limited topographical variety.
Vegetation	Score 3: The IC comprises grass and woody species indicating floral diversity in the area.	Score 1: The open pit areas comprise transformed grassland habitat displaying limited variety in vegetation.	
Water	Score 0: There are no watercourses present within the vicinity of the IC.	Score 3: Surface water is seasonally present within the watercourse located south of the open pit area. When viewing the open pit area and surroundings from Solplaatje, the watercourse is observed in the landscape, however it is not dominant in the landscape.	Score 0: During the field assessment it was evident that there were no watercourses present in the vicinity of the open pit areas.
Colour	Score 1: The IC area displays subtle colour variations of green due to the dense vegetation limiting colour input from other elements.	Score 3: Even though active mining activities and historic mine dumps are present in the surrounding landscape, creating variety in colours together with the grassland area, it does not form the dominant scenic element of the landscape.	Score 1: The open pits areas are situated in transformed grassland areas, adjacent to urban built-up areas, thus the colour patterns (limited colour variation) do not form the dominant scenic element in the landscape.
Adjacent Scenery	Score 3: Adjacent scenery, such as the urban built-up areas, recreational facilities (Durban Deep Golf Course applicable to Bird Reef IC only) and open veld contribute to the greater landscape viewing experience. The mining activities in the proposed MRA does however reduce the overall visual quality of the area.		
Scarcity	Score 1: The landscape character type is representative of the larger region and is not considered to be particularly scarce.	Score 3: The landscape character type is representative of the larger region and is not considered to be particularly scarce, however the watercourse south of the open pit area makes the area distinctive.	Score 1: The landscape character type is representative of the larger region and is not considered to be particularly scarce.
Cultural Modifications	Score 0: Although modifications in the region, such as remnants of mining infrastructure is present, it adds little visual variety in the area and does not introduce any discordant elements.	Score -4: The active mining activities, historic mine dumps and powerlines and power station are detracting modifications in the region, weakening the scenic quality of the area.	Score 0: Modifications in the region, including roads, powerlines and buildings does not introduce any discordant and highly detracting elements in its current state.
Total	Medium	Medium	Medium

4.3.8. Sense of Place

Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. It is created by the land use, character and quality of a landscape, as well as by the tangible and intangible value assigned thereto. The sense of place associated with the open pit areas and ICs are related to the landscape character type of the greater area (proposed MRA) – urban, gently to moderately undulating terrain dominated by urban built-up and mining activities. The sense of place is not unique to the ICs and open pit areas as it is representative of the greater region (proposed MRA). The level of movement and activity within the West Wits Mining Project Area is relatively high due to the commercial and industrial areas as well as active mining taking place in the area, thus it can be described as busy with a lot of vehicular and pedestrian movement.

The sense of place associated with the open pit areas and ICs are therefore not highly significant when compared to its surroundings but may be considered to be of importance due to the ICs and open pit areas situated within open veld in an urban area.

4.4. Visual Exposure and Visibility and Key Observation Points

The proposed Kimberley Reef East Pit and IC is situated within a heavily disturbed area, where historic mining activities took place and the remnants of ventilation shafts and other mining surface infrastructure are present. Furthermore, the proposed pit and IC is surrounded by mine dumps and/ or slimes dams and dense vegetation, thus screening the pit and IC area from sensitive receptors in the receiving visual environment. The visual exposure of the proposed pit and IC will therefore be minimal to negligible on the receiving environment. Additionally, the proposed 11 Shaft Main Reef Pit is situated within a heavily disturbed area where historic mining activities took place, is surrounded by mine dumps and rubbish dumps and old mining surface infrastructure is present within the area, thus the visual exposure to the sensitive receptors in the receiving visual environment will be minimal to negligible. The abovementioned pits and IC are surrounded by dense vegetation which will aid in screening the pits and IC from the receiving visual environment.

The Roodepoort Main Reef and Rugby Club Main Reef open pit areas will have the most significant visual impact on the receiving visual environment due to the close proximity of the R41 roadway, other local roads, residential areas, formal and informal settlements and business areas. Motorists are generally classified as low sensitive receptors due to their momentary views and experience of the receiving environment. Existing infrastructure such

as buildings, walls and vegetation from the open veld areas and ornamental plants associated with the houses serve to obscure the view from some sensitive receptors within the surrounding area.

The Mona Lisa Bird Reef Pit has a moderately high visual exposure on the receiving environment, due to the Solplaatje suburb having a direct view of the proposed pit. The visual character of the area is negatively impacted on by current mining activities, powerlines and the Eskom Princess CNC Substation present within close proximity to the proposed Mona Lisa Bird Reef Pit. Therefore, the current mining activities and anthropogenic structures are likely to detract visual attention from the proposed mining activities.

The Bird Reef Central IC is situated within an area where historic mining infrastructure such as the vertical shaft and remnants of the foundation and walls of buildings are present, thus the residual impact from historic mining remains. The vegetation in the surrounds are well established (dense and tall), obscuring the proposed IC from motorists utilising the unpaved road situated directly adjacent to it as well as the Durban Deep Golf Course immediately northeast of the IC. Aside from the unpaved road and Golf Course, there are no other potential sensitive receptors in the area that will have visual exposure of the IC. However, according to IEMA (2002) users at recreational facilities are considered as high sensitive receptors thus the Bird Reef Central IC has a moderate visual intrusion.

Refer to Appendix H for detail on the methods of assessment associated with the visual exposure and visibility. The tables below describe the line of sight analysis, viewshed analysis and Key Observation Points (KOPs) associated with the open pit areas and ICs. The figures that follow indicate the location of the selected line of sight cross sections and the viewshed analysis.

Preliminary Key Observation Points (KOPs), were identified based on prominent viewpoints, where potential uninterrupted views of the proposed project may occur and at points where positive viewshed areas intersect with the locations of potential receptors (Figure 15). The KOP analysis was further conducted by investigating the visual influence of the proposed infrastructure as per the available layout. Major routes, such as the R41, which carry increased amounts of traffic, as well as local roads, were also be considered during the assessment. The results of the KOP analysis are included in the table below followed by conceptual visual simulations with the arrow indicating where the proposed mining infrastructure will be visible.

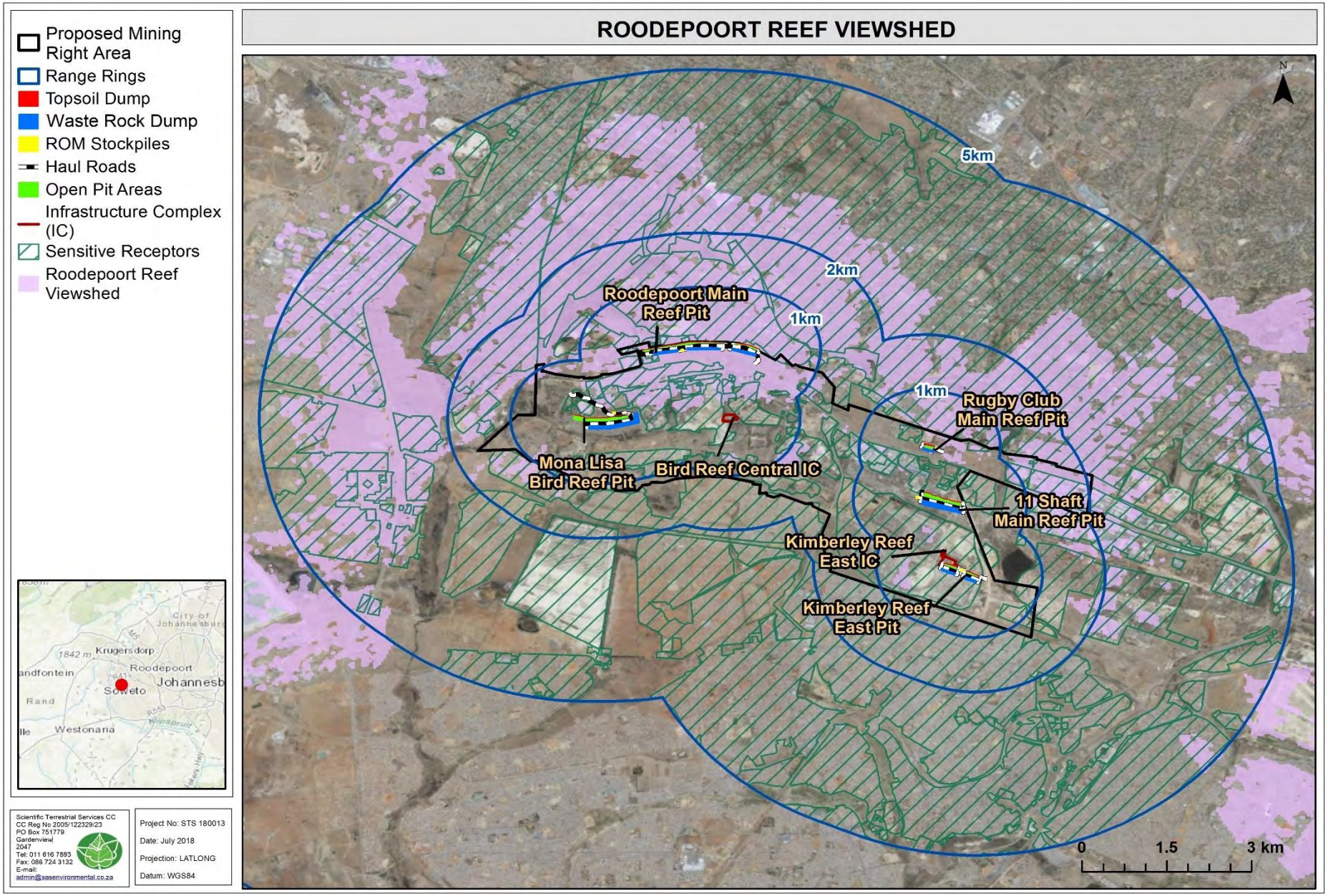


Figure 15: Viewshed (indicated as shaded areas) of the proposed Roodepoort Main Reef Pit overlaid onto digital satellite imagery.

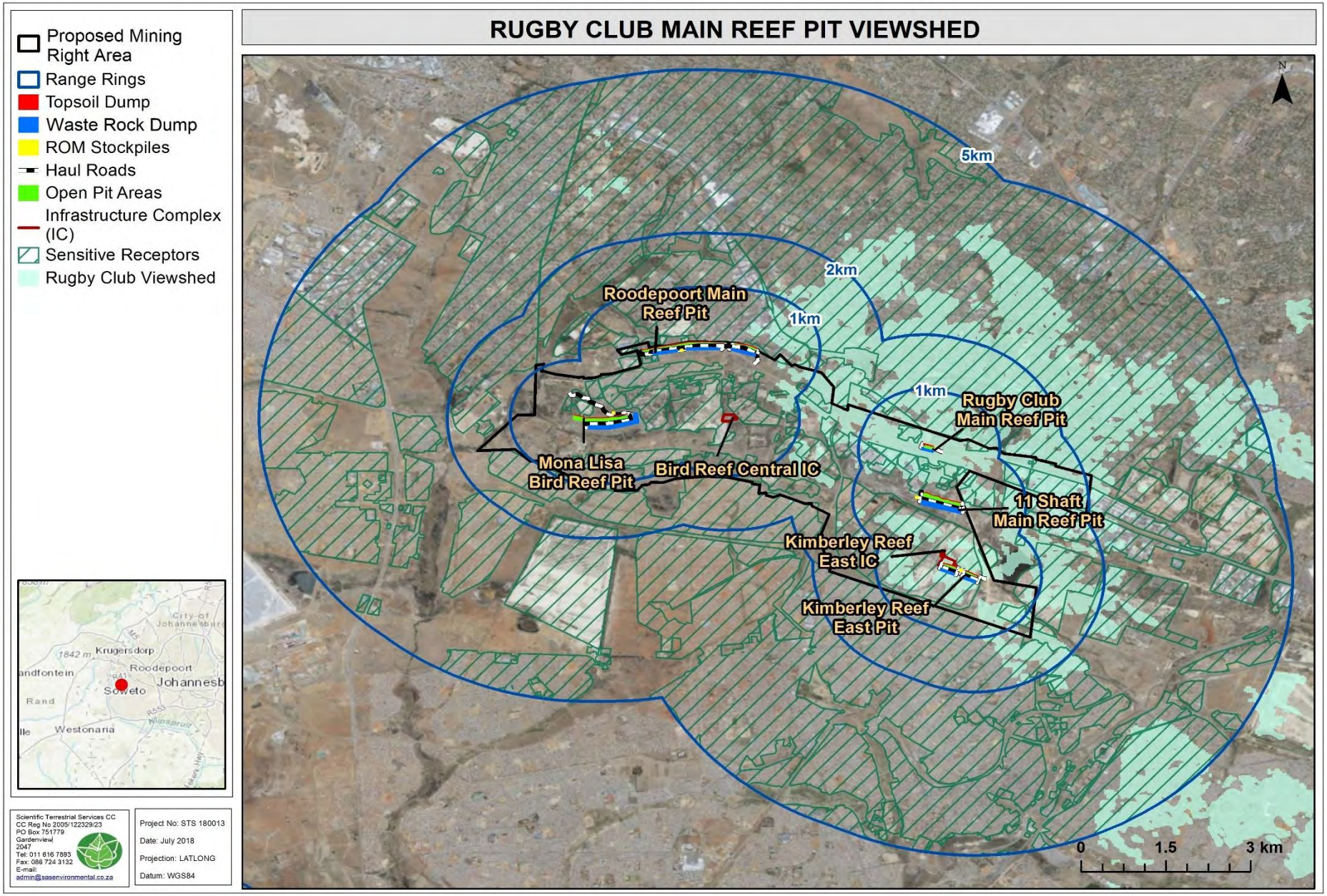


Figure 16: Viewshed (indicated as shaded areas) of the proposed Rugby Club Main Reef Pit overlaid onto digital satellite imagery.

