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BASIC ASSESSMENT REPORT

HARMONY GOLD:
SAVUKA 7A & 7B TAILINGS STORAGE FACILITY PROJECT

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ACRONYMS AND ABBREVIATIONS

BA:	Basic Assessment
BAR:	Basic Assessment Report
CA:	Competent Authority
CBA	Critical Biodiversity Area
CR:	Critically Endangered
DALRRD:	Department of Land Reform and Rural Development
DFFE:	Department Forestry, Fisheries and Environment
DMPR:	Department of Mineral and Petroleum Resources
DWS:	Department of Water and Sanitation
EA:	Environmental Authorisation
EAP:	Environmental Assessment Practitioner
EAPASA:	Environmental Assessment Practitioners Association of South Africa
ECA:	Environmental Conservation Act No. 73 of 1989
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment
EIMS:	Environmental Impact Management Services (Pty) Ltd
EMP:	Environmental Management Plan

EMPr:	Environmental Management Programme
EN:	Endangered
ER:	Engineer's Representative
ERAP:	Emergency Response Action Plan
ESR:	Environmental Site Representative
ESA	Ecological Support Area
GA:	General Authorisation
GIS:	Geographic Information System
GN	Government Notice
Ha:	Hectare
HGM:	Hydrogeomorphic
HIA:	Heritage Impact Assessment
I&AP:	Interest and Affected Party
I&APs	Interested and Affected Parties
IEM	Integrated Environmental Management
km:	kilometre
LC:	Least Concern
LDM:	Lejweleputswa District Municipality
LOM:	Life of Mine
ℓ/s:	Litres per second
LT:	Least Threatened
MA:	Mining Area
MHSA:	Mine Health and Safety Act 29 of 1996
mm:	millimetre
MPRDA:	Mineral Petroleum Resources Development Act
MR:	Mining Right
MSDS:	Material Safety Data Sheet
MPRDA:	Mineral and Petroleum Resources Development Act, 2002
NEMA:	National Environmental Management Act (Act No. 107 of 1998)
NEM:BA:	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEM:WA:	National Environmental Management: Waste Act 59 of 2008
NWA:	National Water Act
PAOI:	Project Area of Influence
PHRAG:	Provincial Heritage Resources Authority Gauteng
PIA:	Palaeontological Impact Assessment
PPP	Public Participation Process

SACNASP: South African Council Natural and Scientific Professions

SAHRA: South African Heritage Resources Agency

SANBI: South African National Biodiversity Institute

SANS: South African National Standards

SCC: Species of Conservation Concern

SDF: Spatial Development Framework

S&EIA Scoping and Environmental Impact Assessment

TSF: Tailings Storage Facility

VU: Vulnerable

WUA: Water Use Authorisation

WULA: Water Use License Application

WWW: World Wide Web

GLOSSARY OF TERMS

This section provides a catalogue of terms and definitions, which may be used in this report and, or other documents drafted for the project.

Table 1: Glossary of terms

Term	Definition
Alien Invasive Species	Species of plants, animals or other organisms that are not indigenous to a region and which easily spread and destroy the indigenous plant species, taking over an area and causing biological and socio-economic harm.
Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted.
Basic Assessment Process	An environmental assessment process that is undertaken in line with Listing Notices 1 and 3 in terms of the NEMA EIA Regulations with the aim of obtaining Environmental Authorisation.
Clearing/Clearance	Clearing/Clearance refers to the removal of vegetation through permanent eradication and in turn no likelihood of regrowth. 'Burning of vegetation (e.g. fire-breaks), mowing grass or pruning does not constitute vegetation clearance, unless such burning, mowing or pruning would result in the vegetation being permanently eliminated, removed or eradicated'.
Competent Authority	An organ of state charged by the National Environmental Management Act (NEMA) with evaluating the environmental impact of an activity and, where appropriate, with granting or refusing an environmental authorisation in respect of that activity.
Conservation Plan Areas (C-Plan Areas)-	A tool developed by the Environmental Provincial Department to identify sensitive areas. The main purposes of this tool is to: • serve as the primary decision support tool for the biodiversity component of the Environmental Impact Assessment (EIA) process. • inform protected area expansion and biodiversity stewardship programmes in the province; and serve as a basis for development of Bioregional Plans in municipalities within the province.

Term	Definition
	Some of the aspects that inform the identification of C-Plan Areas include Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESA's), Watercourses, Ridges, Protected Areas, etc
Critical Biodiversity Area	Areas that are deemed important to conserve ecosystems and species. For this reason, these areas require protection.
Cultural significance	Means aesthetic, architectural, historical, scientific, social, spiritual, linguistic, or technological value or significance.
Development	Means the building, erection, construction or establishment of a facility, structure, or infrastructure, including associated earthworks or Quarries, that is necessary for the undertaking of a listed or specified activity, but excludes any modification, alteration or expansion of such a facility, structure or infrastructure, including associated earthworks or quarries, and excluding the redevelopment of the same facility in the same location, with the same capacity and footprint.
Duty of Care	Every person who causes, has caused or may cause significant pollution or degradation of the environment to take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environmental is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution and degradation of the environment."
Decommissioning	Means to take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily recommissioned.
Environment	the surroundings within which humans exist and that are made up of— (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and (iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.
Ecological Support Area	Areas that support the ecological functioning of protected areas or CBAs or provide important ecological infrastructure.
Environmental Assessment Practitioner	Individual responsible for the planning, management, coordination or review of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instruments introduced through regulations.
Environmental Authorisation	This is a decision by a Competent Authority to authorise a listed activity in terms of the National Environmental Management Act (NEMA). The authorisation means that a project, either in totality or partially, can commence subject to certain conditions. The Competent Authority has a right to refuse to grant authorisation for a project in totality or partially.
Environmental Impact Assessment Process:	An environmental assessment process that is undertaken in line with Listing Notice 2 the NEMA EIA Regulations with the aim of obtaining Environmental Authorisation.
Environmental Management Programme:	A programme with set objectives and timeframes that seek to achieve a required end state and describes how activities that have or could have an adverse impact on the environment will be mitigated, controlled, and monitored.
Flora	Plant life that occurs in a specific geographical region and/habitat.
Fauna	Animal life that occurs in a specific geographical region and/habitat.
Heritage Resource	Means any place or object of cultural significance.

Term	Definition
Indigenous Vegetation	plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Interested and Affected Party	in relation to an application for Environmental Authorisation, this refers to an interested and affected party whose name is recorded in the register opened for that application in terms of regulation 42 of the NEMA EIA Regulations. This party will ideally be interested in the development but also affected by the proposed application and have a certain interest in the application.
Public Participation Process	In relation to the assessment of the environmental impact of any application for an environmental authorisation, means a process by which potential Interested and Affected Parties are given opportunity to comment on, or raise issues relevant to, the application.
Regulated area of a watercourse:	• The outer edge of the 1:100-year flood line and /or delineated riparian habitat whichever is the greatest measured from the middle of a river, spring, natural channel, lake or dam. • In the absence of a determined 1:100-year flood line or riparian area, the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act). • 500m radius from the delineated boundary of any wetland or pan.
Riparian Area	A Habitat that includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.
Species of Conservation Concern	IUCN Red List definition: Threatened species, and other species of significant conservation importance: Extinct, Extinct in the Wild, Near Threatened, Data Deficient. In South Africa, the following additional categories are added: Rare, Critically Rare.
Threatened or Protected Species	These refers to either plants or animals that are at a threat of Extinction or are protected due to their high conservation value or national importance.
Urban Edge	A demarcated edge of an area that is used as land use management tool to manage, direct and control the outer limits of development growth around an urban area. The aim is to control urban sprawl due to its associated adverse impacts.
Watercourse	(a) a river or spring; (b) a natural channel in which water flows regularly or intermittently; (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks;
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

EXECUTIVE SUMMARY

1 INTRODUCTION AND OVERVIEW

Golden Core Trade and Invest (Pty) Ltd - (a subsidiary of Harmony) also referred to as the 'Applicant', own and operate a number of Gold Mines and Plants in the West Wits region in the Gauteng Province, including the Mponeng Operations Gold Mine where the Savuka Plant is located, near Carletonville. The Savuka Plant currently deposits tailings onto the Savuka 5a, 5b, 7a & 7b Tailings Storage Facilities (TSFs). However, these facilities are approaching their final and approved height i.e. 60 metres above ground level (magl), and the current planned Life of Mine (LOM) for the West Wits region exceed the available deposition capacity of these TSFs. Accordingly, Harmony is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs by 5 to 10 metres, to a total height of not more than 70 magl.

Subsequently, Harmony has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Environmental Assessment Practitioner (EAP) to assist with undertaking the required Environmental Authorisation (EA) processes (including the statutory public participation), and to compile and submit the required documentation in support of an application for:

- Environmental Authorisation (EA) in accordance with the National Environmental Management Act, 1998 (NEMA) EIA Regulations - Listed activities:
    - Listing Notice 1, Activity 34.
- Water Use Authorisation (WUA) in accordance with the National Water Act (Act 36 of 1998) – Section 21 Listed activities:
    - Section 21 (c);
    - Section 21 (g); and
    - Section 21 (i).
- Waste Management License in accordance with the National Environmental Management: Waste Act 59 of 2008:
    - Category A: 13.

The proposed height extension of the Savuka 7a & 7b TSFs Project falls within: Merafong City Local Municipality Wards 5 & 27 (West Rand District Municipality) administrative area. The project area is situated within 2 farm properties distributed between Portion 25 of the Farm Doornfontein 118 IQ and Portion 93 of the Farm Blyvooruitzicht 116 IQ.

2 REGULATORY FRAMEWORK AND PROCESS

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA Regulations, the applicant is required to appoint an EAP to undertake the EIA process, as well as conduct the public participation process towards an application for EA/WML. Mining activities, including activities such as the proposed TSF officially became governable under the NEMA EIA Regulations (as amended) in December 2014 with the competent authority currently identified as the DMPR for the waste and NEMA listed activities.

In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIA's in order to apply for, and be considered for, the issuing of an EA/WML. These EIA Regulations provide a detailed description of the EIA process to be followed when applying for EA/WML for any listed activity.

Other legislation and standards or guidelines considered in this application includes:

- Constitution of South Africa Act (Act 108 of 1996 (CSA);
- The ECA (Act 73 of 1989) and ECA Extension Act;
- DFFE Screening Tool;
- National Water Act (Act No. 36 of 1998) (NWA);
- Mineral and Petroleum Resources Development Act No. 28 of 2002 (as amended) (MPRDA);
- National Environmental Management: Waste Act (No. 59 of 2008);
- Government Notice 634: Waste Classification and Management Regulations, 2013;
- Government Notice 635: National Norms and Standards for the Assessment of Waste for Landfill Disposal, 2013;
- Government Notice 636: National Norms and Standards for Disposal of Waste to Landfill, 2013;
- SANS 10234;
- Government Notice R632: The Regulations regarding the planning and management of residue stockpiles and residue deposits and associated amendment, 2015 as amended;
- The National Environmental Management: Biodiversity Act (Act No. 10 of 2004 – NEMBA);
- The National Environmental Management Protected Areas Act (Act No. 57 of 2003 – NEMPAA);
- Conservation of Agricultural Resources (Act 43 of 1983);
- National Heritage Resources Act (No. 25 of 1999) and Regulations;
- National Environmental Management: Air Quality Act (No. 39 of 2004);
- National Dust Control Regulations (2013);
- SANS 10103 (Noise Regulations);
- Occupational Health and Safety Act (No. 85 of 1993);
- Spatial Planning and Land Use Management Act (Act 16 of 2013 – SPLUMA);
- Gauteng Province Environmental Management Framework (EMF) and Guideline;
- Local By-laws;
- Public Participation Guideline in terms of NEMA EIA Regulations (2017);
- Need and desirability Guideline in terms of NEMA (2012);
- National guideline on minimum information requirements for preparing Environmental Impact Assessments for mining act activities that require environmental authorisation (2018);
- 2004 Information Series covering various aspects of the EIA process;
- Procedures for assessment and minimum criteria for specialist studies;
- In South Africa, SANS 10286 (1998) is the primary management guidance document for TSFs. This standard includes principles and minimum requirements for best practice in mitigating risk;
- Although a credible and useful standard, SANS 10286 currently falls short of more stringent global best practice requirements (notably, the GISTM). SANS 10286 has been redrafted to align with the GISTM. The revised document is currently under final review by the South African Bureau of Standards;
- International;

- Global Tailings Industry Standard on Tailings Management, August 2020 convened by Global Tailings Review.org. Co-convened by the ICMM (International Council on Mining and Metals); UNEP (United Nations Environment Programme) and PRI (Principles for Responsible Investment).

3 PROJECT OVERVIEW

The Applicant holds an approved Mining Right (MR) and Environmental Management Programme (EMPr), in terms of the Minerals and Petroleum Resources Development Act (Act 28 of 2002, as amended) (MPRDA), for the mining of gold at various operations in the West Wits region in the Gauteng Province.

3.1 BRIEF OVERVIEW OF THE PROJECT

The Savuka Plant currently deposits tailings onto the Savuka 7a & 7b Tailings Storage Facilities (TSFs). However, these facilities are approaching their final and approved height i.e. 60 metres, and the current planned Life of Mine (LOM) for the West Wits region exceed the available deposition capacity of these TSFs. Accordingly, the applicant is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs. Slurry deposition is currently taking place on the Savuka 7a & 7b TSFs and Harmony is proposing to extend the height of these TSFs by up to a further 5 to 10 m up to a final approved height of 70 metres maximum.

3.2 BRIEF OVERVIEW OF THE NEEDS AND DESIRABILITY OF THE PROJECT

Deposition space is of vital concern in the West Wits Region for the Applicant, with the current active Tailings Storage Facilities nearing their authorised final height and capacity. Accordingly, the applicant identified Savuka 7a & 7b TSFs as the most feasible options to provide additional deposition space.

The Savuka Plant currently deposits tailings onto the Savuka 7a & 7b Tailings Storage Facilities (TSFs). However, these facilities are approaching their final and approved height (60 m above ground level), and the current planned Life of Mine (LOM) for the West Wits region exceed the available deposition capacity of these TSFs. Accordingly, the applicant is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs with between 5 and 10 m (apply for a final approved height of a maximum of 70 m above ground level). No additional infrastructure is planned as part of the proposed activity.

Benefits associated with increasing deposition space are mainly the sustaining production rates and tonnage of the mines in the region, leading to sustainable continuation of the associated mining activities and thereby indirectly benefit job security.

The continuation of operations at the Mponeng Operations and related mining activities has long term benefits such as continued skills development, job maintenance and creation and poverty alleviation for the surrounding communities and the general public as well continued contribution to the South African economy through the socio-economic development programmes. These benefits would be negatively impacted if production need to be ceased should Mponeng Operations run out of deposition capacity.

The needs and desirability analysis component of the DEA (2017), Guideline on Need and Desirability, Department of Environmental Affairs, includes, but is not limited to, describing the linkages and dependencies between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.), is described in this report.