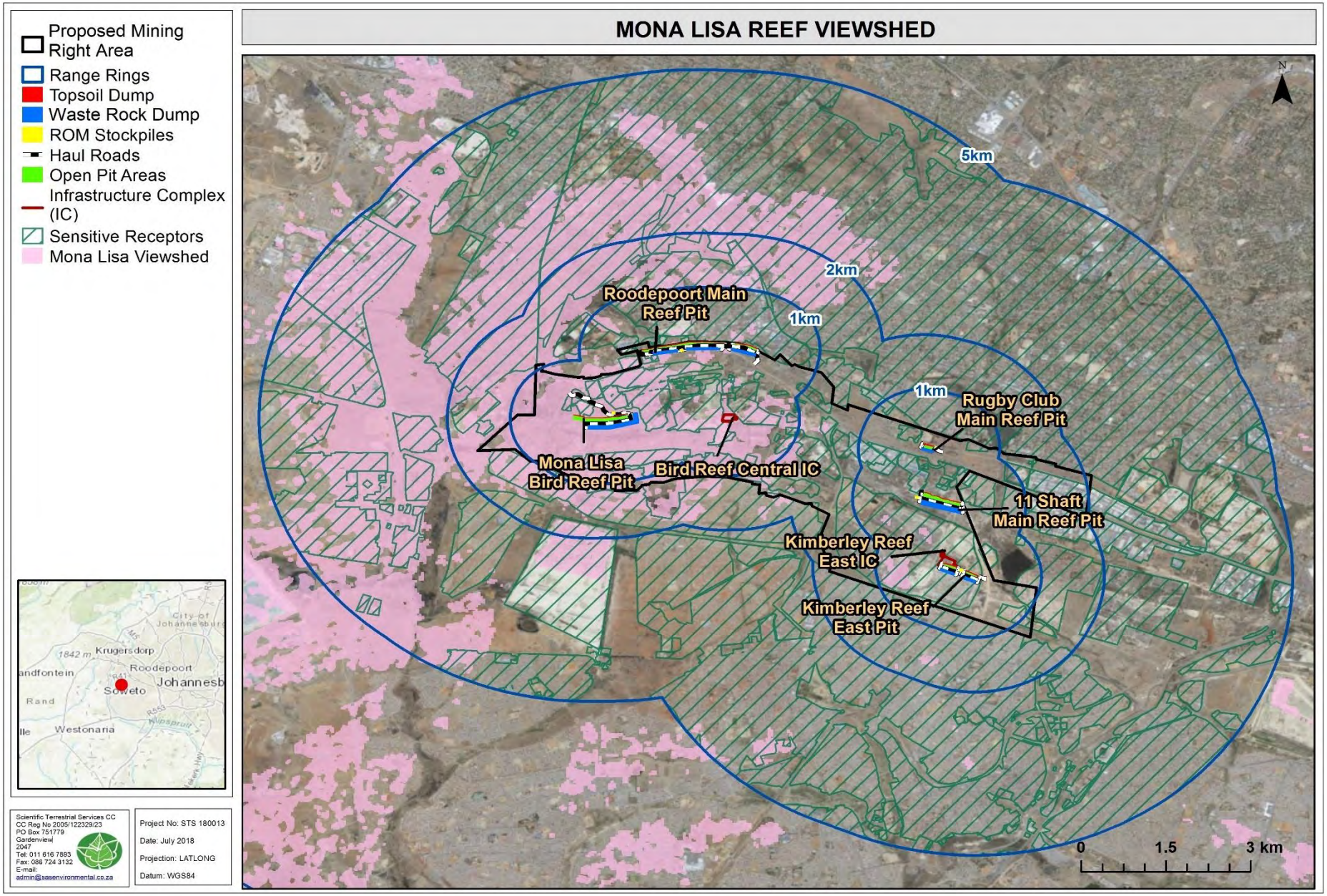


Figure 17: Viewshed (indicated as shaded areas) of the proposed Mona Lisa Bird Reef Pit overlaid onto digital satellite imagery.

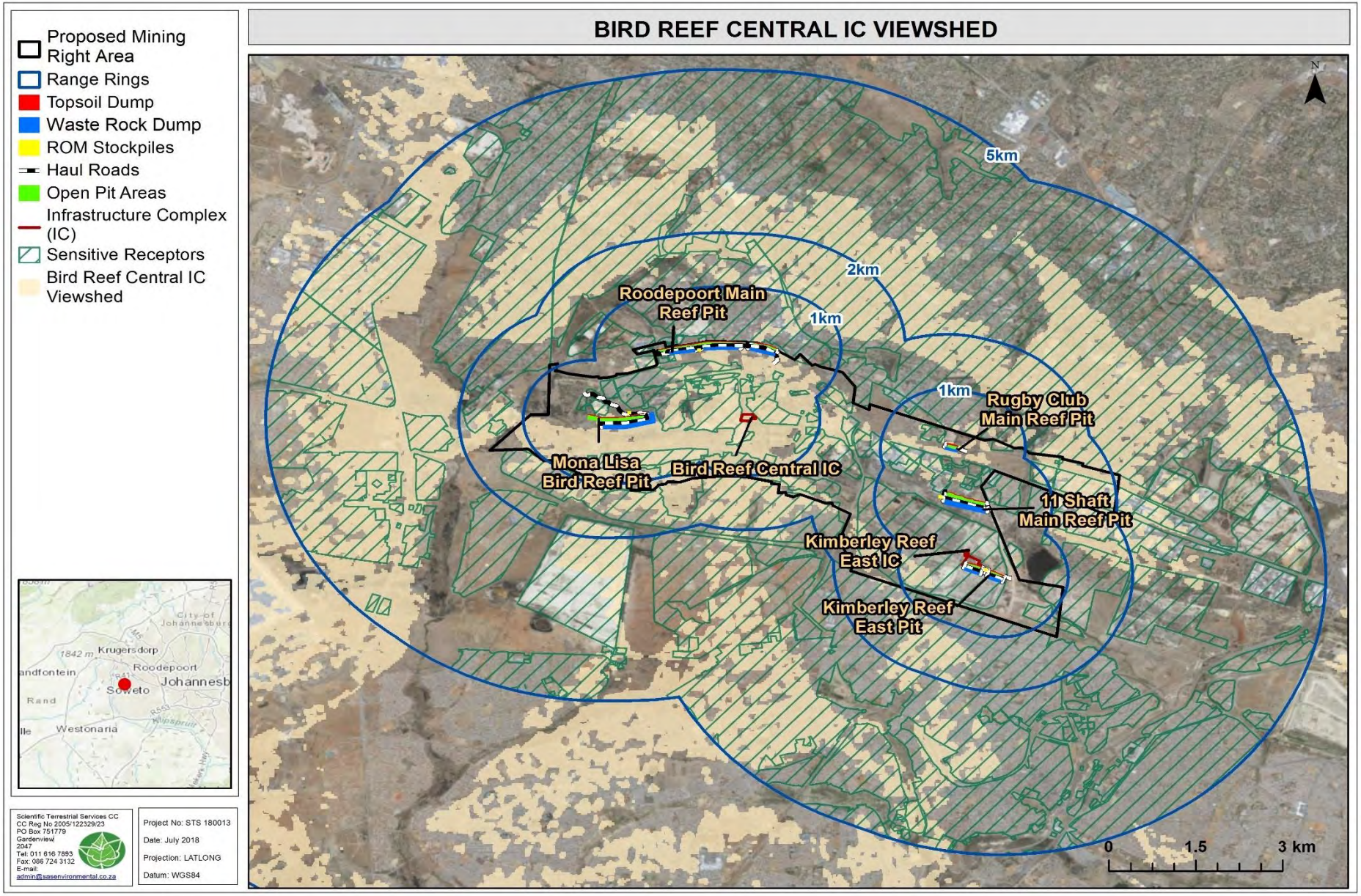


Figure 18: Viewshed (indicated as shaded areas) of the proposed Bird Reef Central Infrastructure Complex (IC) overlaid onto digital satellite imagery.

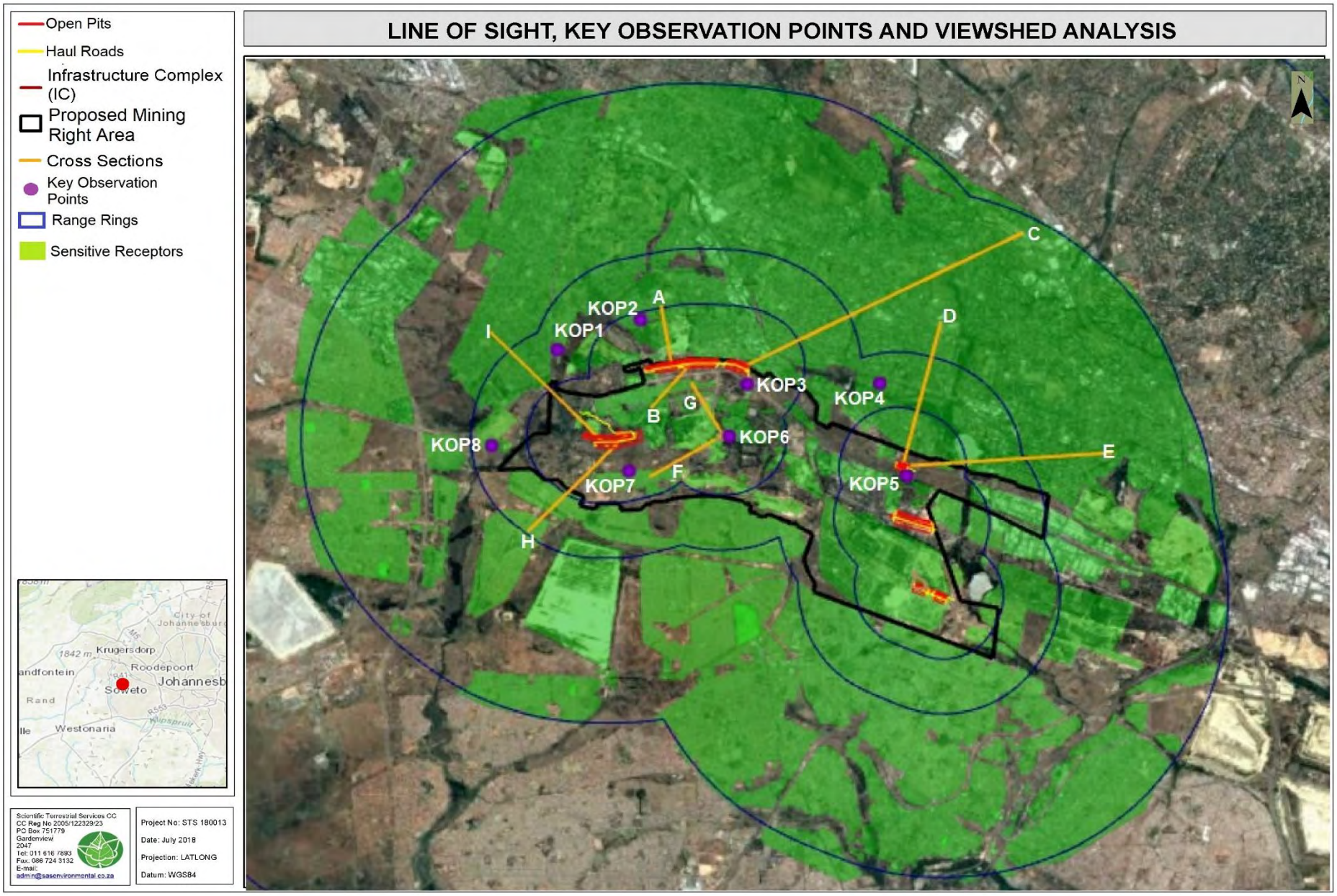


Figure 19: Map indicating the cross sections and Key Observations Points (KOPs) for the proposed West Wits Mining Project.

Table 8: Line of sight analysis for the proposed open pit areas and Infrastructure Complexes(IC).