4 RECEIVING ENVIRONMENT

4.1 GEOLOGY, SOILS AND LAND CAPABILITY

The study area is located within the Witwatersrand basin. The gold and uranium deposits of the Witwatersrand basin constitute one of the great metallogenic provinces of the world. The Witwatersrand sedimentary basin has been deposited over a granite-greenstone basement known as the Kaapvaal Craton (McCarthy and Rubidge,

2005). The accumulated sediments within the basin are collectively known as the Witwatersrand Supergroup and are made up of the West Rand Group (WRG) and the Central Rand Group (CRG).

The Far West Rand goldfields fall within a prominent semi-circular deposit of Transvaal Supergroup rocks, which stretches from the south of Johannesburg, beyond Carletonville to Orkney in the west.

According to the DFFE screening tool, the soils in the TSF area are mostly medium potential agricultural soils with some low agricultural areas and a few spots of high agricultural potential soils. The natural vegetation of the site is classified as Gauteng Shale Mountain Bushveld (according to SANBI, 2018), although there is no to negligible natural vegetation on the site. The TSF covers the full extent of the immediate site and is surrounded by TSFs and other mining activities.

4.2 GROUNDWATER

Groundwater occurrences in the study area are predominantly restricted to the following types of terrains: Weathered and fractured rock aquifer in the Ventersdorp and Transvaal Formations and Dolomitic and Karst Aquifers. Although the dolomite aquifer is the most prominent aquifer in the region, it does not play any role in the activities at the Savuka TSFs. There are no groundwater users downstream from the Savuka TSFs. In terms of the baseline groundwater quality, the specialist concluded the following:

- The groundwater in the monitoring boreholes show a mining impact, with high Total Dissolved Solids (TDS) and sulphate concentrations.
- Several heavy metals exceed the SANS 241 and Livestock Watering guidelines. Apart from the Savuka 7a & 7b TSF's, there is also a larger impact from neighbouring tailings facilities.
- Borehole MB38 is anomalous and has much better quality than the other monitoring boreholes. This is attributed to this borehole being located within the phyto-remediation area.

4.3 SURFACE WATER AND DRAINAGE

The site is positioned within quaternary catchments C23E (Figure 15). Rivers near the site are unnamed, with the National Geospatial Information (NGI)'s 1:50,000 topographical map data illustrating two non-perennial river systems to the north and south, both of which converge to the west of the site (refer to Figure 15 and Figure 16). The southern system is larger than the northern system, however, neither area is sufficiently sized to enable perennial flows (per the NGI's classification). The southern system is associated with a vlei and has upstream furrows directing runoff from part of the greater Mponeng Operation (south of the Old North Complex TSF). Two small dams are noted. The northern system is characterised by two larger dams, both of which appear to be return water dams when reviewing Google Earth imagery. A single non-perennial pan is noted to the north-east of the site.

4.4 AIR QUALITY

The current air quality in the study area is mostly influenced by mining and reclamation activities at Savuka and Mponeng and other companies' mining operations, as well as farming activities, domestic fires, vehicle exhaust emissions and dust entrained by vehicles. These emission sources vary from activities that generate relatively course airborne particulates (such as farmland preparation, dust from paved and unpaved roads, and the mine sites) to fine PM such as that emitted by vehicle exhausts, diesel power generators and processing operations.

Monitoring data were made available to the specialist to analyse. During 2022 to 2024 both the residential and non-residential locations, the dust fall rates were below the respective National Dust Control Regulations (NDCRs) with no exceedances recorded.

4.5 NOISE BASELINE

The area surrounding the project area consists predominately of mining development and other industrial activities. Other dominant land uses in the project area include the local access roads, dirt roads, tar national

road and existing pipeline and powerline servitudes. The proposed properties are expected to be generally flat, with a few steep TSFs in adjacent properties. The area is predominantly characterised by TSFs and other infrastructure related to the mining activities from the Harmony Savuka Mine and other Harmony mining activities in the area. There are some residential areas including schools and community facilities further away from the TSFs.

4.6 TOPOGRAPHY

The northwestern and western sections of the study area comprises gently undulating land that slopes to the west and south to drainage lines that flow to the west and northwest, as well as some *Eucalyptus* plantations. At the residential area associated with Deelkraal, the topography rises to low west-to-east-orientated savannah-covered hills that cross the southern sections of the study area.

4.7 LANDSCAPE QUALITY AND VISUAL

The site is located within an area that is predominantly surrounded by existing mining infrastructure. There are no protected areas in the vicinity of the proposed site. The existing visual condition of the landscape that may be affected by the proposed activity has been described. The study area's scenic quality has been rated low to high within the context of the sub-region. The project footprint is in a landscape type with a low scenic quality. Sensitive receptors, viewing areas and landscape types have been identified and mapped, indicating a potentially low sensitivity to the project. However, the results of the public participation process must confirm this assumption.

4.8 FLORA

The project area is situated within the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

- Seasonal precipitation; and
- The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees. The project area spans across the Gauteng Shale Mountain Bushveld Vegetation Type of this biome.

There is negligible natural vegetation occurring on the study area, as the study area is mainly comprised of the TSFs. The habitat close to the area is described in Section 7.2.3. The TSFs were established decades ago and covers the entire study area. Most of the surrounding land uses are associated with mining. The complete study area and most of the directly adjacent area is already disturbed with mining activities such as the TSFs. During the site visit, the EAP did not encounter any terrestrial biodiversity sensitive features or species on the study area.

4.9 FAUNA

No fauna were observed during the site screening verification visit to the site. The TSFs were established decades ago and covers the entire study area. Most of the surrounding land uses are associated with mining. The complete study area and most of the directly adjacent area is already disturbed by mining activities such as the TSFs. During the site visit, the EAP did not encounter any terrestrial biodiversity sensitive features or species on the study area.

4.10 WETLANDS

Four (4) Hydrogeomorphic (HGM) units were identified within the encompassing 500 m Savuka TSF Project Area Of Influence (PAOI). These were classified as; one (1) channelled valley-bottom, two (2) unchannelled valley-bottoms and one (1) artificial wetland. Several dams were identified within the PAOI, most of which were off-channel features. Furthermore, the one HGM unit has been identified as an artificial depression. In addition, two non-perennial drainage features were identified where one has connectivity to the larger perennial river, namely the Mooiriver. HGM 4 is characterized as “at risk” from the development and the other delineated wetlands as “not at risk” from the proposed development. A 32 m pre-mitigation buffer and a 15 m post-mitigation buffer was applied to the non-artificial wetlands.

4.11 SOCIO-ECONOMIC

The study area is surrounded by various mining residences, other residential areas, institutions, farming communities etc. The main economic activities in the area include mining.

4.12 CULTURAL HERITAGE

The proposed activity is within the existing footprint and as such it will not effect any tangible heritage (archaeology, palaeontology, historic structures) and intangible heritage (local indigenous peoples traditions

5 PUBLIC PARTICIPATION

The Public Participation Process (PPP) as required by Regulation 41(2) of the EIA Regulations, 2014 as amended has commenced. To date the following PPP has been conducted:

- Initial call to register:
    - Newspaper Advertisement: Placement of advertisements in English and SeTswana in the Carletonville/Fochville Herald Newspaper;
    - Placement of site notices: Placement of 6 A1 Correx site notices in English and SeTswana at locations along, within and surrounding the perimeter of the proposed project study area and 7 additional A3 posters in public areas surrounding the study area;
    - Notification of landowners, occupiers and other key I&APs: Notification letters, were distributed to pre-identified I&APs through either email, fax, and/or registered mail where contacts were available.

The BAR is being made available to Interested and Affected Parties (I&APs) for comment for a minimum period of 30 days from the 27th of June 2025 to the 28th of July 2025. All comments received during this period will be included in the Final BAR for submission to the DMPR Gauteng Region for their decision-making process.

6 ENVIRONMENTAL IMPACT STATEMENT

6.1 SUMMARY OF KEY FINDINGS

A summary of the key findings of the environmental impact assessment as undertaken in this BAR is outlined below:

- The majority of the impacts had a low rating prior to mitigation, which were then decreased, but still falls within the low- negative category in the post-mitigation and final significance rating scenario.
- The proposed approved height extension of the Savuka 7a& 7b TSFs has the potential to impact negatively on the surrounding environment. However, the impact assessment conducted by the EAP and specialists concluded that the foreseeable impacts can be mitigated to acceptable levels through the implementation of the proposed mitigation measures.

- Air Quality will only increase slightly and will still fall within all the acceptable levels.
- Radiology impacts can be mitigated to acceptable levels.
- Groundwater pollution will significantly improve with the implementation of phyto-remediation as recommended by the specialist.
- Parts of the TSFs occur within sensitive surface water areas. This primarily includes the influence of the northern and southern river systems adjacent to the TSFs, since the 1:100 RI flood event (medium sensitivity) falls out of the site. The specialist concluded that the activity can be authorised with regard to the hydrological (surface water) environment inclusive of the recommended mitigation measures presented in the report. A review of Mponeng's surface water monitoring plan will be required to ensure that the TSFs are adequately considered (as it relates to monitoring positions).
- The Wetland assessment identified four (4) wetland systems within the 500 m regulated area of the proposed project area of influence. One system is artificial and was not scored. The three natural systems scored an overall PES score ranging from D – "Largely Modified", to E – "Seriously Modified", due to the modifications arising from anthropogenic influences and surrounding mining activities. The ecosystem service score was determined to be "Moderately High" for one and "Intermediate" for the other two HGM's identified. The wetlands average EIS scores were in the "B – High" EIS class. A post-mitigation buffer of 15 m was assigned to the systems.
- The already low noise levels created by the operation of the TSFs, will not increase by the height extension.
- The VIA identified some sensitive visual receptors to the southeast of the TSFs, however, it was concluded that the added impact of the 5 to 10 m height extension is negligible.
- It should be noted that the potentially severe impact of a dam wall break on safety and livelihoods is not adequately conveyed by the impact assessment (final significance low), since the probability is low, but the severity if very high, resulting in the impact appearing less significant than may be warranted.
- Consultation with the community and landowners will be conducted in order to capture any comments or concerns regarding the proposed activities and to ensure the community and landowners are kept informed and allowed to raise issues. The concerns raised will be included in the final BAR.

6.2 FINAL LAYOUT MAP

The final layout map showing the location of the activity against the identified as part of the Basic Assessment Process, Specialist Studies the Provincial Biodiversity Plans is presented in Section 10. The proposed TSF height extension project is located along a disturbed and modified area. The identified sensitivities include the flood line and the three (3) delineated hydrogeomorphic (HGM) units within a 500 m regulated area. These comprise a Channelled Valley Bottom (CVB) and two Unchannelled Valley Bottom (UVB) wetlands. Sensitive air quality and visual impact receptors have also been identified as sensitive.

6.3 SUMMARY OF POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS

The proposed height extension of Savuka 7A and 7B TSFs will have one important positive impact (need and desirability) i.e. extending employment opportunities at the mine and in turn have a positive impact on the continued economy of the area. Several negative direct and indirect impacts have also been identified, that may result from the height extension of the TSFs, such as reduced air quality, ground and surface water impacts, sensitive habitat impacts, visual and noise and resultant impact on sense of place, as well as health impacts from radioactive material and gases being released into the atmosphere and groundwater. These impacts ranges from short to long term and were all rated as low post mitigation.

The implementation of the proposed mitigation measures will ensure that the negative implications and risks of the project are reduced to a low level. Appropriate mechanisms for avoidance and mitigation of these negative impacts are included in the EMPr.

7 CONCLUSION

The impacts on the environment can be mitigated through open communication with the community, landowners, and implementation of the proposed EMPr mitigation measures. It is, therefore, the opinion of the EAP and appointed specialist that the proposed activity should be authorised as long as the proposed mitigation measures are implemented. This will ensure continued employment of the existing workforce.

1 INTRODUCTION

Golden Core Trade and Invest (Pty) Ltd. - (a subsidiary of Harmony) also referred to as the 'Applicant', own and operate a number of Gold Mines and Plants in the West Wits region in the Gauteng Province, including the Mponeng Operations Gold Mine where the Savuka Plant is located, near Carletonville. The Savuka Plant currently deposits tailings onto the Savuka 5a, 5b, 7a & 7b Tailings Storage Facilities (TSFs). However, these facilities are approaching their final and approved height i.e. 60 metres above ground level (magl), and the current planned Life of Mine (LOM) for the West Wits region exceed the available deposition capacity of these TSFs. Accordingly, Harmony is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs by 5 to 10 metres, to a total height of not more than 70 magl.

Subsequently, Harmony has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Environmental Assessment Practitioner (EAP) to assist with undertaking the required Environmental Authorisation (EA) processes (including the statutory public participation), and to compile and submit the required documentation in support of an application for:

- Environmental Authorisation (EA) in accordance with the National Environmental Management Act, 1998 (NEMA) EIA Regulations - Listed activities:
    - Listing Notice 1, Activity 34.
- Water Use Authorisation (WUA) in accordance with the National Water Act (Act 36 of 1998) – Section 21 Listed activities:
    - Section 21 (c);
    - Section 21 (g); and
    - Section 21 (i).
- Waste Management License in accordance with the National Environmental Management: Waste Act 59 of 2008:
    - Category A: 13.

The proposed height extension of the Savuka 7a & 7b TSFs Project falls within: Merafong City Local Municipality Wards 5 & 27 (West Rand District Municipality) administrative area. The project area is situated within 2 farm properties distributed between Portion 25 of the Farm Doornfontein 118 IQ and Portion 93 of the Farm Blyvooruitzicht 116 IQ.

The Public Participation Process (PPP) as required by Regulation 41(2) of the EIA Regulations, 2014 as amended has commenced. To date the following PPP has been conducted:

- Initial call to register:
    - Newspaper Advertisement: Placement of advertisements in English and SeTswana in the Carletonville/Fochville Herald Newspaper;
    - Placement of site notices: Placement of 6 A1 Correx site notices in English and SeTswana at locations along, within and surrounding the perimeter of the proposed project study area and 7 additional A3 posters in public areas surrounding the study area;
    - Notification of landowners, occupiers and other key I&APs: Notification letters, were distributed to pre-identified I&APs through either email, fax, and/or registered mail where contacts were available.

The BAR is being made available to Interested and Affected Parties (I&APs) for comment for a minimum period of 30 days from the 27th of June 2025 to the 28th of July 2025. All comments received during this period will be included in the Final BAR for submission to the DMPR Gauteng Region for their decision-making process.

1.1 REPORT STRUCTURE

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

Table 2: Report Structure

Environmental Regulation NEMA EIA Regulations, 2014	Description	Section in Report
Appendix 1(3)(1)(a):	details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Section 1 and Appendix A
Appendix 1(3)(1)(b):	the location of the activity, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 1.3
Appendix 1(3)(1)(c):	a plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale; or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 1.3
Appendix 1(3)(1)(d):	a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the activities to be undertaken including associated structures and infrastructure-	Section 2
Appendix 1(3)(1)(e):	a description of the policy and legislative context within which the development is proposed including-	Section 3

Environmental Regulation NEMA EIA Regulations, 2014	Description	Section in Report
	(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	
Appendix 1(3)(1)(f):	a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 4
Appendix 1(3)(1)(g):	a motivation for the preferred site, activity and technology alternative;	Section 5
Appendix 1(3)(1)(h):	a full description of the process followed to reach the proposed preferred alternative within the site, including- (i) details of all the alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage, and cultural aspects; (v) the impacts and risks identified for each alternative including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts – aa) can be reversed; bb) may cause irreplaceable loss of resources; and cc) can be avoided, managed, or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent duration and probability of potential environmental impacts and risks associated with the alternatives;	Section 5 Section 6 Section 7 Section 8

Environmental Regulation NEMA EIA Regulations, 2014	Description	Section in Report
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) the outcome of the site selection matrix; (x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and (xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	
Appendix 1(3)(1)(i):	a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 8
Appendix 1(3)(1)(j):	an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be avoided, managed or mitigated;	Section 8 and Appendix Appendix G.

Environmental Regulation NEMA EIA Regulations, 2014	Description	Section in Report
Appendix 1(3)(1)(k):	where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	Section 9
Appendix 1(3)(1)(l):	an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 10
Appendix 1(3)(1)(m):	based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	Section 11
Appendix 1(3)(1)(n):	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 12
Appendix 1(3)(1)(o):	a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 13
Appendix 1(3)(1)(p):	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 14
Appendix 1(3)(1)(q):	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	Section 15
Appendix 1(3)(1)(r):	an undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs;	Section 16

Environmental Regulation NEMA EIA Regulations, 2014	Description	Section in Report
	(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties; and	
Appendix 1(3)(1)(t):	any specific information that may be required by the competent authority; and	None
Appendix 1(3)(1)(u):	any other matters required in terms of section 24(4)(a) and (b) of the Act.	None

1.2 DETAILS OF THE EAP

EIMS has been appointed by Mponeng Operations as the independent Environmental Assessment Practitioner (EAP) to prepare and submit the Environmental Authorisation (EA) and Waste Management License (WML) applications, Basic Assessment Report, and undertaking a Public Participation Process (PPP). The contact details of the EIMS consultant and EAP who compiled this report are as follows:

- Name: Monica Niehof
- Tel No: + 27 11 789 7170
- Fax No: +27 86 571 9047
- E-mail address: savukatsf@eims.co.za

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

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

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

Monica is an Environmental Assessment Practitioner (EAP) and environmental auditor. She is registered as an Environmental Assessment Practitioner (EAP) with EAPASA and she holds a Bachelor of Science Honours degree in Environmental Management from the University of South Africa. She has 13 years' experience in the environmental field, during which Environmental Impact Assessment Process has been one of her main responsibilities. She has extensive experience in Environmental Impact Assessments, including for Environmental Authorisation (EA), Water Use License (WUL), Air Emission License (AEL) and Waste Management License (WML) applications, as well as auditing of EAs and other authorisations and licenses. Experience was gained in sectors including residential, retail, manufacturing, mining, energy, fuel infrastructure etc. Either being part of the EAP or auditing team, or as auditor and as Senior EAP. Clients included Municipalities, Private Companies, individuals, State Owned Entities etc.

1.3 LOCATION OF THE OVERALL ACTIVITY

The table below provides details on the properties that fall within the EA Application Area. The proposed application area is located across two farm portions for which EA is required. Refer to Figure 1 below for the locality map for the proposed activity and Figure 2 for the location within the Gauteng Environmental Management Framework.

Table 3: Locality Details

Farm Name (s)	The proposed project is located on Portion 25 of the Farm Doornfontein 118 IQ and Portion 93 of the Farm Blyvooruitzicht 116 IQ.
Application Area (Ha)	Approximately 270 Ha

Magisterial District	West Rand District Municipality
Distance and direction from nearest town	The proposed extension of the Savuka 7a & 7b TSFs Project falls within: Merafong City Local Municipality Wards 5 & 27 and is located approximately 6.5 km southwest of the central business district of Carletonville.
21-digit Surveyor General Code for each Portion	T0IQ00000000011800025 T0IQ00000000011600093

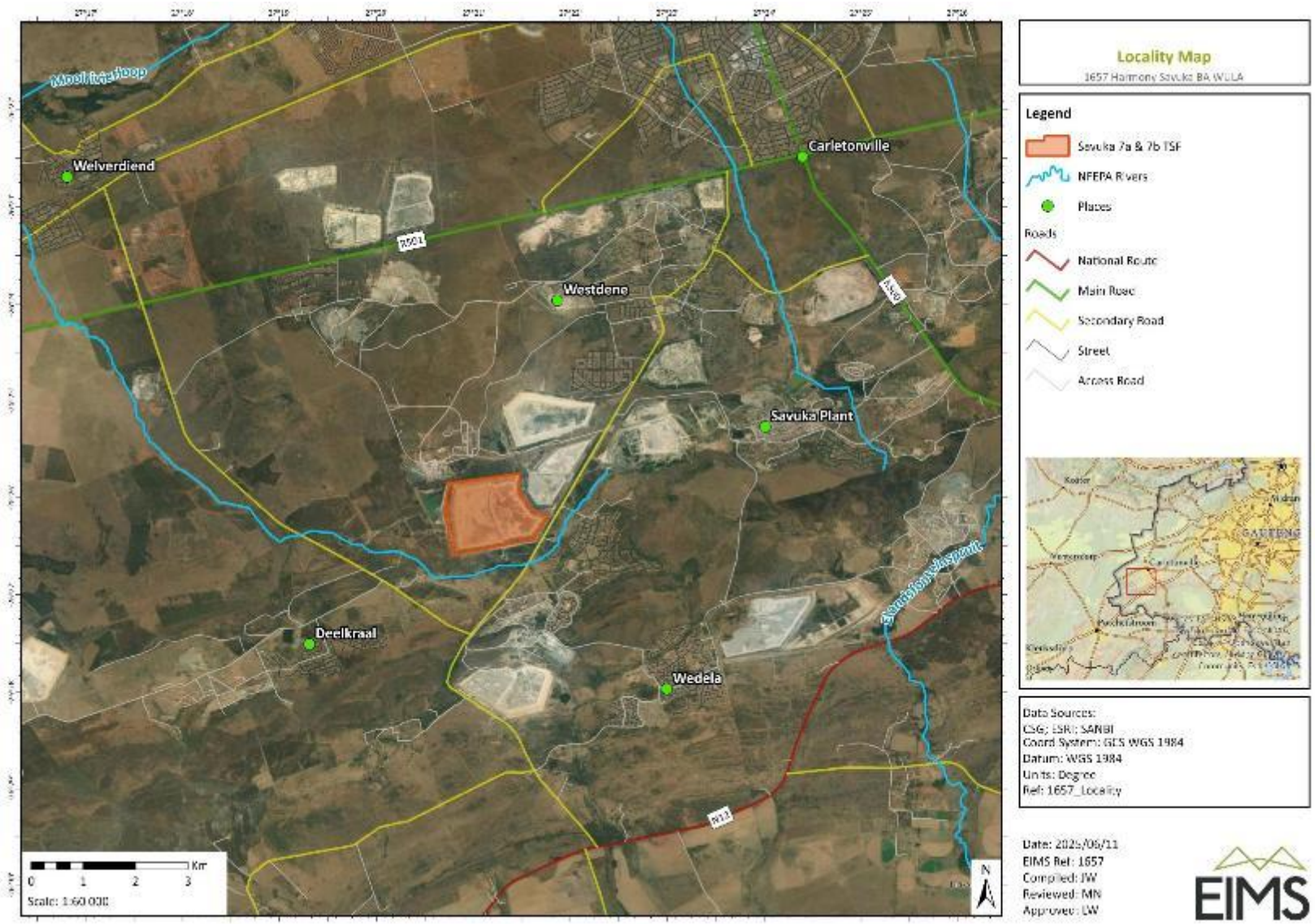

Figure 1: Locality Map for the Harmony Savuka 7a & 7b TSFs.

Figure 2: Gauteng environmental management framework

2 SCOPE OF THE PROPOSED ACTIVITY

The Applicant holds an approved Mining Right (MR) and Environmental Management Programme (EMPr), in terms of the Minerals and Petroleum Resources Development Act (Act 28 of 2002, as amended) (MPRDA), for the mining of gold at various operations in the West Wits region in the Gauteng Province. The Savuka Plant currently deposits tailings onto the Savuka 7a & 7b Tailings Storage Facilities (TSFs). However, these facilities are approaching their final and approved height i.e. 60 metres, and the current planned Life of Mine (LOM) for the West Wits region exceed the available deposition capacity of these TSFs. Accordingly, the applicant is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs. Slurry deposition is currently taking place on the Savuka 7a & 7b TSFs and Harmony is proposing to extend the height of these TSFs by up to a further 5 to 10 m up to a final approved height of 70 metres maximum.

2.1 OVERVIEW OF PROPOSED ACTIVITIES

The specialist studies undertaken to inform this impact assessment includes an Air Quality Impact Assessment, Groundwater Assessment, Hydrological Assessment, Wetland Delineation and Assessment, Visual Impact Assessment, Closure Costing and a Health Risk and Radiological Impact Assessment. The DFFE Screening Tool (Appendix F) has flagged some of the above-mentioned aspects as having either “Very high” or “High” sensitivities in the receiving environment in relation to the proposed project activities.

2.2 LISTED AND SPECIFIED ACTIVITIES

The planned height extension of the 7a and 7b TSFs will require environmental authorisation. Table 4 below outlines the anticipated activities applied for in terms of the NEMA for the proposed height extension of the TSFs.

Table 4: Listed and Specified Activities

Activity No(s):	Applicable listing notice	Project applicable to the listed activity
Listing Notice 1, Activity 34	The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding— (i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or (iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity	Increase of 5 m to 10 m in approved height on existing approximately 270 ha TSF compartments.

Activity No(s):	Applicable listing notice	Project applicable to the listed activity
	will be increased by 50 cubic meters or less per day.	
GNR921 Category A: 13	The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule. The TSFs to be extended will extend in height only and therefore, does not trigger any other additional waste management activity in terms of this Schedule.	Increase of 5 m to 10 m in approved height on existing approximately 270 ha TSF compartments.

3 POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the governing legislation and policies identified which relates to the proposed project. Table 5 below describes the applicable policy and legislative context used to compile the BAR.

Table 5: Applicable Policy and Legislative Context

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
Constitution of South Africa Act (Act 108 of 1996 (CSA)	Section 5 alternative assessment Section 8 impact assessment Appendix H Environmental Management Programme.	The BA and associated impact mitigation actions are conducted to fulfil the requirement of the Bill of Rights. The constitution of any country is the supreme law of that country. The Bill of Rights in chapter 2 section 24 of the Constitution of South Africa Act (Act No. 108 of 1996) makes provisions for environmental issues and declares that: "Everyone has the right - a) to an environment that is not harmful to their health or well-being; and b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: i. prevent pollution and ecological degradation; ii. promote conservation; and iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development". The BA is conducted to identify any harm to the socio-economic and bio-physical environment that may result as a consequence of the proposed development and to protect the environment, prevent pollution and ecological degradation and to secure sustainable development, an Environmental Management Programme has been compiled with input from specialists, according to the mitigation hierarchy.
The ECA (Act 73 of 1989) and ECA Extension Act	The Noise Control Regulations (NCR) was considered in relation to the potential noise that may be generated mainly	Section 25 of the Act and the Noise Regulations (GN R. 154 of 1992) promulgated under this section are still in effect. These Regulations serve to control

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
	during the proposed project. The two key aspects of the NCRs relate to disturbing noise and noise nuisance. Mitigation measures are incorporated in the EMPr in Appendix H.	noise and general prohibitions relating to noise impact and nuisance. In terms of section 25 of the ECA, the National Noise Control Regulations (GN R. 154 – NCRs) published in Government Gazette No. 13717 dated 10 January 1992, were promulgated. The NCRs were revised under GN R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Provincial noise control regulations have been promulgated in Gauteng, Free State and Western Cape Provinces. The NCRs was considered in relation to the potential noise that may be generated mainly during the construction phase of the proposed project. The two key aspects of the NCRs relate to disturbing noise and noise nuisance. Mitigation measures are incorporated in the EMPr.
National Environmental Management Act (Act No. 107 of 1998) (NEMA) and the EIA Regulations, 2014, as amended	This Basic Assessment Report is prepared as in support of the Application for Environmental Authorisation under the NEMA.	In terms of the NEMA, an Application for EA subject to a Basic Assessment Process has been applied for. Activities applied for: • GNR 983 Activity 21D & 34.
DFFE Screening Tool	The screening Tool provided a list of specialist studies for consideration and inclusion in the process. The Screening Tool identified environmental sensitivities and the specialist studies input are discussed in Section 6.9 of the BAR.	A Screening Tool Report was generated from the DFFE Screening tool as per the requirements of Regulation 16 (1)(b)(v) of the EIA Regulations 2014, as amended, and was included in the Application for EA. The screening Tool provided a list of specialist studies for consideration and inclusion in the process.
National Water Act (Act No. 36 of 1998) (NWA):	Section 2.2 of this report provides detail on applicable water uses.	A WUL application has been submitted to DWS in terms of Section 21 of the NWA. The applicable listed water uses are: Section 21 (g): Disposing of waste in a manner which may detrimentally impact a water resource. Section 21 (c): Impeding or diverting the flow of water in a water course.