Line of Sight Analysis		
Cross Section:	A	According to the line of sight analysis there is no clear line of site from the Davidsonville Tennis Court, Manuel Street and the Davidsonville residential area to the Roodepoort Main Reef Pit, due to the topographical screening, vegetation, existing buildings and current mining activities that obscure the view.
	B	The proposed Roodepoort Main Reef Pit will not be visible from the Matholesville residential area due to topographical screening; however the Roodepoort Main Reef Pit will be visible from the R41 (Randfontein Road).
	C	There is no clear line of sight from Constantia Drive to the Roodepoort Main Reef Pit, and the majority of the Constantia Kloof, Horison and Roodepoort residential areas will also not have a clear line of sight due to the distance and the undulating topography of the area. However, some residents within closer proximity to the Roodepoort Main Reef Pit will have a partial line of sight due to vegetation and existing buildings.
	D	The proposed Rugby Club Main Reef Pit will not be visible from the UNISA Florida Campus and Honeyball Avenue, due to topographical screening as well as the distance from the pit. Residents within closer proximity to the Rugby Club Main Reef Pit may have some views of the proposed pit, however the topography, vegetation and existing houses and other infrastructure serve to obscure the view.
	E	There is no clear line of sight between the Unified Public School and the Rugby Club Main Reef Pit due to the undulating topography of the surrounds. Furthermore, according to the line of sight analysis the Florida residential area will have vantage points from where the Rugby Club Main Reef Pit will be visible as well as areas where the proposed pit will not be visible. The houses and associated vegetation will somewhat obscure the view from certain vantage points.
	F	Even though the line of sight analysis indicates a clear line of sight from the Solplaatje residential area to the Bird Reef Central Infrastructure Complex (IC), the existing mining activities (Mine dumps and open pit) will screen the view towards the Bird Reef Central IC.
	G	The Bird Reef Central IC will not be visible from the Matholesville residential area due to the undulating topography and vegetation of the surrounding area as well as the current mining activities taking place in the vicinity of the IC.
	H	There is no clear line of sight from the Bram Fischerville residential area to the Mona Lisa Bird Reef pit due to the undulating topography and surrounding vegetation.
	I	Residents within Witpoortjie as well as motorists traveling on the R41 (Randfontein Road) and Corlett Avenue does not have a clear line of sight towards the Mona Lisa Bird Reef Pit due to the undulating topography of the area as well as vegetation and existing infrastructure and UowardSpiral Mining which has an already negative visual impact on the receiving visual environment.

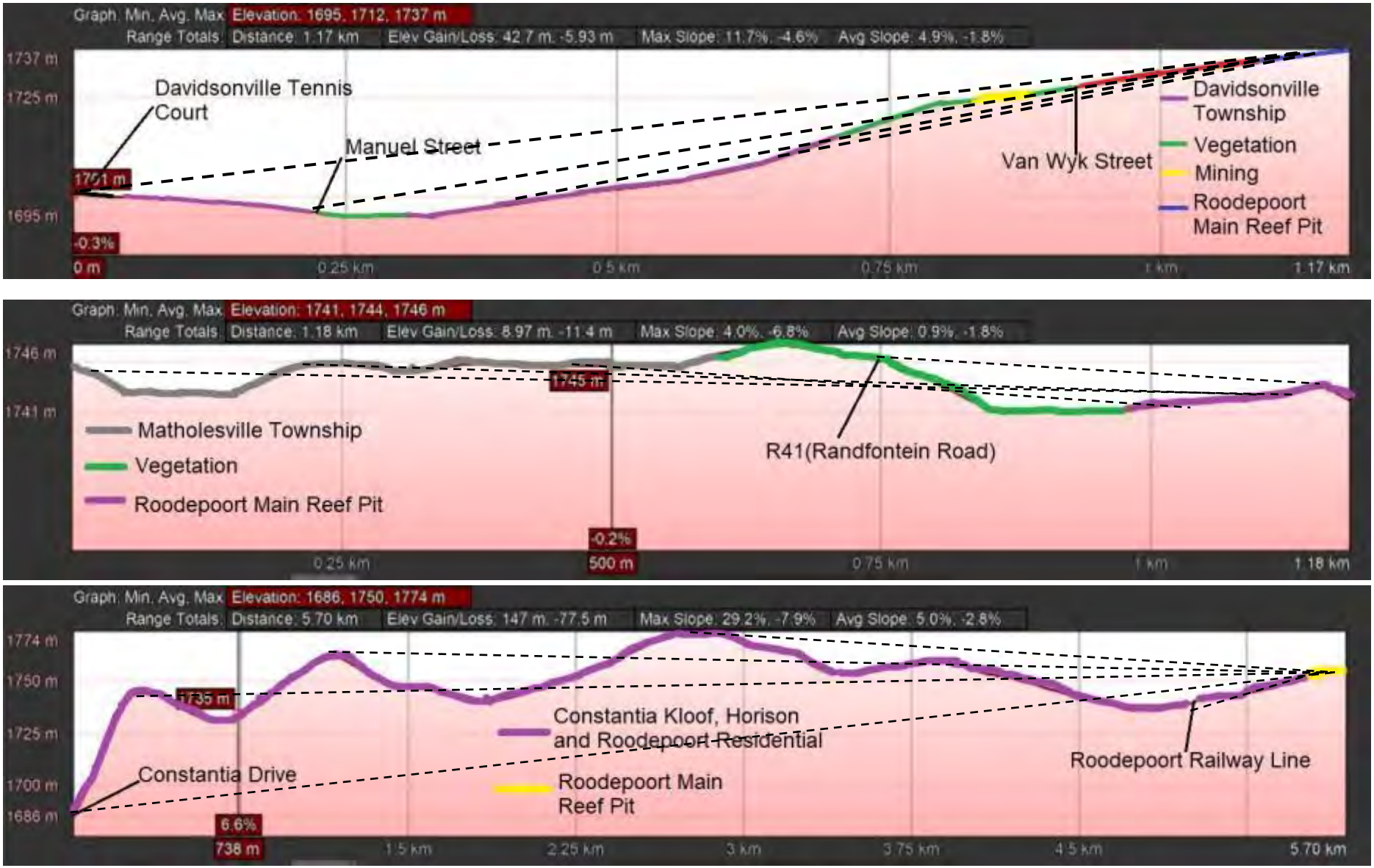


Figure 20: Results of the line of sight analysis from Cross Section A (top), Cross Section B (middle) Cross Section C (bottom) of the Roodepoort Main Reef Pit.

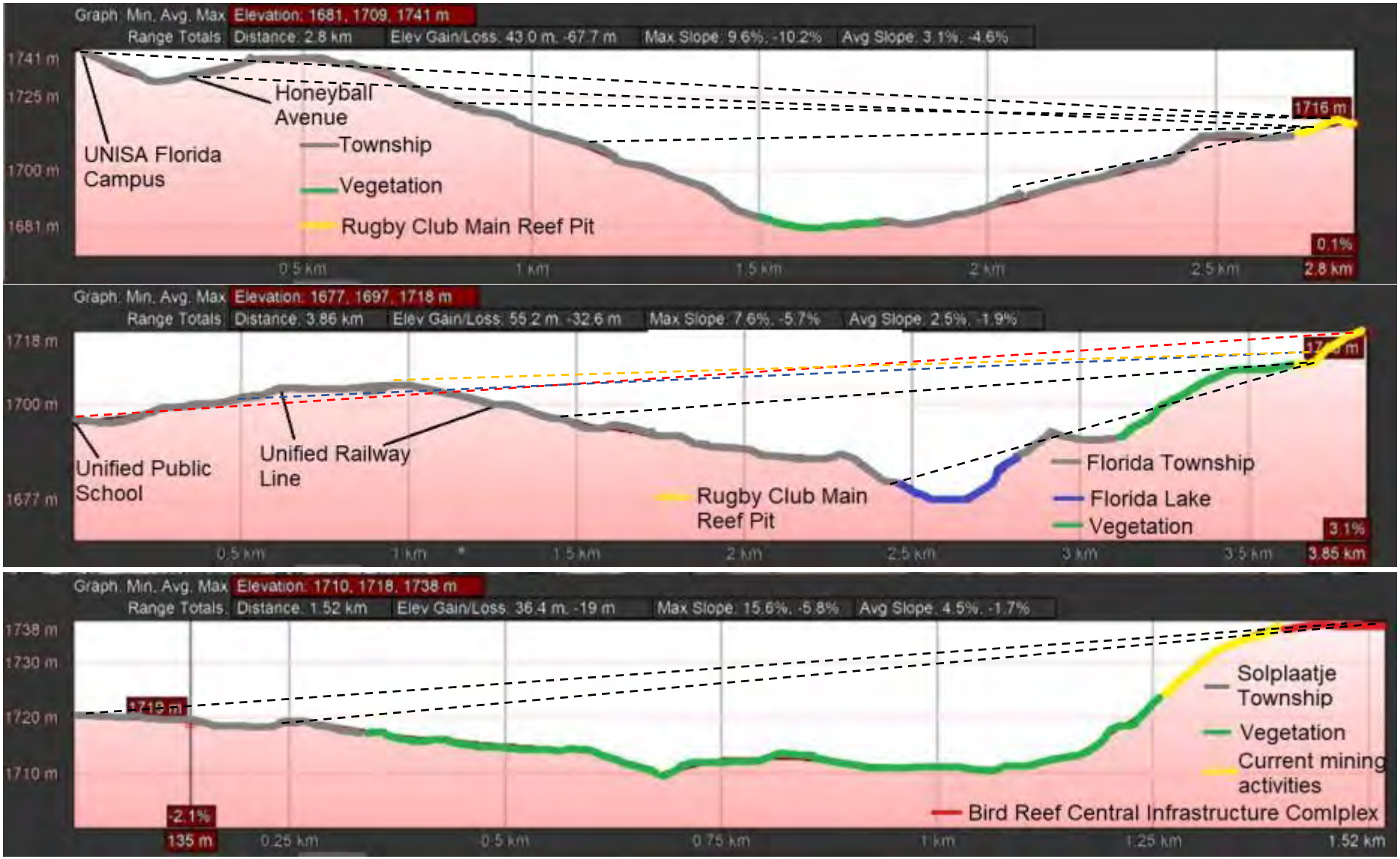


Figure 21: Results of the line of sight analysis from Cross Section D (top), Section E (middle) and Cross Section F (bottom) of the Rugby Club Main Reef Pit and **Bird Reef Central IC.**

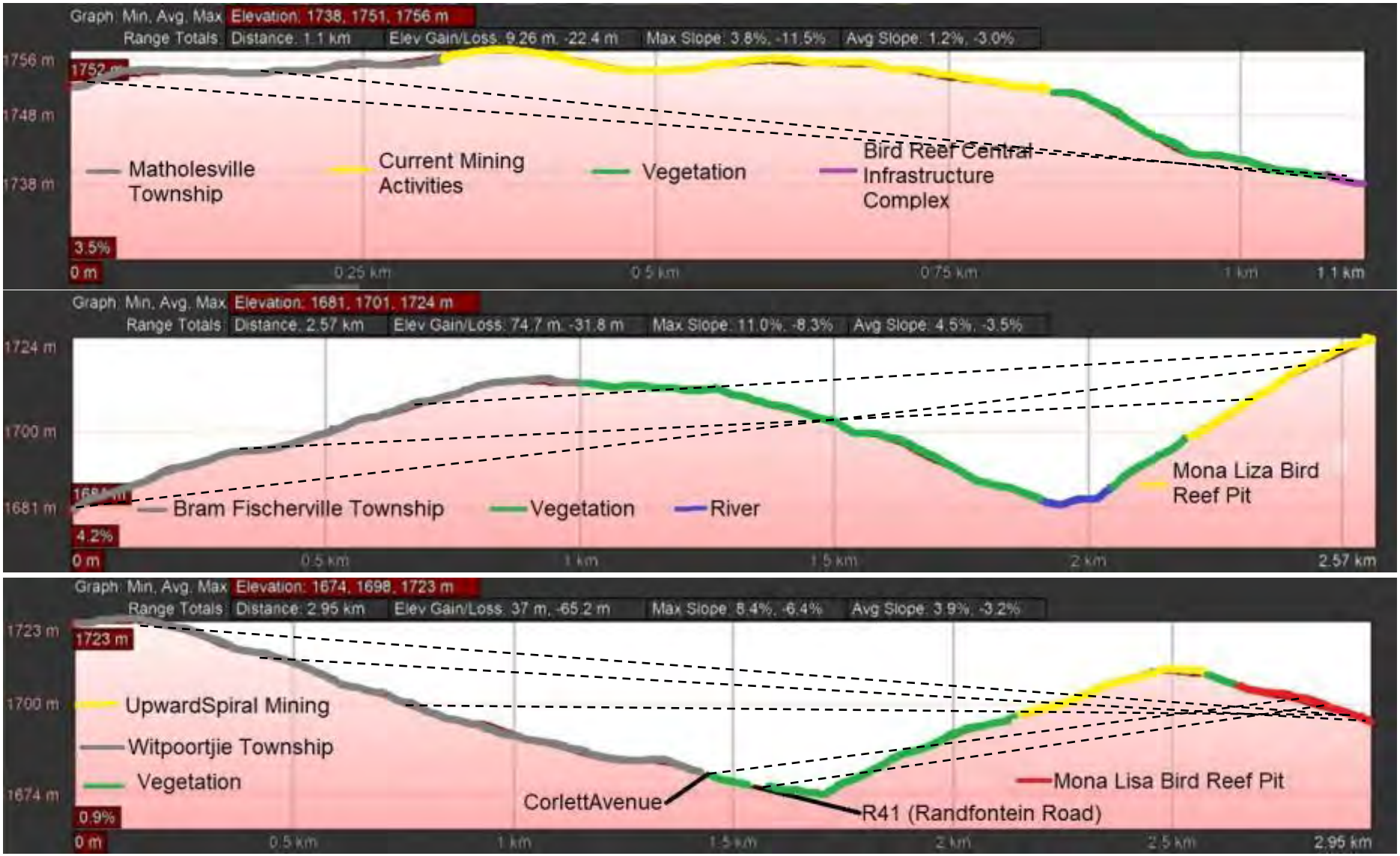


Figure 22: Results of the line of sight analysis from Cross Section G (top), Cross Section H (middle) and Cross Section I (bottom) of the Bird Reef Central IC and Mona Lisa Bird Reef Pit.