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
		Section 21 (i) Altering the bed, banks, course or characteristics of a watercourse.
Mineral and Petroleum Resources Development Act No. 28 of 2002 (as amended) (MPRDA)	This Basic Assessment Report is prepared as in support of the Application for Environmental Authorisation under the NEMA. Section 2.2 of this report provides detail on applicable water uses.	The aim of the MPRDA is to "make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources". The MPRDA outlines the procedural requirements that need to be met to acquire mining rights in South Africa. The MPRDA also requires adherence with related legislation, chief amongst them is the National Environmental Management Act (Act No. 107 of 1998, NEMA) and the National Water Act (Act No. 36 of 1998, NWA). Section 102, Mining Rights, etc). This Basic Assessment Report is prepared as in support of the Application for Environmental Authorisation under the NEMA and a Water Use License Process is being followed to apply for authorisation in terms of the NWA.
National Environmental Management: Waste Act (No. 59 of 2008)	This application and BA process is an integrated Environmental Authorisation and Waste Management License Application Process and this BA Report and EMPr is compiled in support of that application.	This application and BA process is an integrated Environmental Authorisation and Waste Management License Application Process. The applicable listed activity applied for are: GN921 (2013 as amended): Waste Management Activities Category A: 13 : The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule.
Government Notice 634: Waste Classification and Management Regulations, 2013. **Government Notice 635: National Norms and Standards for the Assessment of Waste for Landfill Disposal, 2013.** **Government Notice 636: National Norms and Standards for Disposal of Waste to Landfill, 2013.**	The waste pertaining to this application was classified according to the regulations. The Geohydrologist also recommended alternatives in terms of mitigating ground water pollution due to seepage of waste. Refer to Section 7 and 8.	In terms of GN R.634 of 2013, all waste generators must ensure that their waste is classified in accordance with SANS 10234. This was done and it was concluded that the Type of Waste for the Savuka TSF is a Type 3 waste, requiring a Class C barrier. However, the facility is not lined, as current facilities remain legal in terms of transitional arrangements and based on that the TSFs and RWDs have already been approved in terms of an EMPR authorised before 2 September 2014. Seeing that only the height of the TSF will be extended and no new infrastructure is required or new types of waste will be introduced, it is not

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
SANS 10234.		required for the applicant to install a barrier as part of this application or as part of the amendment of the WUL. The geohydrologist recommended feasible alternatives in terms of mitigating ground water pollution.
Government Notice R632: The Regulations regarding the planning and management of residue stockpiles and residue deposits and associated amendment, 2015 as amended.	This BAR (this report) and EMPr (Appendix H).	The purpose of these Regulations is to regulate the planning and management and reporting of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation. This includes: • The assessment of impacts and analyses of risks relating to the management of residue stockpiles and residue deposits: NEMA process. This Basic Assessment Report is prepared as in support of the Application for Environmental Authorisation under the NEMA. A competent person must recommend the pollution control measures suitable for a specific residue stockpile or residue deposits. Specialist studies have been conducted and mitigation measures are included in the EMPr. It should be noted that the TSF has been approved prior to the coming into effect of this regulations and therefore, it is managed according to the approved management measures as per the approved EMPr.
The National Environmental Management: Biodiversity Act (Act No. 10 of 2004 – NEMBA)	Section 7: Description of the Environment. Site Screening and Verification Report (SSVR) for motivation for no specialist report required for Terrestrial Biodiversity including animal and plant sensitivity themes. (Appendix F). Aquatic biodiversity specialist assessment (Appendix E)	Regulations published under NEMBA provides a list of protected species (flora and fauna), according to the Act (GN R. 151 dated 23 February 2007, as amended in GN R. 1187 dated 14 December 2007) which require a permit in order to be disturbed or destroyed. No vegetation clearance will take place and not fauna will be disturbed by the increase in height of the TSF. The DFFE screening tool indicated a very high sensitivity for both aquatic and terrestrial biodiversity and medium sensitivity for plant and animal species. However, the EAP confirmed through the site screening verification process that the site has low sensitivity for all of the above themes,

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
		except aquatic biodiversity. A motivation was included in the SSVR for why no Terrestrial Biodiversity, including plant and animal species specialist report was not required. An aquatic biodiversity assessment was conducted by a suitably qualified specialist.
The National Environmental Management Protected Areas Act (Act No. 57 of 2003 – NEMPAA)	Appendix F (SSVR) and DFFE screening tool report.	No protected areas will be affected by the proposed development.
Conservation of Agricultural Resources (Act 43 of 1983)	Section 6.4 Description of the receiving environment including sensitive agricultural features. SSVR for motivation why no agricultural assessment was required (Appendix F). EMPr – mitigation measures to prevent erosion, alien invaders etc. (Appendix H).	The law on Conservation of Agricultural Resources (Act 43 of 1983) aims to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants. No additional footprint or agricultural resources will take place for the proposed development. Mitigation measures to prevent spread of alien invaders and erosion and other impacts on the environment and adjacent agricultural resources have been included in Appendix EMPr.
National Heritage Resources Act (No. 25 of 1999) and Regulations	Section 7.3 Description of the receiving environment including heritage and palaeontological features are provided. EMPr – mitigation measures to prevent erosion, alien invaders, groundwater pollution etc. (Appendix H). Section 6 and Appendix D Public Participation Process. Appendix F SSVR SSVR Appendix F	Archaeological and Cultural Sensitivity was low in terms of the DFFE screening tool report and verified by the EAP through the site screening verification process. No study was required. Palaeontological Sensitivity was high in terms of the DFFE screening tool report. However, due to the nature of the activity no study is required. Notification of the proposed development has been submitted to the South African Heritage Resource Agency (SAHRA) via the South African Heritage Resources Information System (SAHRIS) to confirm the opinion of the EAP that no studies is required as the impact will be very low or non-existent.

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
National Environmental Management: Air Quality Act (No. 39 of 2004) **National Dust Control Regulations (2013)**	Section 8 assesses the impact of the generation of dust and other pollutants during the operational phase. EMPR Appendix H Mitigation measures. Appendix E: Air Quality Impact Assessment Report	Mitigation measures relating to the management of air pollutants and dust impacts are included EMPr of this report. This includes dust suppression measures and dust monitoring.
SANS 10103 (Noise Regulations)	Section 8 assesses the impact of noise impacts during installation of the pipeline.	Mitigation measures relating to the management of noise impacts are included Part B: EMPr of this report.
Occupational Health and Safety Act (No. 85 of 1993)	General duties of employers to their employees.	Mitigation measures ensuring the health and safety of employees are included Part B: EMPr of this report.
Spatial Planning and Land Use Management Act (Act 16 of 2013 – SPLUMA)	Figure 1 Locality map and layout. Section 2 Project Description.	The Spatial Planning and Land Use Management Act (Act 16 of 2013 – SPLUMA) is set to aid effective and efficient planning and land use management, as well as to promote optimal exploitation of minerals and mineral resources. The nature of the application is such that it complies with the act. The height extension as preferred and proposed alternative is the most effective use of land and resources.
Gauteng Province Environmental Management Framework (EMF) and Guideline	Figure 2	In terms of the GPEMF the development site falls in Zone 4: Normal control zone. The intention of the zone is that because it is dominated by agricultural uses outside the urban development zone, agricultural and rural development that support agriculture should be promoted in this zone. Seeing that the mine / TSF has been established before the GPEMF, it is not seen as a new development and therefore, it is not going against the intention for this area.
Local By-laws	Merafong City Local Municipality Solid Waste Management By-Laws, 2004: West Rand District Municipality Disaster Management Development Risk Management By-law, 2015	Merafong City Local Municipality Solid Waste Management By-Laws, 2004 is incorporated in mitigation measures regarding waste and is addressed in the impact assessment (Section 8 and EMPr (Appendix H). West Rand District Municipality Disaster Management Development Risk Management By-law, 2015

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
	West Rand Civil Contingencies By-law, 2015 Section 8 EMPr (Appendix H)	This by-law mainly regulates safety in terms of Dolomite. Section 7.1.2 describes the Geotechnical environment of the study area and the risks involved of the proposed development activity in relation to dolomite.
Public Participation Guideline in terms of NEMA EIA Regulations (2017).	Section 6 of the BAR.	The guideline was followed in the initial PPP notification period and will also be followed during the complete BA process.
Need and desirability Guideline in terms of NEMA (2012).	Section 4 of the BAR.	The guideline is being followed in the BA Process as set out in Section 4 of the BAR.
National guideline on minimum information requirements for preparing Environmental Impact Assessments for mining act activities that require environmental authorisation (2018).	Section 1.1 of the BAR.	This report, including all the appendices contains all minimum information requirements for preparing EIAs for mining act activities that require environmental authorisation.
2004 Information Series covering various aspects of the EIA process.	Various sections of the BAR (this report).	The information series was utilised as a guide in conducting the Basic Assessment Process.
Procedures for assessment and minimum criteria for specialist studies.	Appendix E	The specialists is aware of these criteria and all specialist studies complies with these criteria and procedures.
In South Africa, SANS 10286 (1998) is the primary management guidance document for TSFs. This standard includes principles and minimum requirements for best practice in mitigating risk. **Although a credible and useful standard, SANS 10286 currently falls short of more stringent global best practice requirements (notably, the GISTM). SANS 10286 has been redrafted to align with the GISTM. The revised document is currently under final review**	EMPr Appendix H	The tailings are managed in accordance with the SANS standards for tailings management.

Applicable Legislation and Guidelines	Reference Where Applied (i.e., where in this document has it been explained how the development complies with and responds to the legislation and policy context)	How does this Development Comply with and Respond to the Legislation and Policy Context
by the South African Bureau of Standards.		
International		
Global Tailings Industry Standard on Tailings Management, August 2020 convened by Global Tailings Review.org. Co-convened by the ICMM (International Council on Mining and Metals); UNEP (United Nations Environment Programme) and PRI (Principles for Responsible Investment).	EMPr Appendix H	Harmony generally aims to align their operations with the GISTM, however, these TSFs were constructed well before the GISTM standards were drafted. The GISTM is therefore not considered applicable to the Savuka TSF complex.

4 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

Deposition space is of vital concern in the West Wits Region for the Applicant, with the current active Tailings Storage Facilities nearing their authorised final height and capacity. Accordingly, the applicant identified Savuka 7a & 7b TSFs as the most feasible options to provide additional deposition space.

The Savuka Plant currently deposits tailings onto the Savuka 7a & 7b Tailings Storage Facilities (TSFs). However, these facilities are approaching their final and approved height (60 m above ground level), and the current planned Life of Mine (LOM) for the West Wits region exceed the available deposition capacity of these TSFs. Accordingly, the applicant is undertaking a feasibility assessment to increase the height of the Savuka 7a & 7b TSFs with between 5 and 10 m (apply for a final approved height of a maximum of 70 m above ground level). No additional infrastructure is planned as part of the proposed activity.

Benefits associated with increasing deposition space are mainly the sustaining production rates and tonnage of the mines in the region, leading to sustainable continuation of the associated mining activities and thereby indirectly benefit job security.

The continuation of operations at the Mponeng Operations and related mining activities has long term benefits such as continued skills development, job maintenance and creation and poverty alleviation for the surrounding communities and the general public as well continued contribution to the South African economy through the socio-economic development programmes. These benefits would be negatively impacted if production need to be ceased should Mponeng Operations run out of deposition capacity.

The needs and desirability analysis component of the DEA (2017), Guideline on Need and Desirability, Department of Environmental Affairs, includes, but is not limited to, describing the linkages and dependencies between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.). Table 6 presents the needs and desirability analysis undertaken.

Table 6: Needs and desirability analysis for the proposed project

Ref No.	Question	Response
1	Securing ecological sustainable development and use of natural resources	
1.1	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management Framework, Spatial Development Framework (SDF) and global and international responsibilities.	A number of specialist studies informs this application and include: • Hydrology • Geohydrology • Aquatic and Wetland • Air quality • Visual • Health Risk and Radiological • Closure Costing The conclusions and recommendations of these studies are included in this report.
1.2	How will this project disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the ecological statement in Section 10 and the impact assessment in Section 9 of this report.
1.3	How will this development pollute and / or degrade the biophysical environment? What measures were explored to either avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	
1.4	What waste will be generated by this development? What measures were explored to avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	Waste will not be generated during the operational phase, apart from the tailings material. No additional infrastructure is proposed and as such, no additional waste will be generated by the proposed activity.

Ref No.	Question	Response
1.5	How will this project disturb or enhance landscapes and / or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	In terms of the DFFE Screening Tool the site has low heritage sensitivity and as such a specialist study is not required be required. The South African Heritage Resources Agency are a registered Interested and Affected Party and have been approached for comment. Comments will be included in the final BAR.
1.6	How will this project use and / or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the impact assessment in Section 8 of this report. As a result of the fact that this project entails an increase in height of existing TSFs on existing footprints, it is anticipated that this activity will not lead to a significant impact or depletion of non-renewable natural resources.
1.7	How will this project use and / or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and / or impacts on the ecosystem jeopardise the integrity of the resource and / or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	Refer to the impact assessment in Section 8 of this report. As a result of the fact that this project entails an increase in height of existing TSFs on existing footprints, it is anticipated that this activity will not lead to a significant impact or depletion of renewable natural resources.
1.7.1	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)?	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations.
1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used?	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations, as such the proposed activity will not use any additional natural resources.

Ref No.	Question	Response
1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations.
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts:	
1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	The limitations and/or gaps in knowledge are presented in Section 13.
1.8.2	What is the level of risk associated with the limits of current knowledge?	The level of risk is considered low at this stage.
1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	At this stage it is anticipated that this activity will not lead to a significant impact on the receiving environment. Refer to the impact assessment in Section 8 of this report.
1.9	How will the ecological impacts resulting from this development impact on people's environmental right in terms following?	
1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	The proposed activities are anticipated to have low negative ecological impacts. Refer to the impact assessment in Section 8 in this report.
1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	A moderate impact on third party wellbeing and livelihoods is expected. Low ecosystem service impacts are currently foreseen, with mitigation. Refer to the impact assessment in Section 8 of this report.

Ref No.	Question	Response
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	The proposed activities are anticipated to have generally low negative ecological impacts. Refer to the impact assessment in Section 8 in this report.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Refer to Section 5 - details of the alternatives considered.
1.13	Describe the positive and negative cumulative ecological / biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to Section 8 of this report.
2	Promoting justifiable economic and social development	
2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following:	
2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks or policies applicable to the area	Refer to Section 6.9 of this report for a breakdown of the demographics and social environment in the project area. The Merafong City Local Municipality IDP identifies Economic Development as one of the outcomes of one of its key performance areas (IDP 2023/24).
2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations.
2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	Refer to the description of the environment in Section 6 of this report.
2.1.4	Municipal Economic Development Strategy ("LED Strategy").	The proposed activity is only for the height extension of an exiting TSF for additional deposition space

Ref No.	Question	Response
		required for the applicant's existing operations. Considering the location of the activities, it is not anticipated to promote or facilitate spatial transformation and sustainable urban development.
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	Refer to the impact assessment in Section 8 in this report.
2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations. The applicant, however, does have various social and LED initiatives required under their existing Social & Labour Plan (SLP) commitments.
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Refer to the public participation process and feedback contained in Appendix D.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	Refer to the impact assessment and mitigation measures in Section 8 of this report.
2.5	In terms of location, describe how the placement of the proposed development will:	
2.5.1	Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations as such the activity will not create additional residential and employment opportunities, but will sustain current opportunities.
2.5.2	Reduce the need for transport of people and goods.	The activities are not anticipated to have an impact on the transportation of goods and people.

Ref No.	Question	Response
2.5.3	Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms of public transport),	The activities are not anticipated to have any significant impact on the public transport.
2.5.4	Compliment other uses in the area,	The surrounding area is impacted by existing TSF facilities.
2.5.5	Be in line with the planning for the area.	Refer to item 2.1.1 of this table (above).
2.5.6	For urban related development, make use of underutilised land available with the urban edge.	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations on an existing footprint, as such the activity will not require any additional land.
2.5.7	Optimise the use of existing resources and infrastructure.	Yes, the proposed activity is for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations on an existing footprint, as such the activity will promote the use of existing resources and infrastructure.
2.5.8	Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement).	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations on an existing footprint.
2.5.9	Discourage "urban sprawl" and contribute to compaction / densification.	The proposed activity is only for additional deposition space required for the applicant's existing operations on an existing footprint, as such the activity will not require any additional land.
2.5.10	Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs.	Refer to items 2.5.7 – 2.5.9 of this table (above).

Ref No.	Question	Response
2.5.11	Encourage environmentally sustainable land development practices and processes	Refer to impact assessment in Section 8 of this report.
2.5.12	Take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	Refer to alternative analysis in Section 5.
2.5.13	The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential).	The proposed activity is only for the height extension of an exiting TSF for additional deposition space required for the applicant's existing operations on its existing TSF footprint. The applicant, however, does have various social and LED initiatives required under their existing Social & Labour Plan (SLP) commitments.
2.5.14	Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area.	Refer to impact assessment in Section 8 of this report.
2.5.15	In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	Given the scale of the development it is not anticipated that the activities will contribute significantly to settlements or areas in terms of direct socio-economic returns, however the activity will allow operations at Mponeng Mining Operations to continue.
2.6	How was a risk-averse and cautious approach applied in terms of socio-economic impacts:	
2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Refer to Section 13 of this report.
2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The level of risk is low as the activity is not expected to have far reaching negative impacts on socio-economic conditions.