Table 9: The Key Observation Points (KOPs) for the proposed open pit areas and Infrastructure Complexes(IC).

Key Observation Points (KOPs)				
	Location	Visibility	Receptor Sensitivity	Motivation
KOP1	±2 km west of the Roodepoort Main Reef Pit within the Grobler Park residential area	Limited	High – permanent residents in the vicinity of KOP1 Moderate – road users with a limited viewing time	Existing vegetation within the residential area and surrounding area as well as houses, warehouses and buildings, and existing mine dumps in the region will limit the view of the proposed Roodepoort Main Reef Pit.
KOP2	±880 m north of the Roodepoort Main Reef Pit within the Davidsonville residential area	None	High – permanent residents in the vicinity of KOP2 Moderate – road users with a limited viewing time	Vegetation, houses within the Davidsonville and existing mine dumps present within the line of sight, renders the Roodepoort Main Reef Pit not visible.
KOP3	±200 m southeast of the Roodepoort Main Reef Pit on the Randfontein Road	High	Moderate – road users with a limited viewing time	The WRD of Roodepoort Main Reef Pit will be significantly visible on the road as it is situated approximately 200 m away.
KOP4	±1.48 km north of the Rugby Club Main Reef Pit within the Hamberg residential area	Limited	High – permanent residents in the vicinity of KOP4 Moderate – road users with a limited viewing time	The topography of the surrounding area as well as existing vegetation and buildings, almost completely obscures the view toward Rugby Club Main Reef Pit.
KOP5	Directly south of the Rugby Club Main Reef Pit on Main Reef Road, adjacent to Rand Leases.	High	Moderate – people at their work place and road users with a limited viewing time	The Rugby Club Main Reef Pit will be highly visible to motorists traveling on Main Reef Road as well as people at their place of work at Rand Leases. The Rugby Club Main Reef Pit will have a high visual intrusion on the receiving environment.
KOP6	Directly adjacent to the Bird Reef Central Infrastructure Complex and Durban Deep Golf Club	High	High – People at the Durban Deep Golf Course Moderate – road users with a limited viewing time	The historic shaft that will be refurbished for the West Wits Mining Project is visible through the surrounding dense vegetation. Motorists however have a momentary view thereof, and vegetation associated with the Durban Deep Golf Course also partially obscures the view towards the shaft.
KOP7	±460 m south of the Mona Lisa Bird Reef Pit, within Solplaatje residential area	High	High – permanent residents in the vicinity of KOP7 Moderate – road users with a limited viewing time	The Mona Lisa Bird Reef Pit will be highly visible to residents of Solplaatje suburb thus the pit will have a high visual intrusion on the receiving environment, especially to the south (Solplaatje residential area).
KOP8	±1.84 km west of the Mona Lisa Bird Reef Pit at a housing development.	Limited	High – permanent residents in the vicinity of KOP8 Moderate – road users with a limited viewing time	Due to the existing mine dumps in the area, the proposed Mona Lisa Bird Reef Pit will somewhat blend in with the surroundings, thus limiting the visual intrusion thereof.

Figure 23: Conceptual rendering of the view from KOP1 (Witpoortjie) where the Roodepoort Main Reef Pit (indicated by the dashed red arrow) will barely be noticeable in the distance.

Figure 24: Conceptual rendering of the view from KOP2 (Witpoortjie) where the Roodepoort Main Reef Pit (indicated by the dashed red arrow) will not be visible due to the vegetation and existing mine dumps.

Figure 25: Conceptual rendering of the view from KOP3 (Randfontein Road) where the WRD associated with the Roodepoort Main Reef Pit will be highly visible.

Figure 26: Conceptual rendering of the view from KOP4 (Hamberg, residential) where the Rugby Club Main Reef Pit will barely be noticeable in the distance.

Figure 27: Conceptual rendering of the view from KOP5 (Randfontein Road, opposite Rand Leases) where current illegal mining is taking place, as indicated by the red circle, and where the WRD associated with the Rugby Club Main Reef Pit will be highly visible.

Figure 28: View from KOP6 (Unnamed Road) where the Bird Reef Central Infrastructure Complex will be visible, since the existing shaft will be refurbished.

Figure 29: View from KOP7 (Solplaatje residential area) where the Mona Lisa Bird Reef Pit will be highly visible.

Figure 30: View from KOP8 (Housing) where the Mona Lisa Bird Reef Pit will be visible in the distance.

From the viewshed analysis, the Roodepoort Main Reef and Rugby Club Main Reef Pits are expected to be highly visible to receptors present within 2 km thereof, especially to the north, east and west, as these areas fall within the high visibility zone and the proposed pits will form part of the foreground to middle ground of their viewing experience. The viewshed scatters further than 2 km, indicating that less receptors will observe the pits.

The viewshed analysis indicates that the Mona Lisa Bird Reef Pit falls within the high visibility zone of receptors situated within 2 km to the north, south and west, signifying that it will be highly visible to these receptors. Furthermore, according to the viewshed analysis receptors situated to the east of the Mona Lisa Bird Reef Pit will not have a clear line of sight.

The Bird Reef Central Infrastructure Complex viewshed is dense within 1 km to the east and south, indicating that receptors within these areas fall within the high visibility zone of the Bird Reef Central IC. Additionally, the viewshed indicates that the Bird Reef Central IC, will have less vantage points further than 1km.

It is important to note that the viewshed analysis does not take into account the vegetation and existing infrastructure of the area, therefore the field assessment displays a more accurate outcome of the visual intrusion and visibility of the proposed project on the receiving environment.

4.5. Night Time Lighting

In order to understand the potential visual impacts from night lighting, it is important to understand the existing lighting levels. The Institute of Lighting Engineers (ILP) (2011) identifies five environmental zones for exterior lighting control and with which to describe the existing lighting conditions within the landscape (Table 13). These environmental zones are supported by design guidance for the reduction of light pollution, which can then inform proposed mitigation measures and techniques. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

Table 10: Environmental zones as it relates to night time lighting.

Environmental Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically Dark	National Parks, Areas of Outstanding Natural Beauty etc.
E2	Rural	Low District Brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium District Brightness	Small town centres or suburban locations
E4	Urban	High District Brightness	Town/city centres with high levels of night-time activity

The proposed MRA is situated within such a densely urban built-up area the lighting environment within the vicinity of the pit areas and IC are considered to fall within Environmental Zone E4 (Urban) with high district brightness, with various light sources such as street lights, security lighting at commercial and industrial facilities, and lighting associated with the current mining activities. The area therefore contributes significantly to sky glow and light pollution in the greater area.

Since the proposed MRA and greater region is considered high district brightness the proposed open pits ICs will therefore not have a significant contribution to lighting impact on the surrounding environment. Since the opencast mining activities will only take place during the daytime the impact of lighting at night will be negligible. The Bird Reef Central IC associated with the West Wits Mining Project will however somewhat contribute to the effects of sky glow and artificial lighting.

4.6. No Go Alternative

Should the No-Go Option take place, no additional visual impacts will take place.

5. IMPACT ASSESSMENT

This section presents the significance of potential impacts on the visual environment associated with the region surrounding the project area as a result of the proposed mining activities, according to the method outlined in Appendix C. This section presents an assessment of the significance of the impacts prior to mitigation and management measures being put in place and taking into consideration the available mitigatory measures, assuming that they are fully implemented. Recommendations and mitigation measures have also been developed which will assist in minimising the proposed project's visual impact throughout the various development phases of the project.

The potential activities that may trigger visual impacts during various phases of the proposed West Wits Mining Project are outlined in Table 11 below, while the potential impacts and impact ratings pertaining to the visual environment surrounding the West Wit Mining Project infrastructure areas, are presented in the impact tables in the sections that follows.

Table 11: Summary of the anticipated activities for the proposed development.

Phase	Activities
Preconstruction and construction	- Site clearing of the footprint areas associated with the infrastructure areas, stockpiles and dumps and access roads and associated contractor laydown areas; - Construction of the surface infrastructure (including Contractors Laydown Area, Lamp Room, Offices, Workshops, Stores, Parking) and the access road; - Site preparation, vegetation clearance and construction of hard and soft dumps and stockpiles;
Operational	- Opencast and underground mining activities; - Operation of shaft complexes and associated surface infrastructure; - Operation of plant and office complexes and associated infrastructure; and - Security lighting at night for underground mining activities
Decommissioning and closure	- Demolishing of all surface infrastructure; and - Rehabilitation of shaft, office and plant complex areas; and - Backfilling of the open pits.

Since the Roodepoort Main Reef Pit and Rugby Club Main Reef Pit have a similar surrounding visual environment and are adjacent to the R41 roadway, the high visual impacts are expected to be very similar, therefore a consolidated impact assessment was undertaken for these open pit areas. Even though the Mona Lisa Bird Reef Pit is expected to also have a high visual impact on the receiving visual environment, a separate impact assessment was undertaken, since permanent residents at Solplaatje will experience a higher visual impact rather than people at their place of work (in the vicinity of Roodepoort Main Reef Pit and Rugby Club Main Reef Pit). Furthermore, a separate impact assessment was undertaken for the Bird Reef Central IC since the impacts are associated with surface infrastructure for underground mining rather than open pits and associated dumps. In

addition, brief descriptions of potential impacts of the 11 Shaft Main Reef Pit, Kimberley Reef East Pit and IC considered to have minimal to negligible visual impacts are included in the discussion below.

5.1. Impact Discussion

The sections below summarises the possible impacts such as, site clearing, construction of the surface infrastructure, opencast and underground mining activities, operation of surface infrastructure, lighting, demolition of all surface infrastructure; and backfilling of the open pits, that the mining activities will have on the surrounding visual environment. In other words, the sections below provide a broad discussion of the possible impacts that the above mentioned activities will have on the landscape character, sense of place, VAC, visual intrusion, visual exposure and visibility as well as possible lighting sources at night.

5.1.1 Landscape Character and Sense of Place

The proposed project may further impact on the existing landscape and visual character of the region and sense of place associated with the proposed MRA and its immediate surroundings. The character and sense of place of the proposed MRA is associated with the urban, gently to moderately undulating terrain dominated by urban built-up and mining activities.

Historic mining activities have taken place within and in the surrounding area, therefore remnants of surface infrastructure as well as slimes dams and discard dumps are present in the proposed MRA and forms part of the skyline. Additionally, current illegal and legal mining activities are taking place within the proposed MRA, thus the proposed West Wits Mining Project will not set a precedent for mining in the area and can therefore be considered to be in keeping with the sense of place of the area. Even though current mining activities are taking place in the greater area, the Roodepoort Main Reef and Rugby Club Main Reef Pits are situated directly north of the main road (Randfontein Road) and directly south of businesses and houses thus the visual impact on the landscape character and sense of place, although already busy, for road users, people at their place of work and residents will be most significant.

The Mona Lisa Bird Reef Pit footprint area in its current state provides a source of relative calmness and tranquillity, irrespective of the mining activities taking place to the northwest of the pit area, since it comprises grassland with limited anthropogenic structures in the footprint area. The proposed mining activities in this area will therefore have a negative

visual impact on the landscape character and sense of place, especially for people residing in Solplaatje situated south of the pit.

Since remains of the historic shaft fall within the Bird Reef Central IC, which will be refurbished, the visual impact on the landscape character and sense of place will not be significant as the impact is already present and receptors in the area are accustomed to the presence of the shaft.

The landscape character and sense of place associated with the 11 Shaft Main Reef Pit, the Kimberley Reef East Pit and IC is already negatively impacted by the surrounding historic and ongoing mining activities, thus the visual impact of the proposed mining activities in these areas are low to negligible. Furthermore, the slimes dams and dumps screens the abovementioned pits and IC from surrounding receptors.

With the implementation of mitigation measures, such as concurrent rehabilitation and rollover mining, the proposed impacts during the operational phase at all pits will be lower. The duration of the impact, should mitigation measures not be implemented, may be long term, however, should mitigation be effective and the recovery of the landscape be actively sought after closure, the duration of the impact may be lowered.

5.1.2Visual Intrusion and VAC

Given that the 11 Shaft Main Reef Pit, the Kimberley Reef East Pit and IC have a high VAC (due to vegetation and existing mining structures) and are screened by the slimes dams and dumps and associated tall and dense vegetation, the abovementioned pits and IC will have a low to negligible visual intrusion on surrounding receptors. Ensuring that limited vegetation removal occurs and / or retaining the trees on the periphery of these areas, and wherever possible, lights be directed downwards so as to avoid illuminating the sky, the visual impact on the surrounding environment will remain low.

The altered visual environment during the various phases of the proposed mining activities at the Mona Lisa Bird Reef, Roodepoort Main Reef and Rugby Club Main Reef Pits will lead to undesirable levels of visual intrusion, with moderate levels of incompatibility with surrounding land uses as well as visual contrast and discord between the pit areas and its surroundings. The level of visual intrusion as a result of the proposed mining activities, with specific mention of vegetation clearing and removal of topsoil, is considered to be medium

during the construction phase and high during the operational phase, in line with the medium VAC.

The perceived visual impacts associated with the construction and operational phases of the Bird Reef Central IC is considered to be moderately intrusive to the receiving environment, especially to people playing golf at the Durban Deep Golf Course northeast of the IC. The surrounding environment has a moderate VAC due to the dense vegetation, and provided that vegetation be retained around the periphery of the IC, the proposed mining infrastructure will not be significantly visually intrusive to the surrounding environment.

5.1.3Visual Exposure and Visibility

The proposed project may impact on visual exposure and visibility, which relates directly to the perception of sensitive visual receptors towards the project. Sensitive visual receptors have been determined to primarily consist of residents living within the residential areas, motorists traveling on the roads within and around the proposed MRA, scholars at schools in the residential areas, users of outdoor recreational facilities such as the Durban Deep Golf Course, parks, sportsgrounds, Orlando Soccer Stadium, and people at their place of work in the industrial and commercial areas.

Direct visual exposure will take place as a result of the loss of vegetation and excavation activities at the open pits and IC being visible to residents, people at their place of work and motorists traveling on the roads in the immediate vicinity thereof. Indirect visual exposure includes fugitive dust generated by construction and operation related activities such as construction vehicles driving on the roads as well as blasting and earthworks which will alter the visual environment.

In addition to mining infrastructure, the open pits and associated dumps will alter the landforms and create noticeable contrast in the landscape. It is however important to note, that there are active mining activities taking place within and around the proposed MRA, thus people occupying and working in the Soweto and Roodepoort and surrounding neighbourhoods are already accustomed to the mining type landscape.

It is important to note that due to the density of the residential areas and associated ornamental plants, the undulating topography and existing mine dumps and slimes dams in the area, the proposed open pit areas and ICs will be partially to completely screened from various vantage points in the surrounding environment.

5.1.4Night Time Lighting

Lighting associated with the proposed mining project may be visible during both day and night, but lighting is only likely to have a visual impact during the night time. Lighting may be visible for significant distances and indirect lighting impact, such as sky glow (the scattering of light in the sky) and glare may reduce the night sky quality at locations some distance from the light sources.

It is however important to note that the region and the area in the immediate vicinity of the proposed MRA is considered to have high district brightness, thus it is already heavily impacted by night-time lighting, the impact of the open pits and IC will not be highly significant. Since the Bird Reef Central IC is situated within an area with less lighting sources the lighting impact as a result of the IC is likely to be higher. The duration of the impact will last for the life of the mining operation. The effective implementation of mitigation measures pertaining to lighting, with particular reference to lighting design and placement, may lead to this impact being reduced. Furthermore, no lighting structures will be required at the open pits as mining activities will only take place during daytime hours.

A summary of the impact assessment is provided below, taking into consideration all visual cues (landscape character, sense of place, VAC etc.) as discussed above when calculating the visual impacts of the various mining activities associated with the proposed West Wits Mining Project.

Table 12: Summary of the impact assessment undertaken as part of the assessment of the West Wits Mining Project.

CONSTRUCTION PHASE									
Impact		Open Pit Area / Infrastructure Complex	Management	Severity	Duration	Spatial Scale	Consequence	Probability	Significance
Activity	Site clearing of the project footprint areas associated with the open pit areas and infrastructure complexes and haul roads and associated contractor laydown areas.								
• Removal of vegetation leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape and visual intrusion on sensitive receptors. • Erosion and loss of topsoil leading to increased visual contrast, loss of Visual Absorption Capacity of the landscape. • Alteration of natural features as a result of infrastructure placement and positioning, including potential loss of wetlands, leading to loss of visual quality and visual exposure. Natural features act as visual resources and disturbance of such landscape features will also have an impact on landscape character and sense of place of the region. • Construction related earthworks activities resulting in increased dust suspension. • Increased vehicular movement in the vicinity of the proposed MRA.		Roodepoort Main Reef Pit and Rugby Club Main Reef Pit	Unmanaged	H	L	H	H	VH	H
			Managed	H	L	M	M	H	M
		Mona Lisa Bird Reef Pit	Unmanaged	H	L	H	H	VH	H
			Managed	H	L	M	M	H	M
		Bird Reef Central Infrastructure Complex	Unmanaged	M	L	M	M	H	M
			Managed	M	L	L	M	M	L
Mitigation Measures	• The development footprints and disturbed areas should be kept as small as possible and the areas of natural vegetation and topsoil must be kept to a minimum. • As far as possible, surface infrastructure should be placed in areas that have already been disturbed. • The extent of all surface infrastructure footprint areas and permanent structures must be minimised to what is absolutely essential. • It must be ensured that existing vegetation in the vicinity of surface infrastructure and along the main roads is retained during the construction phase to act as visual screens from surrounding receptor sites. • Erosion, which may lead to high levels of visual contrast and further detract from the visual environment, must be prevented throughout the lifetime of the project by means of putting soil stabilisation measures in place and concurrent rehabilitation. • It must be ensured that topsoil stockpiles are not steeply sloped and it is recommended that such stockpiles be vegetated with an indigenous grass species to minimise visual contrast and prevent soil losses. • The relevant exposed construction site areas and access gravel roads must be irrigated on a regular basis, with just enough moisture to keep the dust down without creating undue runoff. • Rubble must be removed from site on a regular basis. • Litter and dust management measures should be in place at all times. • The sites should be kept neat and tidy at all times. • On site activities will be limited to be undertaken between 6am and 6pm								
Activity	Construction of the infrastructure complex and haul roads. Excavation of open pits.								
• Excavation during construction of mining infrastructure and open pits will lead to visual intrusion and visual exposure of sensitive receptors. • Topographical alteration as a result of construction activities leading to a change in the landscape character which will lead to increased level of visual intrusion and a potential impact on sense of place of the region. • Mine infrastructure including buildings, stockpiles and dumps being visible over long distances and creating contrast with the surrounding landscape. • An increase in construction vehicular and human activity in the area, leading to an increase in dust. • Excavation resulting in increased dust suspension. • Use of security lighting.		Roodepoort Main Reef Pit and Rugby Club Main Reef Pit	Unmanaged	H	L	H	H	VH	H
			Managed	H	L	M	M	H	M
		Mona Lisa Bird Reef Pit	Unmanaged	H	L	H	H	VH	H
			Managed	H	L	M	M	H	M
		Bird Reef Central Infrastructure Complex	Unmanaged	M	L	M	M	H	M
			Managed	M	L	L	M	M	L

Mitigation Measures	• Excavated areas are to be infilled with available material during decommissioning and closure. • Excavation is to be kept to a minimum and limited to essential areas. • As far as possible, natural contours must be followed during infrastructure placement. • Where mining infrastructure is sited within view of visually sensitive areas, vegetation around the IC should be retained to assist in screening the IC. • The height of structures should be a low as possible, where this can be achieved without increasing the infrastructure footprint. • Stockpiles may be placed to screen mining activities from the potential viewers. • Painting or coating infrastructure components to match darker colours in the natural surroundings may reduce the distance required for effective screening. • Visually cluttered material storage yards and laydown areas should be screened through the use of material fencing, which will result in a more unified and tidy appearance. • Natural colours should be used in all instances and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. White structures are to be avoided as these will contrast significantly with the natural surroundings. • The identification of appropriate colours and textures for facility materials should take into account both summer and winter appearance. • The use of permanent signs and project construction signs should be minimised and visually unobtrusive. • During rehabilitation, the removal of infrastructure, backfilling into open cast areas, ripping of roads and reshaping of impacted areas should take place. • The relevant exposed construction site areas and haul roads should be irrigated on a regular basis, with just enough moisture to keep the dust down without creating undue runoff • Construction activities should be restricted to daylight hours as far as possible, in order to limit the need to bright floodlighting and the potential for skyglow. • All lights used for illumination (except for lighting associated with security) should be faced inwards and shielded to avoid light escaping above the horizon. • Making use of motion detectors on security lighting, at office areas and the maintenance area, ensures that the site will remain in relative darkness, until lighting is required for security and maintenance purposes.

OPERATIONAL PHASE								
Impact	Open Pit Area / Infrastructure Complex	Management	Severity	Duration	Spatial Scale	Consequence	Probability	Significance
Activity	On-going mining activities, increasing the height of the stockpile and dumps. Increase in trucks on the surrounding roads, transporting the material extracted							
• Continual stockpiling of material, including the resource, and potentially increasing heights of stockpile and dumps during operational activities. • Generation of dust leading to visual intrusion, visual exposure of receptors and impacts on the overall landscape character. • Additional vehicular traffic impacting on the character of the region and leading to visual exposure of receptors further from the proposed MRA to mining activities. • Night time lighting due to security lighting, adding to the skyglow of the area.	Roodepoort Main Reef Pit and Rugby Club Main Reef Pit	Unmanaged	H	M	H	H	VH	H
		Managed	H	L	M	M	H	M
	Mona Lisa Bird Reef Pit	Unmanaged	H	M	H	H	VH	H
		Managed	H	L	M	M	H	M
	Bird Reef Central Infrastructure Complex	Unmanaged	M	H	H	H	H	H
		Managed	M	H	M	M	H	M
Mitigation Measures	• It is recommended that stockpiles be vegetated with indigenous grasses in order to blend more easily into the existing landscape and for screening purposes. • The design and height increase of stockpiles must be monitored to ensure that these components relate to acceptable environmental standards in terms of slope and elevation. • Stockpiles are ideally to be shaped at an adequate slope from the commencement of the project to ensure that it integrates more successfully into the natural topography of the visual landscape. • It must be ensured, wherever possible, that existing natural vegetation is retained in the vicinity of the Bird Reef Central IC. • All haul roads will require effective dust suppression such as regular watering. • An effective dust management plan taking into account stockpile and dump areas, as well as haul roads must be designed and implemented in order to mitigate the impact of dust on sensitive receptors throughout all mining phases. • Vehicle speed on unpaved roads must be reduced to limit dust generation. • As far as possible, existing roads are to be utilised, also for construction purposes, to prevent cumulative impacts from roads and traffic. • Transport of the mined resource should be optimised as far as possible to limit the number of additional vehicles on local and district roads. • A lighting engineer may be consulted to assist in the planning and placement of light fixtures for the mining facility and all ancillary infrastructures in order to reduce visual impacts associated with glare and light trespass. • As far as possible, operational activities should take place during the daylight hours, in order to limit the use of bright floodlighting and to avoid the use of additional night-time lighting which may add to skyglow. As underground mining activities will take place 24 hours 7 days a week, it must be ensured that up-lighting structures be avoided. • Outdoor lighting must be strictly controlled. • The use of high light masts and high pole top security lighting should be avoided along the periphery of the operations. Any high lighting masts should be covered to reduce sky glow. • Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surrounding of the mining infrastructure, thereby minimising the light spill and trespass. • Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum. Only “full cut-off” light fixtures that direct light only below the horizontal must be used on the building. • Censored and motion lighting may be installed at office areas, workshops and other buildings to prevent use of lights when not needed. • Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose. • Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night-time maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and skyglow (BLM, 2013). • The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects, and is associated with other human physiological issues (BLM, 2013).							

CLOSURE AND DECOMMISIONING PHASE								
Impact	Open Pit Area / Infrastructure Complex	Management	Severity	Duration	Spatial Scale	Consequence	Probability	Significance
Activity	Backfilling of the open pit areas with material from the WRD and topsoil stockpiles and demolition of surface infrastructure							
• Removal of infrastructure and general decommissioning and closure activities leading to visual intrusion on sensitive receptors. • Ineffective rehabilitation leading to landscape scarring, permanent visual contrast and a permanent alteration of the landscape character and sense of place within the region.	Roodepoort Main Reef Pit and Rugby Club Main Reef Pit	Unmanaged	M	M	M	M	M	L
		Managed	L	L	L	L	M	VL
	Mona Lisa Bird Reef Pit	Unmanaged	M	M	M	M	M	L
		Managed	L	L	L	L	M	VL
	Bird Reef Central Infrastructure Complex	Unmanaged	L	M	M	M	M	L
		Managed	L	L	L	L	M	VL
Mitigation Measures	• Decommissioning footprints and disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose. • All areas where infrastructure is removed must be resloped to resemble the pre-development landscape and revegetated as soon as possible. • Concurrent/ progressive rehabilitation must be implemented and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available by replacing topsoil and revegetating disturbed areas. • Indigenous and locally occurring plant species selected for use in re-vegetation should be selected taken quick growth rates into consideration in order to cover bare areas and prevent soil erosion. • Upon final rehabilitation, it must be aimed to remove all much surface infrastructure and to reshape the landscape to pre-development conditions.								