Ref No.	Question	Response
2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	The level of risk is low as the activity is not expected to have far reaching negative impacts on socio-economic conditions.
2.7	How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:	
2.7.1	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the impact assessment in Section 8 of this report.
2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	Refer to the impact assessment in Section 8 of this report.
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to the impact assessment in Section 8 this report.
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	Refer to the impact assessment in Section 5 and Section 8 of this report.
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Refer to the impact assessment in Section 5 and Section 8 this report.
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	By conducting an BA Process, the applicant ensures that equitable access has been considered. Refer to the impact assessment in Section of this report.

Ref No.	Question	Response
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	Refer to the impact assessment in Section 8 of this report. The EMPr will specify timeframes within which mitigation measures must be implemented.
2.13	What measures were taken to:	
2.13.1	Ensure the participation of all interested and affected parties.	Refer to Section 6 of this report, describing the public participation process undertaken for the proposed project.
2.13.2	Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Refer to Section 6 of this report, describing the public participation process undertaken for the proposed project. advertisement, notification letter and site notice have been made available in English, Afrikaans and Setswana to assist in understanding of the project. Further, registered I&APs will be provided with an opportunity to comment on the Final BA report.
2.13.3	Ensure participation by vulnerable and disadvantaged persons,	
2.13.4	Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	
2.13.5	Ensure openness and transparency, and access to information in terms of the process,	
2.13.6	Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	
2.13.7	Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein will be promoted?	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	Refer to Section 6 of this report, describing the public participation process undertaken for the proposed project.

Ref No.	Question	Response
2.15	What measures have been taken to ensure that current and / or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Current and potential future workers will have to be educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Furthermore, adequate measures will have to be taken to ensure that the appropriate personal protective equipment is issued to workers based on the conditions that they work in and the requirements of their job.
2.16	Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1	The number of temporary versus permanent jobs that will be created.	The project will ensure job security for currently employed people, as they will be able to continue with their current jobs. This impact would be experienced on a wider level since it will allow them to meet the needs of their family members. No new jobs will be created at this stage.
2.16.2	Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area).	
2.16.3	The distance from where labourers will have to travel.	
2.16.4	The location of jobs opportunities versus the location of impacts.	
2.16.5	The opportunity costs in terms of job creation.	
2.17	What measures were taken to ensure:	
2.17.1	That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment.	The EIA Process requires governmental departments to communicate regarding any application. In addition, all relevant departments are notified at various phases of the project by the EAP.
2.17.2	That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures.	
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Refer to Section 6 of this report, describing the public participation process implemented for the

Ref No.	Question	Response
		application, as well Section 8, the impact on any national estate.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Refer to the impact assessment and mitigation measures in Section 8 of this report.
2.20	What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	The proposed activity are not anticipated to produce significant additional pollution, environmental damage or adverse health effects in the long term.
2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Refer to Section 5 description of the process followed to reach the proposed preferred site.
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to the impact assessment and mitigation measures in Section 8.

5 MOTIVATION FOR THE OVERALL PREFERRED SITE, ACTIVITIES AND TECHNOLOGY

The activity alternatives as well as preferred site and technology are discussed in Section 5 below. The properties identified for the proposed development are owned by the Applicant.

5.1 FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED ALTERNATIVES WITHIN THE SITE

This section describes the specific site area and the preferred location of site features, having taken into consideration the comments raised by interested and affected parties, and the consideration of alternatives to the initially proposed site layout.

In terms of Section 24(4)(b)(i) of the NEMA, the Environmental Impact Assessment Regulations (2014, as amended), requires the application to identify alternatives for the proposed project in terms of:

- Location of the development;
- The type of activity to be undertaken;
- Design or layout of the development;
- The technology to be used;
- The operational aspects of the activity; and
- The option of not implementing the activity.

5.2 DETAILS OF DEVELOPMENT FOOTPRINT AND PROPERTY/SITE ALTERNATIVES

The proposed alternative is to increase the height of existing TSFs and it is therefore anticipated to have no additional impact on the current properties.

Additional footprints on the same or surrounding property/ies that have been considered are described in the sections below. These are however, not assessed in the impact assessment, as they have been eliminated based on a desktop feasibility study. Reasons are provided below.

5.2.1 HEIGHT EXTENSION OF DEELKRAAL TSF

This scenario includes re-utilising the existing and dormant Deelkraal TSF (refer to Figure 3) by extending the height of the TSF. This TSF is located further away than the proposed alternative to the Savuka Plant and is not connected to the plant.

In considering the environmental permitting requirements for the height extension of these TSFs, the following aspects need to be considered:

- The facility is dormant.
- It is assumed that the facility is at its final design height.
- It is assumed that new deposition pipelines will be required.
- The pipelines from Savuka Plant may cross, or be within 500 m of wetlands or watercourse.

This option would require additional infrastructure including *inter alia*, pipelines from the TSF to the Savuka Plant to pump tailings to the TSF and these pipelines will have to cross water courses and or wetlands. This option therefore, based on the nature of the activity and its potential environmental and economic impacts have not been considered in the Basic Assessment Process.

5.2.2 OLD DRD TAILINGS STORAGE FACILITY

This option proposes to re-deposit on the footprint of the Old DRD TSF (refer to Figure 3). The Old DRD TSF is located approximately 6 km north-east of the proposed alternative. This option would firstly require engagements with the owner of this footprint as Harmony is not the owner of the property. In addition, this option would also require additional infrastructure including *inter alia*, TSF and starter wall, solution trenches, Return Water Dam, pipelines and access roads. This option therefore, based on the nature of the activity and its potential environmental and socio-economic impacts have not been considered in the Basic Assessment Process.

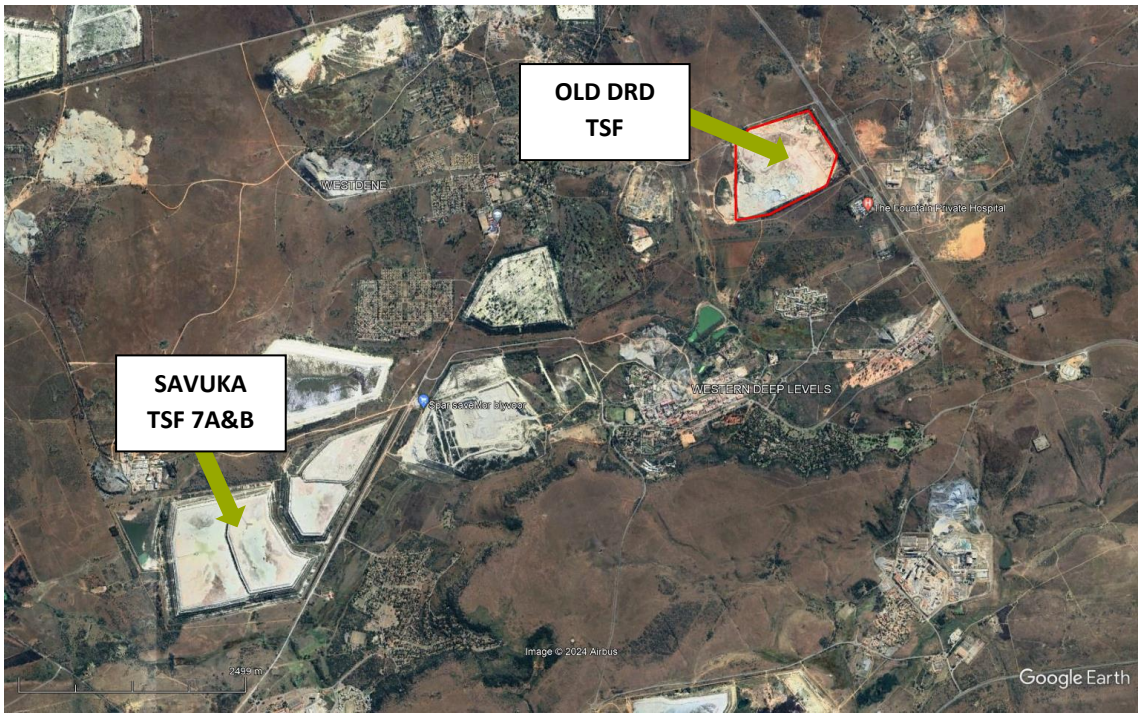

Figure 3: Location of old DRD TSFs

5.2.3 OLD SAVUKA TAILINGS STORAGE FACILITY

This option proposes to re-deposit on the footprint of the Old Savuka TSF (refer to Figure 4). The Old Savuka TSF is located immediately north-east of the proposed alternative and TSF 5a & 5b. This option would require additional infrastructure including *inter alia*, TSF and starter wall, solution trenches (existing and extension of existing), Return Water Dam (existing), pipelines and access roads. In addition, the mine is currently reclaiming this footprint, which means that there would not be sufficient space available to start redepositing on this footprint for some time. This option therefore, based on the nature of the activity and its potential environmental and socio-economic impacts have not been considered in the Basic Assessment Process.

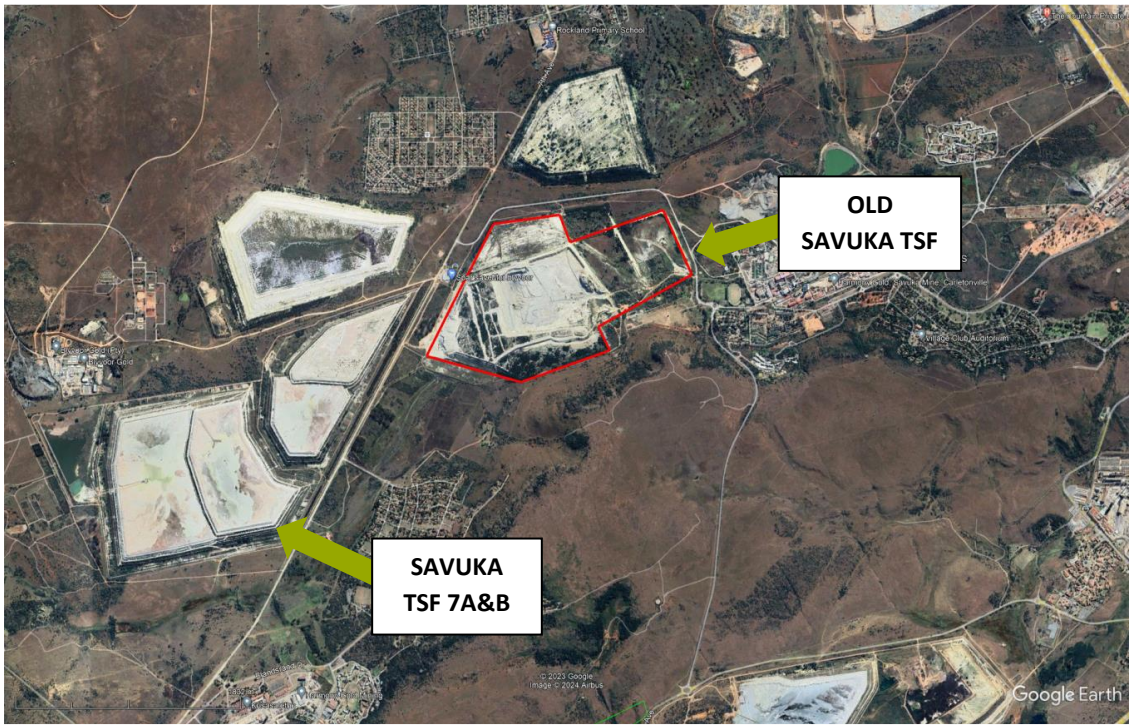

Figure 4: Location of old Savuka TSF

5.2.4 SAVUKA VALLEY TAILINGS STORAGE FACILITY

This option proposes to deposit within the valley between the Savuka 5b TSF and the Savuka 7a TSF (refer to Figure 5). This option would require additional infrastructure including *inter alia*, TSF and starter wall, solution trenches (use and extension of existing trenches), Return Water Dam (use of existing Return Water Dam), topsoil stockpile, subsoil stockpile, pipelines (assuming existing slurry pipeline will be used) and access roads (use of existing access roads). In addition, it will not provide sufficient space for the costs associated thereto. This option therefore, based on the nature of the activity and its potential environmental and socio-economic impacts have not been considered in the Basic Assessment Process.

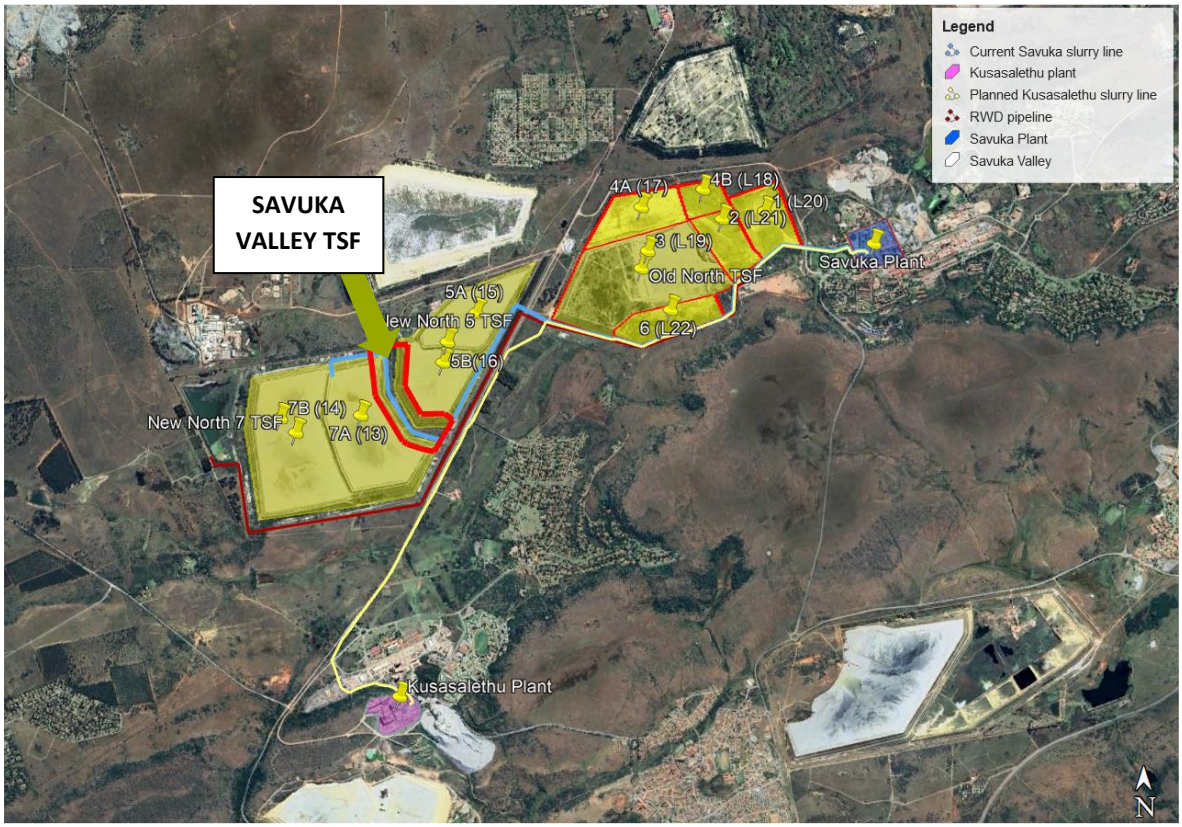

Figure 5: Location of proposed Savuka Valley TSF

5.2.5 HEIGHT EXTENSION OF SAVUKA 7A&7B TSFS

This scenario includes continuing to deposit tailings onto the existing and operation Savuka 7a & 7b TSFs (refer to Figure 1 and Figure 4 by extending the height of the approved height of the TSFs. These TSFs is located the closest to the Savuka Plant and is connected to the plant.