5.2. Cumulative Impacts

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Cumulative visual impacts resulting from landscape modifications as a result of the proposed West Wits Mining Project in conjunction with other planned mining activities are likely to be of some significance.

5.3. Residual Impacts

Certain surface infrastructure components may remain present once decommissioning has occurred, leading to a permanent alteration of the visual environment. Since scarring is still present in the landscape from historic mining activities, the proposed mining activities are highly likely to add to permanent scarring of the terrain. Material from the open pit areas will be backfilled once mining activities have ceased. Alien vegetation, which is likely to proliferate as a result of disturbance from the mining activities may also remain present after decommissioning.

5.4. Monitoring

It is recommended that a visual monitoring programme, to ensure that mitigation measures regarding visual impacts are implemented and maintained, be designed for implementation throughout all development phases. This programme would largely be based on visual reconnaissance at ground level and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements. The following points aim to guide the design of the monitoring plan:

- Development and implementation of a decommissioning and site plan in order to ensure that the area's pre-development scenic quality and integrity are restored or should any other development be planned post closure it must be ensured that the project area is visually integrated into the surrounding landscape setting. Important aspects addressed should include requirements that most aboveground and near-ground structures be removed, that the project site be re-graded, and that indigenous vegetation be re-established to be consistent with the surrounding landscape;
- The plan should include provisions for monitoring the efficacy of the proposed mitigation measures and determining compliance with the project's visual impact mitigation requirements;
- The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results;

- The selected KOPs should be used over the life of the project to review the success of the mitigation plan;
- Predevelopment visual conditions and the inventoried visual quality rating and scenic integrity should be reviewed after construction;
- The visual monitoring programme should be based on the following parameters:
  - Airborne dust (in line with air quality assessment)
  - Visibility of lights at night from surrounding receptors;
  - Number of lights visible;
  - Vegetation cover and height; and
  - Disturbance to receptors.
- Maintenance of mining infrastructures and operations must be monitored;
- Results of the monitoring activities must be taken into account during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects from mining related activities become apparent.

6. CONCLUSION

Scientific Terrestrial Services (STS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the Environmental Impact Assessment process for an application for a Mining Right for the opencast and underground mining for the West Wits Mining Project, located north of Soweto, Gauteng Province.

The proposed MRA is located within the City of Johannesburg Metropolitan Municipality and can be accessed via the R41 (Mainreef road / Randfontein) and the M77, with the R558 immediately west of the proposed MRA, with the R24 (Albertina Sisulu / Hamberg) running along the northern boundary of the proposed MRA (Figures 1 to 3). The proposed MRA partly falls within Roodepoort (northern portion) and partly within Soweto (southern portion).

In broad terms the proposed project would involve the development of five open pit mining areas referred to as the:

1. Mona Lisa Bird Reef Pit;
2. Roodepoort Main Reef Pit;
3. Rugby Club Main Reef Pit;
4. 11 Shaft Main Reef Pit; and
5. Kimberley Reef East Pit.

The proposed project further includes the refurbishment of two existing infrastructure complexes (IC), to access the existing underground mine workings. These infrastructure complexes are referred to as the:

1. Bird Reef Central IC, and
2. Kimberley Reef East IC.

The open pit areas and the ICs as well as surrounding areas have been subject to various historic and current legal and illegal mining activities for several years, as well as cultivated agriculture and grazing/browsing activities which have influenced the visual character of the area. Based on the findings from both the desktop and field assessment it is evident that the proposed project is located within a region with gently to moderately undulating terrain dominated by urban built-up and mining activities. Therefore, the most dominant land uses in the surrounding areas are; mining activities, residential areas, and commercial and industrial facilities.

Due to the abovementioned characteristics of the area, the various open pit areas and ICs will have a minimal to high visual impact on the receiving environment. The surrounding landscape is considered to have a moderate VAC, mostly due to the dense urban built-up, the existing mine dumps, slimes dams and tailings facilities. Based on Table 4 above it is evident that the impact significance of the 11 Shaft Main Reef Pit, Kimberley Reef East Pit and Kimberley Reef East IC are deemed to be of very low significance. This is due to the location of these open pits and IC situated within heavily disturbed areas surrounded by historic mine dumps and surface infrastructure remnants such as ventilation shafts, which have been allowed to return to a densely vegetated state, which assist in the absorption of the open pits and IC. Furthermore, the well-established vegetation and undulating topography of the area further indicates that the proposed open pits and IC will be screened from receptors within the immediate surrounding environment. Since the impact significance of the 11 Shaft Main Reef Pit, Kimberley Reef East Pit and Kimberley Reef East IC are deemed to be of very low significance it was not deemed necessary to provide further detail for these areas.

The overall landscape of the Roodepoort Main Reef Pit, Rugby Club Main Reef Pit, Mona Lisa Bird Reef Pit and the Bird Reef Central IC are considered of moderate scenic quality. This is due to unsightly areas such as exposed bare ground, industrial properties, existing historic mine dumps, slimes dams and tailings facilities that weaken the scenic value of the urban built-up area.

The sense of place associated with the ICs and open pit areas are related to the landscape character type of the greater area (proposed MRA) – urban, gently to moderately undulating terrain dominated by urban built-up and mining activities. The sense of place is not unique to the ICs and open pit areas as it is representative of the greater region (proposed MRA). The level of movement and activity within the proposed MRA is relatively high due to the commercial and industrial areas as well as active mining taking place in the area, thus it can be described as busy with a lot of vehicular and pedestrian movement.

From the elevation profile and line of sight analysis, supported by the findings of the field assessment and Key Observation Point (KOP) analysis, it was evident that the open pits and ICs are located within the foreground and middle ground of receptors within a 5 km radius thereof.

Several potential risks to the receiving aesthetic and visual environment as a result of the proposed project have been identified, relating to impacts on visual character and sense of place, visual intrusion and visual exposure and visibility, as well as night time lighting impacts. The significance of these impacts may be reduced should appropriate and effective mitigation measures be implemented.

It is the opinion of the specialist that the due to location of the Roodepoort Main Reef Pit, the Rugby Club Main Reef Pit and the Mona Lisa Bird Reef Pit will have the most significant visual (high) impact on the receiving environment. Ensuring that vegetation clearance is limited to the proposed mining pit and infrastructure footprint, the safety berm that will be constructed on the periphery of the open pits with topsoil should not be higher than 1.5m, and no opencast mining activities taking place 24-hours 7 days a week (underground mining activities will however take place 24 hours 7 days a week) the significance of the mining impact may be reduced. Concurrent rehabilitation, and the short period of mining at each pit (longest mining period will be 6 months at the Rugby Club Main Reef Pit and the 11 Shaft Main Reef Pit) will reduce the duration of the impact in the area. The landscape character, quality and value have already been altered significantly by historic and current ongoing mining activities.

It should be noted that the visual impacts associated with the proposed open pits are likely to be of higher significance, due to the proximity to residential and other areas. However, the duration of the visual impacts associated with the open pit areas will be of short duration (longest mining operation is 6 months) and once these areas are backfilled and rehabilitated the visual impact of the open pit areas will significantly be reduced.

Even though the visual impact of the proposed ICs are of moderate significance the duration thereof will be longer (20years) since it is associated with the underground mining activities. However, these ICs are situated within more remote areas where the surrounding historic mine dumps, dense and high vegetation and undulating topography assists in screening these areas from potential sensitive receptors.

The proposed West Wit Mining Project will therefore not have a detrimental visual impact on the receiving environment and is thus not fatally flawed from a visual impact perspective. It is recommended that, from a visual impact perspective, the proposed mining activities be taken into consideration on a site-specific basis, and that the recommended mitigation measures for the identified impacts be implemented, ensuring that the relevant authorities are consulted in accordance with the stipulated guidelines.

REFERENCES

Astronomical Society of South Australia. 2012. *Light pollution brochure.*

Bureau of Land Management, 1984, *Visual Resource Management,* BLM Manual Handbook 8400, Release 8-24, U.S. Department of the Interior, Washington, DC.

Bureau of Land Management, 1986, *Visual Resource Contrast Rating,* BLM Manual Handbook 8431-1, Release 8-30, U.S. Department of the Interior, Washington, DC, Jan.

Bureau of Land Management, 1986, *Visual Resource Inventory,* BLM Manual Handbook 8410-1, Release 8-28, U.S. Department of the Interior, Washington, DC, Jan.

Bureau of Land Management, U.S. Department of Interior. 2004. *Bureau of Land Management Visual Resource Inventory Classes, Appendix C:* Visual Absorption Capacity

Bureau of Land Management. *Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands.* First Edition 2013

Department of the Environment and Local Government, Ireland 2000. *Landscape and Landscape Assessment.* Consultation Draft of Guidelines for Planning Authorities.

ILP 2011. *Guidance notes for the reduction of obtrusive light.* GN01: 2011, Rugby: Institute of Lighting Professionals

Mucina, L. & Rutherford, M.C. (eds.). 2012. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitizia 19. South African National Biodiversity Institute, Pretoria, South Africa.

NPAES: DEA and SANBI. 2009. National Protected Areas Expansion Strategy Resource Document. Online available: http://bgis.sanbi.org/protectedareas/NPAESinfo.asp

Oberholzer, B., 2005. *Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1.* CSIR Report No. ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

SAPAD: Department of Environmental Affairs. 2017. South Africa Protected Areas Database (SAPAD_OR_2017_Q2. Online available: [http://egis.environment.gov.za]

STS. 2018. Faunal and Floral Assessment for the proposed West Wits Mining Project

Swanwick, C. and Land Use Consultants (2002). *Landscape character assessment guidance for England and Scotland,* Cheltenham: Countryside Agency and Battle by: Scottish National Heritage.

The Landscape Institute, Institute of Environmental Management and Assessment, 2002. Second Edition *Guidelines for Visual and Landscape Impact Assessment.* E & FN Spon, London.

The Landscape Institute, Institute of Environmental Management and Assessment, 2013. Third Edition, *Guidelines for Visual and Landscape Impact Assessment.* E & FN Spon, London.

The Landscape Institute, Institute of Environmental Management and Assessment, 2013. Third Edition, *Guidelines for Visual and Landscape Impact Assessment*. E & FN Spon, London.

SLR. 2018. Scoping Report for the Proposed West Wits Mining Project. Various Portions of Farms Glenlea 228IQ, Randglen, 229IQ, Vogelstruisfontein 231IQ & 233IQ, Roodepoort 236IQ & 237IQ, Vlakfontein 238IQ, Doornkop 239IQ, Witpoortjie 245IQ, Dobsonville 386IQ, Soweto 387IQ, 641IQ, 649IQ, 663IQ, 677IQ, 710IQ, Gauteng.

APPENDIX A – METHOD OF ASSESSMENT

Level of Assessment

The following methods of assessment for determining the level of detail of the assessment was utilised in this report (Oberholzer, 2005):

Table A1: Categories of development and impact severity.

Type of environment	Category 1 development	Category 2 development	Category 3 development	Category 4 development	Category 5 development
Protected/wild areas of international, national or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high scenic, cultural, historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected
Areas or routes of medium scenic, cultural, historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural, historical significance/disturbed	Little or no visual impact expected, possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected
Disturbed or degraded sites/run down areas/ wasteland	Little or no visual impact expected, possible benefits	Little or no visual impact expected, possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

The following key provides an explanation to the categories of development:

Category 1 development:
e.g. nature reserves, nature-related recreation, camping, picnicking, trails and minimal visitor facilities.

Category 2 development:
e.g. low-key recreation / resort / residential type development, small-scale agriculture / nurseries, narrow roads and small-scale infrastructure.

Category 3 development:
e.g., low-density resort / residential type development, golf or polo estates, low to medium-scale infrastructure.

Category 4 development:
e.g. medium density residential development, sports facilities, small-scale commercial facilities / office parks, one-stop petrol stations, light industry, medium-scale infrastructure.

Category 5 development:
e.g. high density township / residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll roads, large scale infrastructure generally. Large-scale development of agricultural land and commercial tree plantations. Quarrying and mining activities with related processing plants.

The following box explains the nature of the impacts:

Very high visual impact expected:
Potentially significant effect on wilderness quality or scenic resources;
Fundamental change in the visual character of the area;
Establishes a major precedent for development in the area.

High visual impact expected:
Potential intrusion on protected landscapes or scenic resources;
Noticeable change in visual character of the area;
Establishes a new precedent for development in the area.

Moderate visual impact expected:
Potentially some effect on protected landscapes or scenic resources;
Some change in the visual character of the area;
Introduces new development or adds to existing development in the area.

Minimal visual impact expected:
Potentially low level of intrusion on landscapes or scenic resources;
Limited change in the visual character of the area;
Low-key development, similar in nature to existing development.

Little or no visual impact expected:
Potentially little influence on scenic resources or visual character of the area;
Generally compatible with existing development in the area;
Possible scope for enhancement of the area.

From the above, the severity of the impact determines the level of the assessment:

Table A2: Impact assessment level of input determination.

Approach	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	Very high visual impact expected
Level of visual input recommended	Level 1	Level 2	Level 3	Level 4	

The following box explains the inputs required at each level of assessment (Oberholzer, 2005).