The TSFs are included in the 2014 EMPr amendment. The facility is further included in the current Water Use Licence (WUL). In considering the environmental permitting requirements for the height extension of these TSFs, the following aspects need to be considered:

- The facility is already operational and connected to the plant.
- The facility is not yet at its final design height.
- It is mentioned in the EMPr as an active facility.
- No new infrastructure is required to keep the facility operating.
- The facility is licensed in the Water Use License.

This option would not require additional infrastructure and will therefore, not have additional impacts on the surrounding environmental, except for slight increases in existing impacts e.g. in air quality, mainly due to the increased height and duration of the operation of the TSFs. This option therefore, based on the nature of the activity and its potential environmental and economic impacts have been considered in the Basic Assessment Process as the preferred alternative.

5.3 TYPE OF ACTIVITY

Due to the nature and benefits of the proposed activity, no assessment of alternative activities was undertaken.

5.4 DESIGN OR LAYOUT ALTERNATIVES

The current layout plan for the proposes project is considered as the preferred layout plan. Due to the limited additional impacts and no additional footprint to be disturbed of the proposed alternative, no other layout alternatives were considered for the project.

5.5 TECHNOLOGY AND OPERATIONAL OR PROCESS ALTERNATIVES

Process alternatives imply the investigation of alternative processes or technologies that can be used to achieve the same goal. The current deposition method is dry-walling, however, this will be changed to cyclone deposition on approval of this application. Cyclone deposition will allow the applicant to deposit tailings at a quicker rate. Cyclone deposition creates underflow material with high permeability, a quicker consolidation and strength gain rate than the original tailings, so that the underflow can be used to form a superior and/or quicker impoundment wall to the tailings storage facility.

No further alternative technologies or operational and or process alternatives were considered.

5.6 THE “NO-GO” OPTION

The no- go alternative would imply that no additional tailings will be deposited on the Savuka 7a & 7b TSFs after the approved height of 60 m above ground level is reached. The option of the project not proceeding that both negative and positive impacts would not take place. As such, negative impacts on biodiversity and water resources would not occur and also that the positive impacts such as continuation of mining at the West Wits complex, without interruption and all the benefits associated therewith for e.g. continuation of employment etc. In other words, operations at the Savuka Plant will have to cease and a significant number of jobs will be lost.

6 DETAILS OF THE PUBLIC PARTICIPATION PROCESS TO BE FOLLOWED

The Public Participation Process (PPP) is a requirement of several pieces of South African Legislation and aims to ensure that all relevant I&APs are consulted, involved and their opinions are taken into account and a record included in the reports submitted to Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study.

The landowners and adjacent landowners (refer to Figure 6 and other pre-identified key I&APs were sent an initial notification letter on the 28th of March and 16th of April 2025, disseminated via email, fax, and registered mail. I&APs were provided an initial registration period to register for the proposed project. All pre-identified and registered I&APs were notified of the availability of the BAR for review and comment. All comments received during this period have been included in this BAR for submission to the Competent Authority. A full description of the PPP has been included in the Comments and Responses Report, attached as Appendix BD to this report.

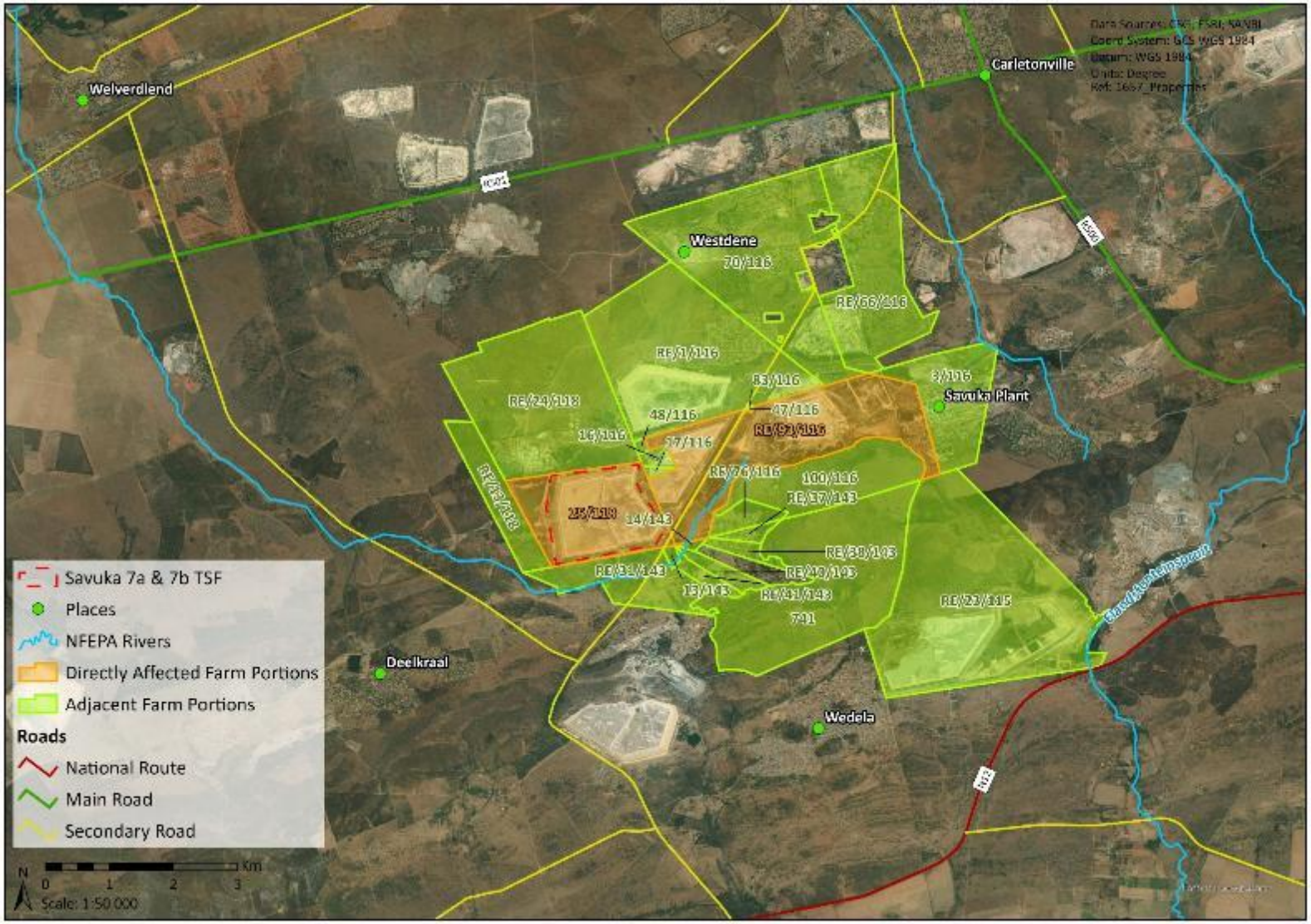

Figure 6: Affected Properties Map

6.1 IDENTIFICATION OF I&APS

An initial I&AP list was compiled using existing databases, GIS analysis and WinDeed searches to determine the contact details of the registered landowners of the project affected properties and surrounding properties. The I&AP database includes amongst others: landowners, communities, regulatory authorities, and other specialist interest groups. Additional I&APs have been registered during the initial notification and call to register period. The I&AP database has been continuously updated throughout the duration of the BA process. A full list of I&APs is attached in Appendix B.

6.2 LIST OF AUTHORITIES IDENTIFIED AND NOTIFIED

The following authorities have been identified and notified, but not limited to:

- Merafong City Local Municipality;
- West Rand District Municipality;
- The Department of Mineral and Petroleum Resources
- National Department of Forestry, Fisheries and Environment;
- National Department of Water and Sanitation;
- National Department of Rural Development and Land Reform;
- National Nuclear Regulator;
- Gauteng Department of Agriculture and Rural Development;
- Gauteng Department of Roads and Transport;
- Gauteng Department of Health;
- Gauteng Department of Community Safety;
- South African Resource Heritage Agency (SARHA);
- Agricultural Research Council; and
- South Africa Civil Aviation Authority.

6.3 LIST OF KEY STAKEHOLDERS IDENTIFIED AND NOTIFIED

The following key stakeholders have been identified and notified of the proposed activity:

- Birdlife South Africa;
- Endangered Wildlife Trust;
- Eskom Soc Ltd;
- Local Ward Councillors.
- Mining Affected Communities United in Action (MACUA);
- South African National Roads Agency Ltd (SANRAL); and
- Wildlife and Environment Society of South Africa (WESSA).

Refer to Appendix B for the full list of I&APs.

6.3.1 LIST OF SURROUNDING SURFACE RIGHTS HOLDERS/LANDOWNERS IDENTIFIED

The following surrounding surface rights holders/landowners of the area under application have been identified as part of this application:

- Blyvooruitzicht Gold Mining Co Ltd;
- Anglogold Ashanti Ltd;
- Blywonder Trust (Pty) Ltd;
- Deelkraal Behuising Trust;
- Eskom Holdings SOC Ltd;
- Gauteng Provincial Government;
- Gold Fields Limited;
- Howden Group South Africa Limited;
- Jocapari Trust;
- Carleton Midas;
- Morgan Creek Sewerage Plants;
- Rand Water;
- Randfontein Estates Ltd (Care of Harmony Gold);
- Republic of South Africa;
- Welverdiend Township Development Company Ltd; and
- Other private individuals.

6.4 NOTIFICATION OF I&APS

All I&APs were notified of the EA Application via the following one or more of the following methods:

- Initial call to register:
    - Newspaper Advertisement: Placement of advertisement in English and SeTswana in the Carletonville Herald Newspaper on 27 March 2025 and in English and Afrikaans in the Gauteng Provincial Government Gazette on 16 April 2025.
    - Placement of site notices: Placement of 6 A1 Correx site notices in English and Setswana at various locations along, within and surrounding the perimeter of the proposed project study area;
    - Notification of landowners, occupiers and other key I&APs: Notification letters, were distributed to pre-identified I&APs through either email, fax, and/or registered mail where contacts were available.

Refer to Appendix B for proof of notification sent to I&APs and for proof of correspondence with I&APs. The following will still be conducted:

Table 7: PPP still to be conducted.

Notification of I&APs of Reports for Public Review	**Notification of pre-identified I&APs via either email, fax, SMS and registered mail where contacts are available.** **Contact details were included in the notification should I&APs require assistance accessing the information or require copies of reports.**
	One (1) hard copy of report will be submitted to local public libraries where members of the public could access the report.

Notification of I&APs of Reports for Public Review	Notification of pre-identified I&APs via either email, fax, SMS and registered mail where contacts are available. Contact details were included in the notification should I&APs require assistance accessing the information or require copies of reports.
Availability of BAR for public review Reports (Basic Assessment Report) **The BAR is being made available for public review and comment for a period of 30-days from the 27th of June to the 28th of July 2025.**	An electronic copy of the report was placed on the EIMS website. A data free service was made available to anyone who has limitations with respect to data downloads
	The project team has made themselves available to I&AP meeting requests to discuss the project.
Notification of Decision	Notification of registered I&APs via either email, fax, SMS and registered mail where contacts are available. Contact details are to be included in the notification if I&APs require assistance accessing the decision.

I&APs were provided an opportunity to register for the proposed project from the 27th of March 2025. I&APs were also notified of the availability of the BAR which has been made available for 30 days from the 27th of June to the 28th of July 2025 for review and comment. Comments obtained during the BAR public review and comment period and the responses will be included in the final submission to DMPR.

6.5 SUMMARY OF ISSUES RAISED BY I&APS

Any comments received during the initial PPP to date have been included in Appendix B of this report, kindly refer to Appendix B of this report for the table of correspondence. Refer to the I&AP database in Appendix B for a full list of pre-identified and registered interested and affected parties.

7 THE ENVIRONMENTAL ATTRIBUTES AND BASELINE ENVIRONMENT

This section of the BA Report provides a description of the environment that may be affected by the proposed project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area and where relevant with input from various specialists that were appointed to undertake the specialist assessments for the application area. Refer to Appendix D for copies of the specialist reports undertaken. The following specialist studies were undertaken:

- Air Quality Impact Assessment – Airshed Planning Professionals.
- Groundwater Assessment - Hydrology Impact Assessment – MVB Consulting.
- Hydrological Assessment – Mike Bollaert.
- Wetland Delineation and Assessment – The Biodiversity Company.
- Visual Impact Assessment – Graham Young Landscape Architect.
- Closure Costing (EIMS & Minelock Environmental Engineers).
- Health Risk and Radiological Impact Assessment – Airshed Planning Professionals and Aquisim Consulting.

7.1 PHYSICAL ENVIRONMENT

7.1.1 CLIMATE AND WEATHER

7.1.1.1 CURRENT AND HISTORIC CLIMATE

According to Köppen-Geiger Climate classification, Carletonville has a Subtropical steppe climate (Classification: BSh). The summers are long, warm, and mostly clear and the winters are short, cold, dry, and clear. Over the course of the year, the temperature typically varies from 2°C to 27°C and is rarely below -2°C or above 31°C. (Figure 7). Carletonville experiences significant seasonal variations in monthly rainfall, average monthly rainfall reaching 96 mm in January and being as low as 2mm in July.

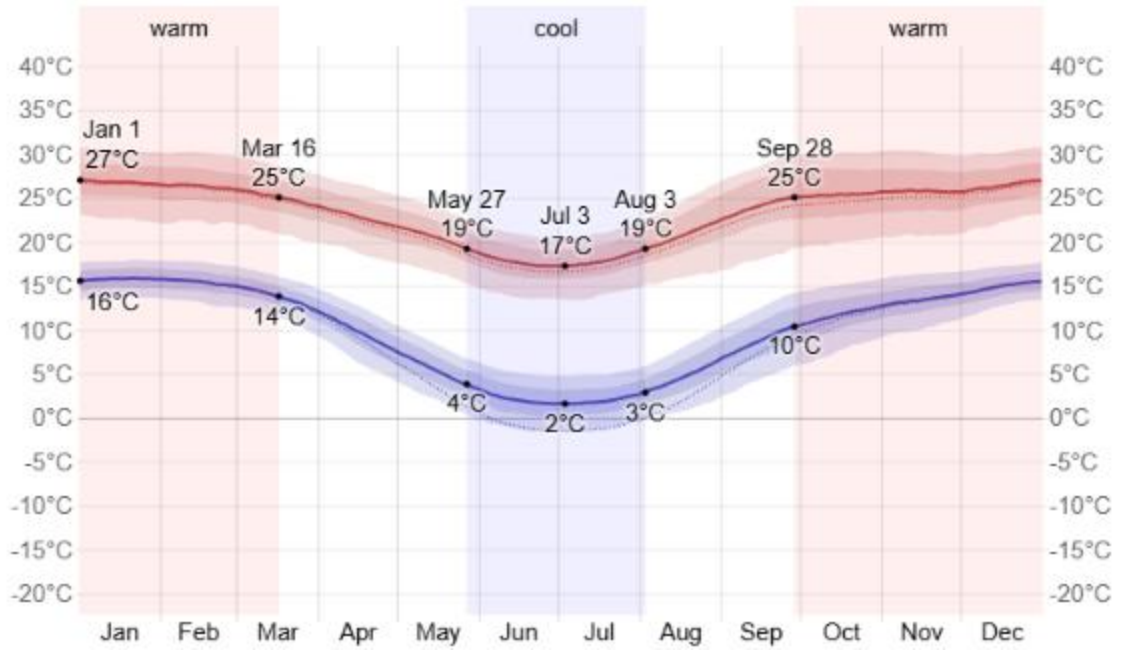

Figure 7: Graph showing average annual temperature Carletonville (Weatherspark, accessed 17/10/2024) https://weatherspark.com/y/94205/Average-Weather-in-Carletonville-Gauteng-South-

7.1.2 GEOLOGY, SOILS AND LAND CAPABILITY

This section is mainly informed by the background information supplied by the geohydrologist in the groundwater assessment for the proposed activity.

The study area is located within the Witwatersrand basin. The gold and uranium deposits of the Witwatersrand basin constitute one of the great metallogenic provinces of the world. The Witwatersrand sedimentary basin has been deposited over a granite-greenstone basement known as the Kaapvaal Craton (McCarthy and Rubidge, 2005). The accumulated sediments within the basin are collectively known as the Witwatersrand Supergroup and are made up of the West Rand Group (WRG) and the Central Rand Group (CRG). The lowermost sedimentary strata of the WRG, which attains a maximum thickness of 5 000 m, were deposited in a shallow sea environment and are mostly comprised shales and quartzites. The WRG is overlain by quartzites and conglomerates of the CRG. These sediments are an accumulation of riverine deposits, with high concentrations of gold and uranium associated with certain conglomerate layers (McCarthy and Rubidge, 2005). The Witwatersrand basin constitutes a Northeast to Southwest trending basin 350 km x 160 km, underlying southern Gauteng, North West and northern Free State Provinces.

The volcanic and sedimentary rocks are part of the Ventersdorp Supergroup (McCarthy and Rubidge, 2005). Rifting of the Kaapvaal Craton, followed by erosion and thereafter subsidence of the continent below sea level. The subsequent subsidence of the continent caused river systems to be drowned and buried by beach and shallow-water marine deposits, resulting in the deposition of the conglomerate, sandstone and mudstone deposits of the Black Reef Formation. Bacteria thrived in this shallow sea environment and bacterial growth resulted in the accumulation of >1 000 m thick dolomitic deposit as well as large amounts of iron and manganese, which precipitated as a result of oxygen release by cyano-bacteria (McCarthy and Rubidge, 2005). The dolomitic deposition that resulted constitutes the Malmani Subgroup Dolomites of the Chuniespoort Group and Transvaal Supergroup, which stretches from Johannesburg, to Carletonville and beyond to Orkney.

7.1.2.1 REGIONAL GEOLOGY AND MINERALOGY

The Far West Rand goldfields fall within a prominent semi-circular deposit of Transvaal Supergroup rocks, which stretches from the south of Johannesburg, beyond Carletonville to Orkney in the west.

The Far West Rand goldfields represent the southern limb of the asymmetrical Hartbeesfontein-anticline (also referred to as the Westrand-anticline). Small windows of Archaean granitoids and Black Reef Formation quartzites outcrop in the crest of the anticline. The Transvaal Supergroup, which forms the southern limb of the anticline, dip 6_o to the south. This anticline represents an important watershed, which separates rivers draining to the north, i.e. towards the Limpopo River and onwards to the Indian Ocean, from those draining to the South, i.e. towards the Vaal and Orange Rivers, and thereafter the Atlantic Ocean. A north-south cross-section through the region shows that the Pretoria Group has been eroded along the edge of the Hartbeesfontein-anticline, exposing the Malmani dolomites of the Chuniespoort Group along the length of the Wonderfontein Spruit. The Pretoria Group sediments (Rooihoogte and Timeball Hill Formations), however, form prominent hills (Gatsrante) south of the dolomites and represent the southern boundary of the Wonderfontein Spruit catchment. Refer to Figure 8 for a map showing the regional geology.

7.1.2.2 SOILS AND LAND CAPABILITY

Agricultural potential are determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes. The land capability is determined by the physical features of the landscape including the soils present. The land potential or agricultural potential is determined by combining the land capability results and the climate capability for the region.

According to the DFFE screening tool, the soils in the TSF area are mostly medium potential agricultural soils with some low agricultural areas and a few spots of high agricultural potential soils. The natural vegetation of the site is classified as Gauteng Shale Mountain Bushveld (according to SANBI, 2018), although there is no to negligible natural vegetation on the site. The TSF covers the full extent of the immediate site and is surrounded by TSFs and other mining activities. Refer to Figure 9 for a map showing the soil types in and surrounding the study area and Figure 10 for a map showing land cover.

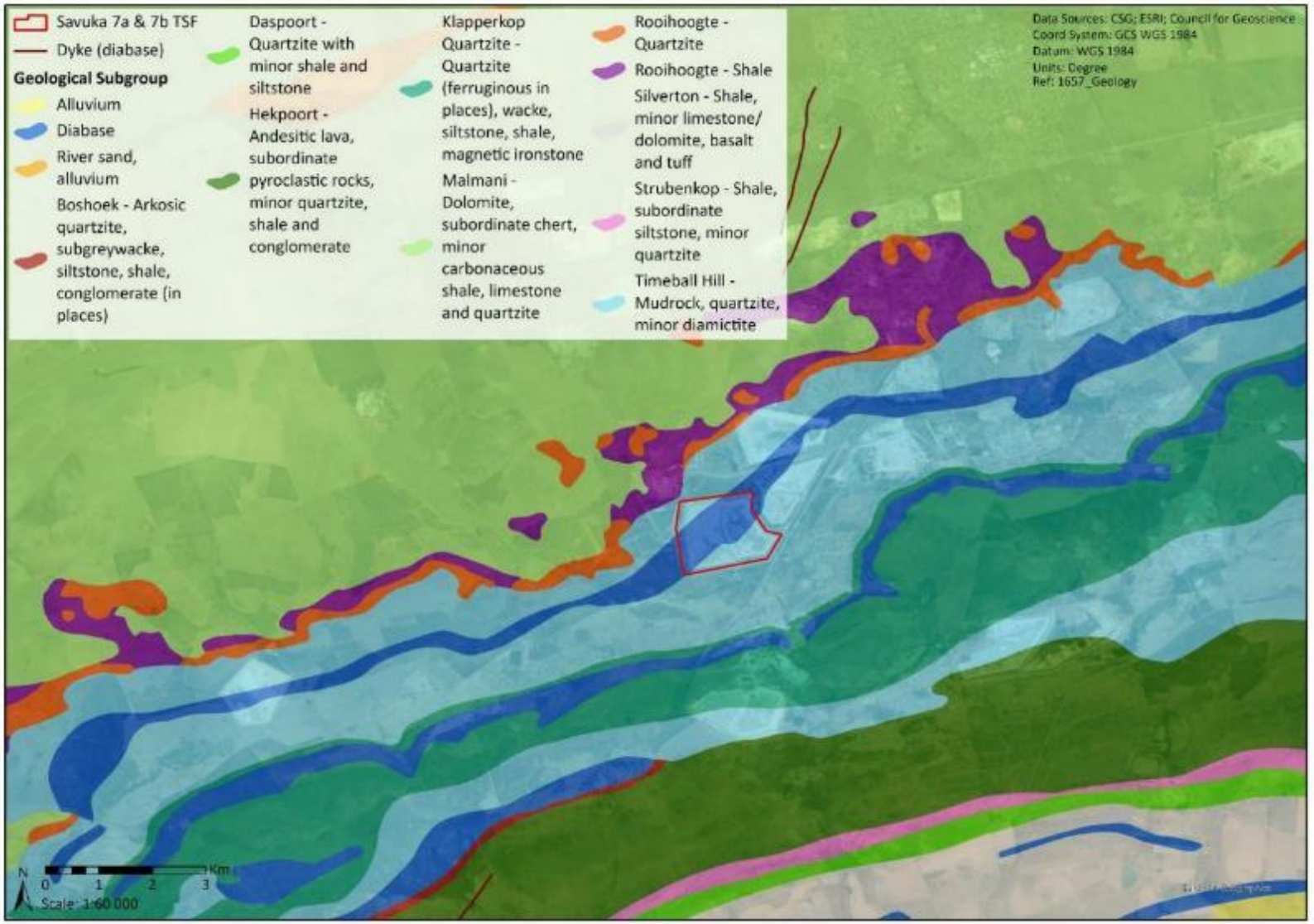

Figure 8: Regional geology

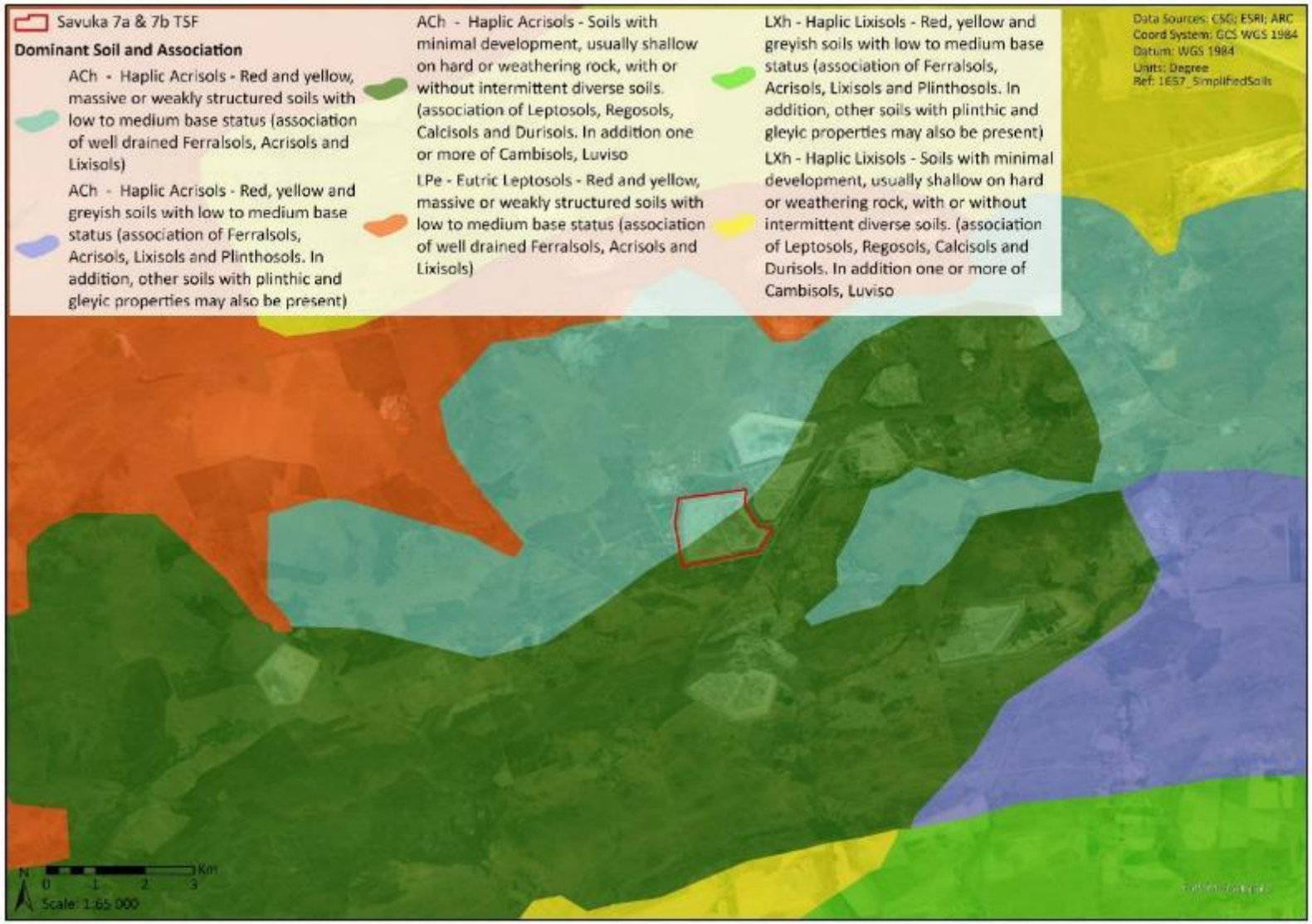

Figure 9: Simplified Soils

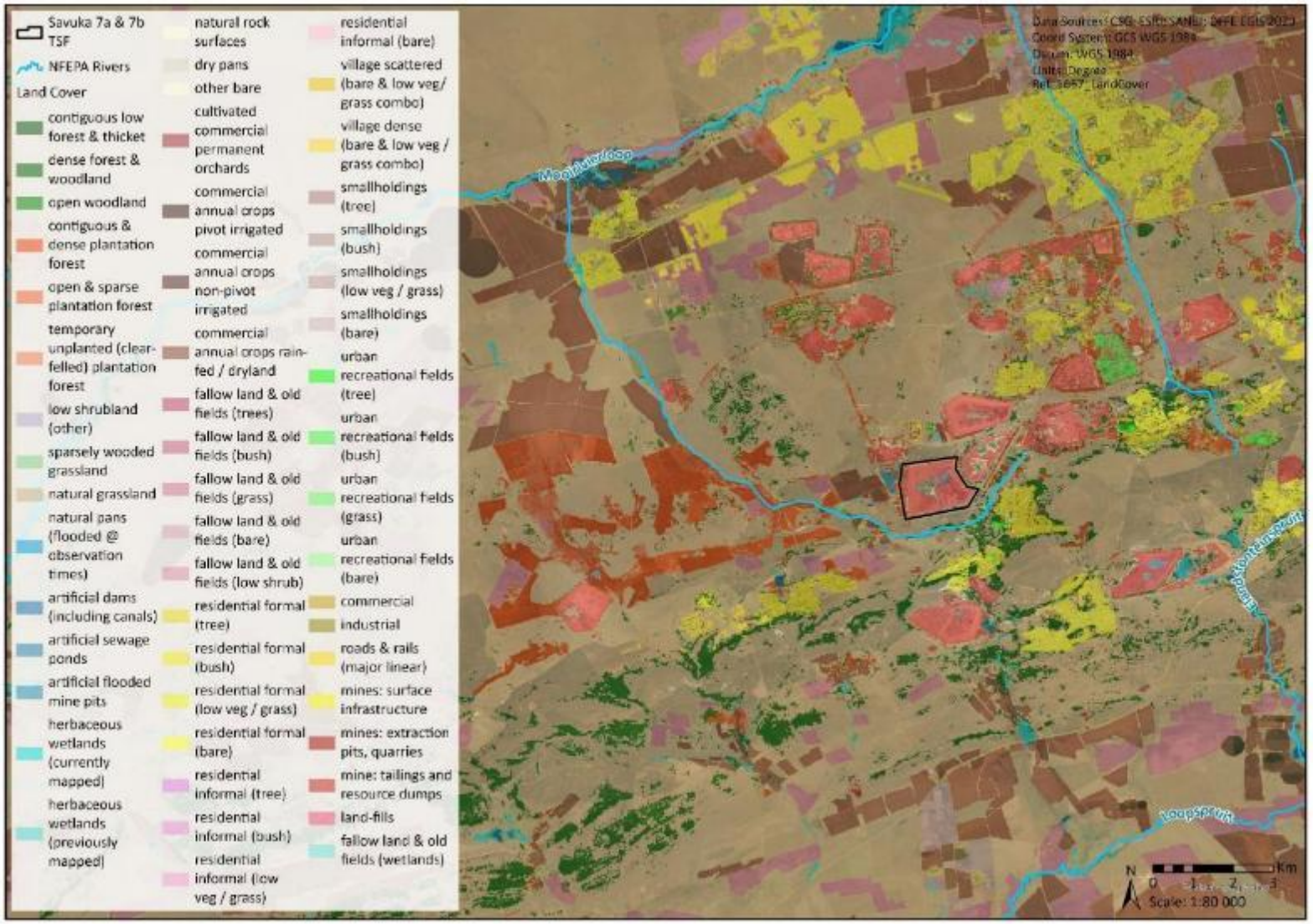

Figure 10: Land Cover

7.1.3 HYDROPEDOLOGY

A Hydropedology Statement was provided by The Biodiversity Company in support of the Water use License (WUL). The statement pertains to the relevance of hydropedology, and any associated risks towards the adjacent watercourses that may be caused by the proposed activity.