Level 1 input:
Identification of issues, and site visit;
Brief comment on visual influence of the project and an indication of the expected impacts / benefits.

Level 2 input:
Identification of issues raised in scoping phase, and site visit;
Description of the receiving environment and the proposed project;
Establishment of Receptor Site area and receptors;
Brief indication of potential visual impacts, and possible mitigation measures.

Level 3 assessment:
Identification of issues raised in scoping phase, and site visit;
Description of the receiving environment and the proposed project;
Establishment of Receptor Site area, view corridors, viewpoints and receptors;
Indication of potential visual impacts using established criteria;
Inclusion of potential lighting impacts at night;
Description of alternatives, mitigation measures and monitoring programmes.
Review by independent, experienced visual specialist (if required

Level 4 assessment:
As per Level 3 assessment, plus complete 3D modelling and simulations, with and without mitigation.
Review by independent, experienced visual specialist (if required).

APPENDIX B – IMPACT ASSESSMENT METHODOLOGY

Impacts are assessed based on consideration of the impact severity, spatial scale and duration of impacts, which together determine the impact consequence. The impact consequence together with the probability of the impact occurring determine the overall impact significance.

The criteria for determining the severity, spatial scale and duration of potential impacts are presented in Table 1. The criteria are based on the criteria detailed in *DEAT (2002) Specialist Studies, Integrated Environmental Management Information Series 4, Department of Environmental Affairs and Tourism (DEAT), Pretoria*; *DEAT (2002) Impact Significance, Integrated Environmental Management Information Series 5, Department of Environmental Affairs and Tourism (DEAT)* and the criteria and methodology developed by Theo Hacking[1]. Table D1 also provides the definition for determining impact consequence (combining severity, spatial scale and duration) and impact significance (the overall rating of the impact).

Table B1: Criteria for the assessment of impacts

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		Significance = consequence x probability
Definition of CONSEQUENCE		Consequence is a function of severity, spatial extent and duration
Criteria for ranking of the SEVERITY of environmental impacts	H	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action. Irreplaceable loss of resources.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints. Noticeable loss of resources.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints. Limited loss of resources.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints. Limited loss of resources.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction. Noticeable improvement of resources.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity. Significant improvement of resources.
Criteria for ranking the DURATION of impacts	L	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	L	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

Impact consequence and significance are determined from Table B2 and Table B3. The interpretation of the impact significance is presented in Table B4.

[1] Hacking, Theo (1999) An innovative approach to structuring environmental impact assessment reports. Anglo American Corporation-Envirolink. Unpublished.

Table B2: Method of determining impact consequence

PART B: DETERMINING CONSEQUENCE					
SEVERITY = L					
DURATION	Long term	H	Medium	Medium	Medium
	Medium term	M	Low	Low	Medium
	Short term	L	Low	Low	Medium
SEVERITY = M					
DURATION	Long term	H	Medium	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Low	Medium	Medium
SEVERITY = H					
DURATION	Long term	H	High	High	High
	Medium term	M	Medium	Medium	High
	Short term	L	Medium	Medium	High
			L	M	H
			Localised Within site boundary Site	Fairly widespread Beyond site boundary Local	Widespread Far beyond site boundary Regional/ national
			SPATIAL SCALE		

Table B3: Method of determining impact and significance

PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	H	Medium	Medium	High
	Possible/ frequent	M	Medium	Medium	High
	Unlikely/ seldom	L	Low	Low	Medium
			L	M	H
			CONSEQUENCE		

Table B4: Interpretation impact significance

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	Decision guideline
High	Influences the decision regardless of any possible mitigation.
Medium	Should have an influence on the decision unless it is mitigated.
Low	Will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

Mitigation measure development

According to the DEA *et al.,* (2013) "Rich biodiversity underpins the diverse ecosystems that deliver ecosystem services that are of benefit to people, including the provision of basic services and goods such as clean air, water, food, medicine and fibre; as well as more complex services that regulate and mitigate our climate, protect people and other life forms from natural disaster and provide people with a rich heritage of nature-based cultural traditions. Intact ecological infrastructure contributes significant savings through, for example, the regulation of natural hazards such as storm surges and flooding by which is attenuated by wetlands".

According to the DEA *et al.,* (2013) Ecosystem services can be divided into 4 main categories:

- Provisioning services are the harvestable goods or products obtained from ecosystems such as food, timber, fibre, medicine, and fresh water;
- Cultural services are the non-material benefits such as heritage landscapes and seascapes, recreation, ecotourism, spiritual values and aesthetic enjoyment;
- Regulating services are the benefits obtained from an ecosystem's control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards; and

- Supporting services are the natural processes such as nutrient cycling, soil formation and primary production that maintain the other services.
-

Loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces socio-economic options for future generations. This is of particular concern for the poor in rural areas who have limited assets and are more dependent on common property resources for their livelihoods. The importance of maintaining biodiversity and intact ecosystems for ensuring on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act), and is fundamental to the notion of sustainable development. In addition, International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa (DEA *et al.,* 2013).

The primary environmental objective of the Mineral and Petroleum Resources Development Act (MPRDA) is to give effect to the environmental right contained in the South African Constitution. Furthermore, Section 37(2) of the MPRDA states that "any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations".

Pressures on biodiversity are numerous and increasing. According to the DEA *et al.,* (2013) Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and much of the world. The most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including[2]:

- Cultivation and grazing activities;
- Rural and urban development;
- Industrial and mining activities, and
- Infrastructure development.

Impacts on biodiversity can largely take place in four ways (DEA *et al.,* 2013):

- **Direct impacts:** are impacts directly related to the project including project aspects such as site clearing, water abstraction and discharge of water from riverine resources;
- **Indirect impacts:** are impacts associated with a project that may occur within the zone of influence in a project such as surrounding terrestrial areas and downstream areas on water courses;
- **Induced impacts:** are impacts directly attributable to the project but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries; and
- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining operations within the same drainage catchment or numerous residential developments within the same habitat for faunal or floral species.

[2] Limpopo Province Environment Outlook. A Report on the State of the Environment, 2002. Chapter 4.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted the definition of a clear mitigation strategy for biodiversity impacts.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated (DEA *et al.,* 2013):

- **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
- **Minimise impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
- **Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation tool as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
  - **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
  - **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources on the study area supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
  - **Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended post closure land use; and
  - **Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
- **Offset impact:** refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity

offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity the residual impacts should be considered to be of *very high significance* and when residual impacts are considered to be of *very high significance*, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.[3]

In light of the above discussion the following points present the key concepts considered in the development of mitigation measures for the proposed development.

- Mitigation and performance improvement measures and actions that address the risks and impacts[4] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation wherever possible.

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[3] Provincial Guideline on Biodiversity Offsets, Western Cape, 2007.

[4] Mitigation measures should address both positive and negative impacts

APPENDIX C – LANDSCAPE CHARACTER

Landscape character, from an aesthetic perspective, is mainly defined by natural determinants, such as vegetation, geology and topography, as well as cultural factors including land use, settlement patterns and the manner in which humans have transformed their natural surroundings. According to Swanwick (2002), landscape character may be defined as a distinct, recognisable and consistent pattern of elements in the landscape that makes it unique and provides it with a particular sense of place. Individual “landscape elements” that contribute to landscape character include hills, rolling plains, valleys, woods, trees, water bodies, as well as buildings and roads. “Landscape features” are those elements that are prominent or eye-catching.

Landscapes may be divided into landscape character types, which are defined as distinct types of landscape that are relatively homogeneous in character. Such landscape character types are generic in nature and may occur in different areas in different parts of the country, but wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation, land use and settlement patterns (Swanwick, 2002).

Key aesthetic aspects of the landscape are described in the table below, according to the method prescribed by Swanwick (2002).

APPENDIX D – VISUAL ABSORPTION CAPACITY

Visual Absorption Capacity (VAC) refers to the inherent ability of a landscape to accommodate change without degeneration of the visual quality and without resulting in an overall change of the identified landscape character type. A high VAC rating implies a high ability to absorb visual impacts and manmade structures and the ability of natural features such as trees or higher-lying areas to screen or hide an object where it would have been visible otherwise (Oberholzer, 2005), while a low VAC rating implies a low ability to absorb or conceal visual impacts.

The factors that have been considered during the VAC analysis are listed and explained in the table below, according to the methodology prescribed by the United States Bureau of Land Management (BLM, 2004) and as adapted to the South African context (Table D1). Five factors have been considered, namely vegetation, soil contrast, visual variety, topographical diversity and recovery time.

Table D1: VAC Factors and Rating table.

Factors	Rating Criteria and Score		
Vegetation	Low, uniform vegetation or sparse vegetative cover, typically less than 1m in height, lacking in variety, uniform colour, minimal screening capability, typically low scrub or grass type vegetation. Score: 1	Vegetation of moderate height (1 – 2m), some species variety (2 to 3 types), some variation in colour, mostly continuous vegetative cover, effectively screens low-profile projects such as low-profile surface disturbance, scrub/grass, and intermingled shrubs. Score: 2	Higher vegetation (>2m height), lush, continuous vegetative cover; some variety of vegetative types is typical but not mandatory, provides significant screening capability of projects up to 4 – 6m in height, woodlands. Score: 3
Soil contrast	Surface disturbance would expose a high degree of contrast in colour with surrounding soil, rock and vegetation. Score: 1	Surface disturbance would expose a medium degree of contrast in colour with surrounding soil, rock and vegetation. Score: 2	Surface disturbance would expose only a low degree of contrast in colour with surrounding soil, rock and vegetation. Score: 3
Visual variety	Rating unit exhibits a low degree of visual variety in terms of the landscape character elements of form, line and texture and may also exhibit minimal variety in landforms, vegetation, or colour. Score: 1	Rating unit exhibits a medium degree of visual variety in terms of the landscape character elements of form, line, and texture and may also exhibit medium variety in landforms, vegetation, or colour. Score: 2	Rating unit exhibits a high degree of visual variety in terms of the landscape character elements of form, line, and texture and may also exhibit high degree of variety in landforms, vegetation, or colour. Score: 3
Topographical diversity	Landform has low amount of topographic diversity and variety. Score: 1	Landform has moderate amount of topographic diversity and variety. Score: 2	Landform has high amount of topographic diversity and variety. Score: 3
Recovery time	Long-term recovery time (greater than 5 years) Score: 1	Medium recovery time (3 to 5 years) Score: 2	High (rapid) recovery time (1 to 2 years) Score: 3

Scores, when added, amounting to between 5 and 7 are categorised as Low, scores between 8 and 11 as Medium and between 12 and 15 as High.

VAC is further closely related to visual intrusion, which refers to the physical characteristics and nature of the contrast created by a project on the visual aspects of the receiving environment. It is also, as with VAC, a measure of the compatibility or conflict of a project with the existing landscape and surrounding land use. The visual intrusion ratings are listed in the table below.

Table D2: Visual intrusion ratings.

Rating	Explanation
High visual intrusion	Results in a noticeable change or is discordant with the surroundings.
Moderate visual intrusion	Partially fits into the surroundings, but clearly noticeable.
Low visual intrusion	Minimal change or blends in well with the surroundings.

APPENDIX E – LANDSCAPE QUALITY

Landscape visual quality, integrity or 'scenery beauty' relates primarily to human impact on a landscape and the physical state of the landscape in terms of intactness from visual, functional and ecological perspectives (Swanwick, 2002). It also serves as an indication of the condition of landscape elements and features (as outlined in Section 5.3.5), which in turn depends largely on an observer's visual perception through either increasing or reducing the visual quality of a landscape. Visual quality is thus a factor of an observer's emotional response to physical landscape characteristics and therefore assigning values to visual resources is a subjective process.

According to the BLM Visual Resource Management (VRM) system (1984), a system specifically developed for minimising the visual impacts of surface-disturbing activities and maintaining scenic values for the future, landscape, visual and scenic quality evaluation may be determined based on seven key factors, as outlined in the tables below and adapted to the South African environment. It is important to note that there may be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area, however within the context of the proposed project, this method of assessment is deemed suitable as an indication of landscape quality.

Table E1: Landscape Quality - Explanation of Rating Criteria.

Factor	Definition
Landform	Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental or they may be exceedingly artistic and subtle.
Vegetation	Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Consider also smaller scale vegetation features, which add striking and intriguing detail elements to the landscape.
Water	That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.
Colour	Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.
Adjacent Scenery	Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units that would normally rate very low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.
Scarcity	This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.
Cultural Modifications	Cultural modifications in the landform/water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit. Rate accordingly.

Table E2: Scenic Quality - Rating Criteria and Scoring system.

Factor	Rating Criteria and Score		
Landform	High vertical relief as expressed in prominent cliffs, spires, massive rock outcrops, areas of severe surface variation, highly eroded formations, dune systems or detail features that are dominant and exceptionally striking and intriguing. Score: 5	Steep canyons, mesas, buttes, interesting erosional patterns, landforms of variety in size and shape or detail features, which are interesting though not dominant or exceptional. Score 3	Low rolling hills, foothills, or flat valley bottoms or few or no interesting landscape features. Score: 1
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. Score: 5	Some variety of vegetation, but only one or two major types. Score: 3	Little or no variety or contrast in vegetation. Score: 1
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. Score: 5	Flowing, or still, but not dominant in the landscape. Score: 3	Absent, or present, but not noticeable. Score: 0
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snowfields. Score: 5	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element. Score: 3	Subtle colour variations, contrast, or interest; generally mute tones. Score: 1
Adjacent Scenery	Adjacent scenery greatly enhances visual quality Score: 5	Adjacent scenery moderately enhances overall visual quality. Score: 3	Adjacent scenery has little or no influence on overall visual quality. Score: 0
Scarcity	One of a kind, unusually memorable or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. Score: 5	Distinctive, though somewhat similar to others within the region. Score: 3	Interesting within its setting, but fairly common within the region. Score; 1
Cultural Modifications	Modifications add favourably to visual variety while promoting visual harmony. Score: 2	Modifications add little or no visual variety to the area, and introduce no discordant elements Score: 0	Modifications add variety but are very discordant and promote strong disharmony. Score: -4

Scores, when added, amounting to less than 11, are categorised as Low, scores between 12 and 18 as Medium and scores more than 19 as High.

APPENDIX F – LANDSCAPE VALUE

Landscape value is concerned with the relative value that is attached to different landscapes. Landscape values are described as the environmental or cultural benefits, including services and functions that are derived from various landscape attributes (Department of the Environment and Local Government, Ireland (DoE, 2000). A landscape may be valued by different communities for many different reasons without any formal designation, recognising, for example, perceptual aspects such as scenic beauty, tranquillity or wildness, special cultural associations, the influence and presence of other conservation interests, or the existence of a consensus about importance, either nationally or locally (DoE, 2000). These attributes include the components and image of the landscape as already established in the assessment of landscape character, including aesthetic and ecological components, but also includes historical and socio-cultural associations, as well as religious and mythological dimensions.

In determining landscape value, the people or groups of people who could be affected by the proposed development should be considered, due to landscapes being valuable to people in different ways. In this regard, consideration is given to:

- People who live and work in an area may have a different perception of the landscape to that held by visitors because of their more regular contact with the landscape and the ongoing changes within it;
- Special interest, for example the ecological, cultural or historic value of the landscape, as knowledge of these issues can often affect people's perception and appreciation of a landscape; and
- Landscapes valued by a public wider than the local population, because they have a strong image or are well known and valued nationally and internationally.

APPENDIX G – VISUAL RECEPTORS

The number of observers and their perception of the proposed project will have an impact on the VIA and also on the perceived sensitivity of the landscape. The perception of viewers is difficult to determine as there are many variables to consider, such as cultural background, state of mind, reason for the sighting and how often the project is viewed within a set period. It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the project. It is also necessary to generalise the viewer sensitivity to the proposed project to some degree (Oberholzer, 2005).

The IEMA (2002) identifies a number of potential sensitive receptors that may be affected by a proposed development, namely:

- Users of recreational landscapes/ public footpaths and bridleways, including tourists and visitors;
- Residents;
- Users of public sports grounds and amenity open space;
- Users of public roads and railways;
- Workers; and
- Views of or from within valued landscapes.

The sensitivity of visual receptors and views will depend on:

- The location and context of the viewpoint;
- The expectation and occupation or activity of the receptor; and
- The importance of the view.

The most sensitive receptors may include:

- Users of outdoor recreational facilities, including public rights of way, whose attention or interest may be focused on the landscape;
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; and
- Occupiers of residential properties with views affected by the development.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscape of acknowledges importance or value);
- People travelling through or past the affected landscape in cars on trains or other transport routes;
- People at their place of work.

APPENDIX H – VISUAL EXPOSURE AND VISIBILITY

Visual exposure refers to the geographic area from which the proposed project will be visible and is defined by the degree of visibility of a proposed project from various receptors sites. Visibility, in turn, is determined by distance between the components of a proposed project and the viewer.

Visual exposure is determined by the zone of visual influence or the "viewshed". A viewshed is the topographically defined area that includes all the major observation sites from where a proposed development will be visible. The boundary of the viewshed tends to connect high points in the landscape through following ridgelines and demarcates the zone of visual influence. The zone of visual influence usually fades out beyond 5km distance and the further away from an observer the project is, the less visible it would be. It is also important to note that the actual zone of visual influence of the proposed project may be smaller than indicated because of screening by existing vegetation and infrastructure, which may partially or totally obscure a view.

General visibility classes, as applicable to the proposed infrastructure are indicated in the table below.

Table H1: Visibility classes (IEMA, 2002).

Class	Description
Highly visible	Clearly noticeable within the observer's view frame 0 to 5km
Moderately visible	Recognisable feature within observer's view frame 5 to 7.5km
Marginally visible	Not particularly noticeable within observer's view frame 7.5 to 10km
Hardly visible	Practically not visible unless pointed out to observer 10 to 15km+

Three distance zones have been identified (BLM, 1984) based on visibility from travel routes and observation points. These have been determined and confirmed through field verification.

- Foreground – includes local and sub-regional areas visible from main roads, picnic/scenic areas on the side of the road, residential areas such as towns and villages, isolated houses, industrial/commercial areas and gravel forestry roads, and any other viewing locations which are up to 1 kilometre away.
- Middle ground – includes local and sub-regional areas visible from main roads, picnic/scenic areas on the side of the road, residential areas such as towns and villages, isolated houses, industrial/commercial areas and gravel forestry roads, or other viewing locations which are up to 2,5 kilometres away.
- Background – includes sub-regional areas visible from between 2,5 to 5 kilometres away.

Line of Sight Analysis

A line of sight and elevation profile analysis has been conducted through drawing of a graphic line between two points on a surface that shows where along the line the view is obstructed. In Google Earth Pro a series of cross-sections have been evaluated, extending from various points of the proposed project areas, towards possible receptor sites. The visibility of each point along the cross section was calculated though the use of the Google Earth Pro Elevation Profile function. Emphasis was placed on confirming whether the proposed development areas will be visible from sensitive receptors in the vicinity. Various cross sections, selected to traverse a variety of receptor sites, were investigated to supplement information provided by the KOP analysis.

Viewshed Analysis

The viewshed analysis calculates the geographical locations from where the proposed project might be visible. This potential visual exposure of the project has been modelled by creating a Digital Terrain Model (DTM) from 1m contour data, and applying a viewshed analysis using GIS software, whereby all areas with a line of sight towards the proposed project is indicated. It must be noted that

the heights of existing infrastructure and vegetation are not included in the calculation of the viewshed and it is, therefore, important to bear in mind that the proposed development will not be visible from all points within the viewshed, as views may be obstructed by visual elements, whereby such intervening objects will modify the viewshed at ground level.

APPENDIX I – INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and STS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX J – SPECIALIST INFORMATION

Details of the specialist who prepared the report

Details of the specialist who prepared the report

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The expertise of that specialist to compile a specialist report including a curriculum vitae

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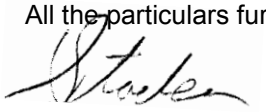
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

Specialist Declaration

I, Stephen van Staden, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Project Manager` q

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist with focus on Freshwater Ecology
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust and emerald Management Trust

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP);
Accredited River Health practitioner by the South African River Health Program (RHP);
Member of the South African Soil Surveyors Association (SASSO);
Member of the Gauteng Wetland Forum;

EDUCATION

Qualifications

Tools for wetland assessment, short course, Rhodes University	2016
MSc (Environmental Management) (University of Johannesburg)	2002
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2000
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	1999

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe
Eastern Africa – Tanzania
West Africa – Ghana, Liberia, Angola, Guinea Bissau
Central Africa – Democratic Republic of the Congo

PROJECT EXPERIENCE (Over 2500 projects executed with varying degrees of involvement)

1 Mining Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)
6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

REFERENCES

- Terry Calmeyer (Former Chairperson of IAIA SA)
  Director: ILISO Consulting Environmental Management (Pty) Ltd
  Tel: +27 (0) 11 465 2163
  Email: terryc@icem.co.za

- Alex Pheiffer
  African Environmental Management Operations Manager

SLR Consulting
Tel: +27 11 467 0945
Email: apheiffer@slrconsulting.com

- Marietjie Eksteen
  Managing Director: Jacana Environmental
  Tel: 015 291 4015

Yours faithfully

STEPHEN VAN STADEN

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF SANJA ERWEE

PERSONAL DETAILS

Position in Company	Ecologist, GIS Technician, Visual Specialist
Date of Birth	8 April 1991
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2014

EDUCATION

Qualifications

BSc Zoology	2013
Short Courses	
Global Mapper	2015
SANBI BGIS Course	2017
Global Mapper Lidar Course	2017

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, KwaZulu-Natal

SELECTED PROJECT EXAMPLES

GIS Assessments

- Completed GIS mapping and GIS analysis for a significant number of ecological projects
- Desktop assessment of 45 wetland and river crossings identified along the proposed Fibreco Fibre Optic Cable Route changes between Cape Town to George, George to Port Elizabeth and from Port Elizabeth to Durban
- High level desktop ecological study and site sensitivity report as part of the site selection process for the possible Rapid Rail Extension to the Gauteng Rapid Rail Network
- Ecological scan and site sensitivity report as part of the environmental authorisation process prior to prospecting activities for two prospecting areas in Newcastle, Kwazulu-Natal
- High level desktop study and site sensitivity report as part of the environmental authorisation process prior to prospecting activities on Portion 4 of the Farm Kapstewel no 436, Administrative District of Hay, Northern Cape
- Cumulative Sensitivity Analyses using GIS Techniques for the Fuleni Anthracite Project, KwaZulu Natal.
- High level desktop study and site sensitivity report for mining activities on the farm Wessel 227 and Dibiaghomo, North of Black Rock, Northern Cape Province
- High level desktop study and site sensitivity report prior to prospecting activities for the Minerano Gold Fields Project, near Viljoenskroon, Free State Province

Wetland Assessments

- Wetland and aquatic ecological assessment for the proposed N3 De Beers Pass Route.
- Wetland assessment as part of the environmental authorisation process for the proposed Sappi Enstra Mill Wastewater Pipeline in Springs
- Wetland Verification and Rehabilitation Criteria for Aspen Hills Estate
- Wetland Ecological Assessment for development in Shoshanguve, adjacent to Tshwane University of Technology
- Wetland assessment as part of the environmental authorisation process for the proposed Braakfontein Coal Mine near Newcastle, Kwazulu-Natal Province
- Wetland assessment as part of the water use license application for the proposed extension of a flood protection wall within the Sorex Estate, Centurion, Gauteng

Faunal Assessments

- Faunal assessment as part of the environmental authorisation process for the proposed New Belfast Mine Railway Siding, Mpumalanga
- Terrestrial ecological scan as part of the environmental authorisation process for the proposed construction of a

sewer system in the Ekangala Township, Gauteng Province
- Faunal assessment as part of the environmental authorisation process for the Ledig Water Project near Pilanesberg National Park, North West Province
- Faunal assessment as part of the ecological assessment for the Op Goedenhoop Section 102 Coal Project, Mpumalanga Province
- Terrestrial faunal, floral and wetland ecological assessment update for the proposed water supply pipeline upgrade at the Duvha Power Station, Mpumalanga

Rehabilitation Plan

- Wetland rehabilitation plan for Dorothy Road, Midrand, Gauteng Province
- Rehabilitation and Management Plan for the Freshwater Resources within the Proposed Rivierplaas Farm No 1486 Residential Development, Western Cape Province
- Wetland Rehabilitation and Management Plan for proposed mixed land use development (Kosmosdal extension 92) on the remainder of portion 2 of the farm Olievenhoutbosch 389 jr, Gauteng
- Wetland rehabilitation and management plan, including input into the stormwater management, landscaping and Red Data Listed species conservation for the Olifantsvlei Cemetery, Gauteng

Risk Assessment

- Motivation for General Authorisation for the development of a pipeline at Sappi in Springs, Gauteng Province

Water Use Licence Application

- Assisting in the public participation for an Integrated Water Use Licence for the proposed sewer pipeline and upgrade of the Refengkgotso Waste Water Treatment Works (WWTW);
- Writing an emergency response plan for the proposed sewer pipeline and Refengkgotso WWTW

Visual Impact Assessment

- Assistance with the proposed Haga Haga Wind Energy Facility and Grid Connection between Komga and Soto, Eastern Cape Province
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Transvaal Gold Mining Estates (TGME) Development Project: Gold Mining Project (GMP) – Pre-Mined Residue (PMR) And Hard Rock Mining (HRM) Near Sabie (Project 10161), Mpumalanga Province
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Transvaal Gold Mining Estates (TGME) Development Project: Gold Mining Project (GMP) – Pre-Mined Residue (PMR) And Hard Rock Mining (HRM) Near Pilgrims Rest (Project 10167), Mpumalanga Province
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed N3 Logistics Hub, adjacent to the N3 national highway, Gauteng Province
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Mining of Gypsum on Portion 0 of the Farm Kanakies 332, near Loeriesfontein, Northern Cape Province
- Visual Impact Assessment as part of the Environmental Impact Assessment and Authorisation Process for the proposed construction of a New Water Treatment Plant at the Khutala Colliery, Ogies, Mpumalanga Province
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Olievenhoutbosch Solar Facility, Centurion, Gauteng Province