The previously site land type data confirmed the hillslopes transects and the modelled conceptual models of delineated soil hydropedological groups resources in the catchment with the proposed Tailings Storage Facilities (TSFs) (Figure 11). Two main hillslope hydropedological patterns were identified which are applicable to the catchment of influence with the proposed development (see Table 8). The first hydropedological pattern has recharge (Shallow) soils from the crest to the lower mid-slope section transecting to a responsive (saturated) hydropedological soil type at the valley bottom. The second hydropedological pattern has recharge (Shallow) soils from the crest to the mid-slope section transecting to recharge (deep) then a responsive (saturated) hydropedological soil type at the valley bottom merging to a watercourse.

Several model exercises were undertaken to determine the catchment extent of the sub-basin for the wetlands (Figure 12) associated with the project area. These models indicate minimal impacts are expected. The site is in a land type commonly associated with shallow recharge hydropedological soils groups (Glenrosa and Mispah), recharge (deep) hydropedological types (Hutton soil forms) and responsive saturated hydropedological types (Rensburg) see Figure 12 and Table 8. It is worth considering the source of water associated with the moisture content within the watercourse. The reach of the water resources adjacent to the proposed Savuka TSFs extension and associated infrastructure derives most water flows from the catchments north-east and north, which are characterised with recharge (Shallow and deep). This indicates that surface and also subsurface recharge flows are predominantly responsible for the level of moisture in the watercourses.

Table 8: Hydropedological patterns for the Savuka TSF height extension Project.

Hydropedological hillslope patterns	
Hillslope Transect	**Hydropedological patterns**
H1	Recharge (Shallow) - Recharge (Shallow) - Responsive (Saturated)
H2	Recharge (Shallow) - Recharge (Deep) - Responsive (Saturated)

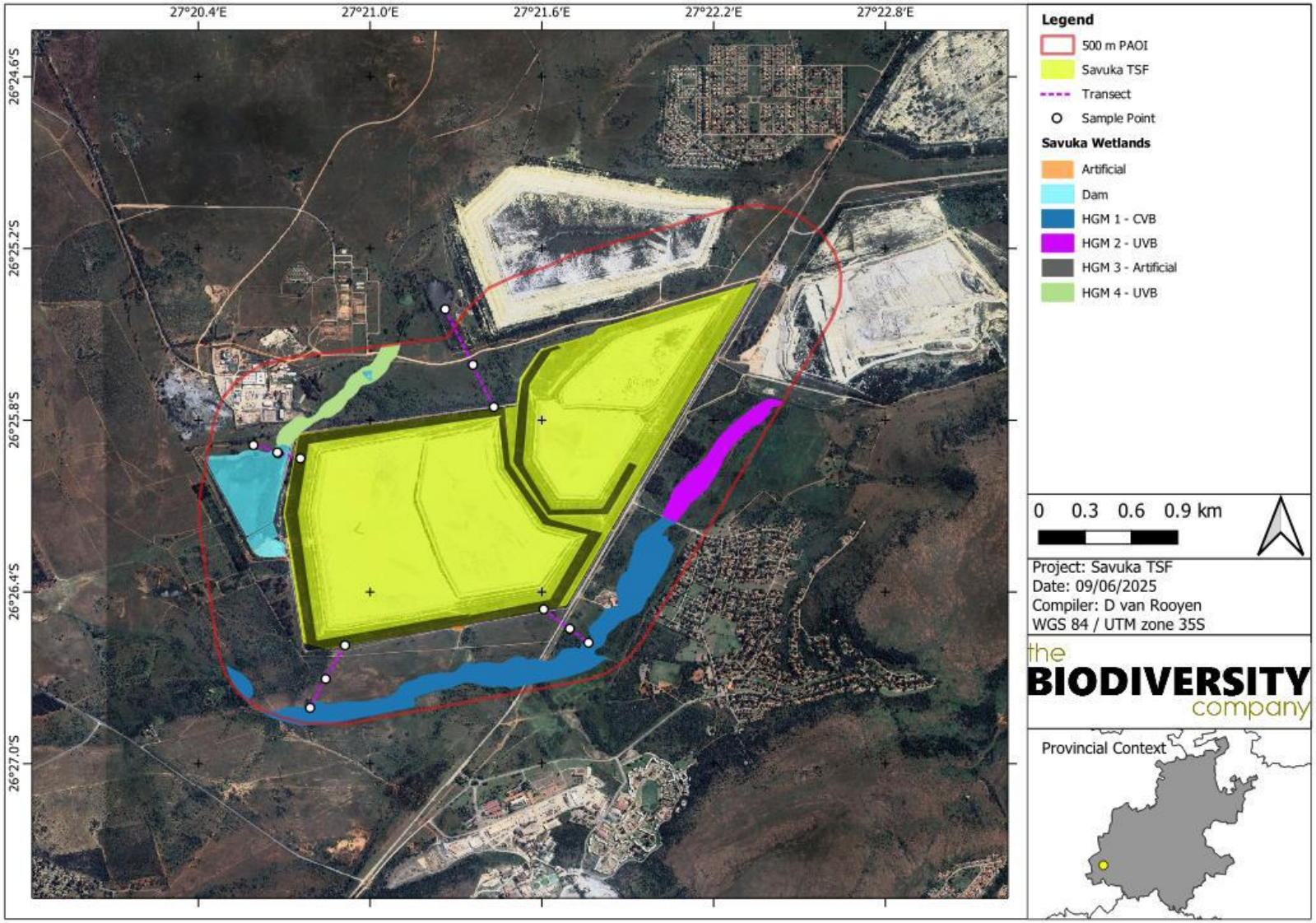

Figure 11: The assessed hillslope transects hydropedological patterns regarding the Savuka TSF height extension project

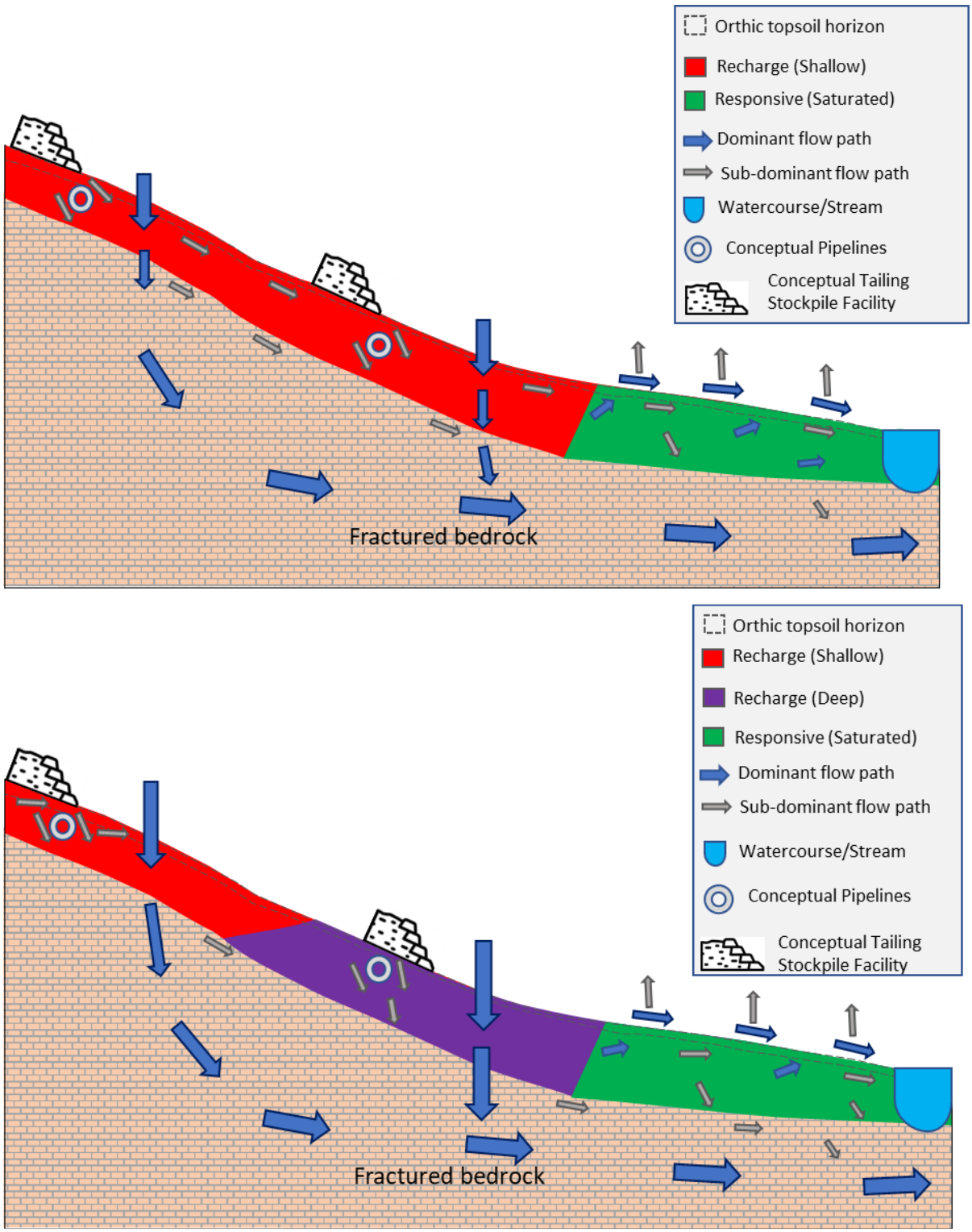

Figure 12: The Conceptual hydropedological flows after the Savuka TSFs extension project.

7.1.4 GROUNDWATER

A geohydrological study and conceptual groundwater model was conducted by MvB Consulting for the Savuka TSF. This section describes the geohydrological setting and conceptual model of the study area. The geohydrological setting and conceptual model of the study area is described according to the following criteria:

- Borehole Information;
- Aquifer Type;

- Groundwater Use;
- Aquifer Parameters;
- Aquifer Recharge;
- Groundwater gradients and flow;
- Groundwater quality; an
- Aquifer Classification.

7.1.4.1 BOREHOLE INFORMATION

There are several groundwater monitoring boreholes in the vicinity of the Savuka TSFs. No private boreholes could be located within a 2km radius of the TSF. The localities of the available boreholes are shown Figure 13.

Figure 13: Monitoring Boreholes Locations

7.1.4.2 AQUIFER TYPE

Groundwater occurrences in the study area are predominantly restricted to the following types of terrains: Weathered and fractured rock aquifer in the Ventersdorp and Transvaal Formations and Dolomitic and Karst Aquifers. Although the dolomite aquifer is the most prominent aquifer in the region, it does not play any role in the activities at the Savuka TSFs.

Within the weathered and fractured aquifer, groundwater occurs in the near-surface geology in the weathered and fractured sedimentary deposits (quartzite and shale) of the Transvaal strata. The lava of the Hekpoort Formation has similar weathering characteristics to that of the shale and is, therefore, deemed as the same aquifer. These formations are not considered to contain economic and sustainable aquifers, but localised high yielding boreholes may, however, exist where significant fractures are intersected. Groundwater occurrences are mainly restricted to the weathered formations, although fracturing in the underlying "fresh" bedrock may also contain water. Experience has shown that these open fractures seldom occur deeper than 60m. The base of the aquifer is the impermeable quartzite, shale and lava formations, whereas the top of the aquifer would be the surface topography. The groundwater table is affected by seasonal and atmospheric variations and generally mimics the topography. These aquifers are classified as semi-confined. The two aquifers (weathered and fractured) are mostly hydraulically connected, but confining layers such as clay and shale often separate the two. In the latter instance the fractured aquifer is classified as confined. The aquifer parameters, which includes transmissivity and storativity is generally low and groundwater movement through this aquifer is therefore also slow.

Dolomite aquifers in the region are known to contain large quantities of groundwater and are commonly associated with sustainable groundwater abstraction. The water that plaques the underground mining is primarily derived from the dolomite aquifer overlying the workings. The depth to groundwater in the region ranges from 4 m to 41 m below surface in the non-dewatered groundwater compartments (Zuurbekom and Boskop/Turffontein). This is in contrast to the groundwater levels in excess of 200 m in the dewatered compartments (Gemsbokfontein West, Venterspost, Bank and Oberholzer). The unsaturated zone in the dolomite aquifer ranges from weathered wad material and Karoo sediments within deep solution cavities or grykes (deeply weathered paleovalley within the dolomite) to relatively fresh fractured dolomite between major solution cavities and at depth. The shallow weathered dolomite aquifer has been formed because of the karstification which has taken place prior to the deposition of the Karoo sediments on top of the dolomites. There is general agreement that this aquifer is the significant source of water within the dolomite. The base of the weathered dolomite (aquifer) is irregular in nature and there are zones of deep weathering (grykes). The maximum depth to the base of this aquifer is in the order of 200 m below surface. The non-weathered dolomite approximates a traditional fractured rock aquifer at depth where dissolution has been less pronounced. It is extremely unlikely that any significant groundwater flow occurs below these depths except along intersecting structural conduits to the underlying mine workings.

In terms of the relationship between the weathered / fractured aquifer and the dolomite aquifer, evidence has shown that there is very little connectivity between the weathered / fractured aquifer and the underlying dolomite aquifer. Even in compartments where the dolomite aquifer is dewatered the groundwater levels in the weathered / fractured aquifer remains unaffected. Based on the exploration borehole information, it appears that the dolomite that that is covered by Transvaal strata is less karstified and the dolomite aquifer is therefore not as well developed. The mines situated south of the "Gatsrant" are generally dry mines with limited groundwater inflow, whereas the mines north of the "Gatsrant" is plagued by high groundwater inflow volumes. This is, in part, attributed to the well-defined karstification in the northern dolomites.

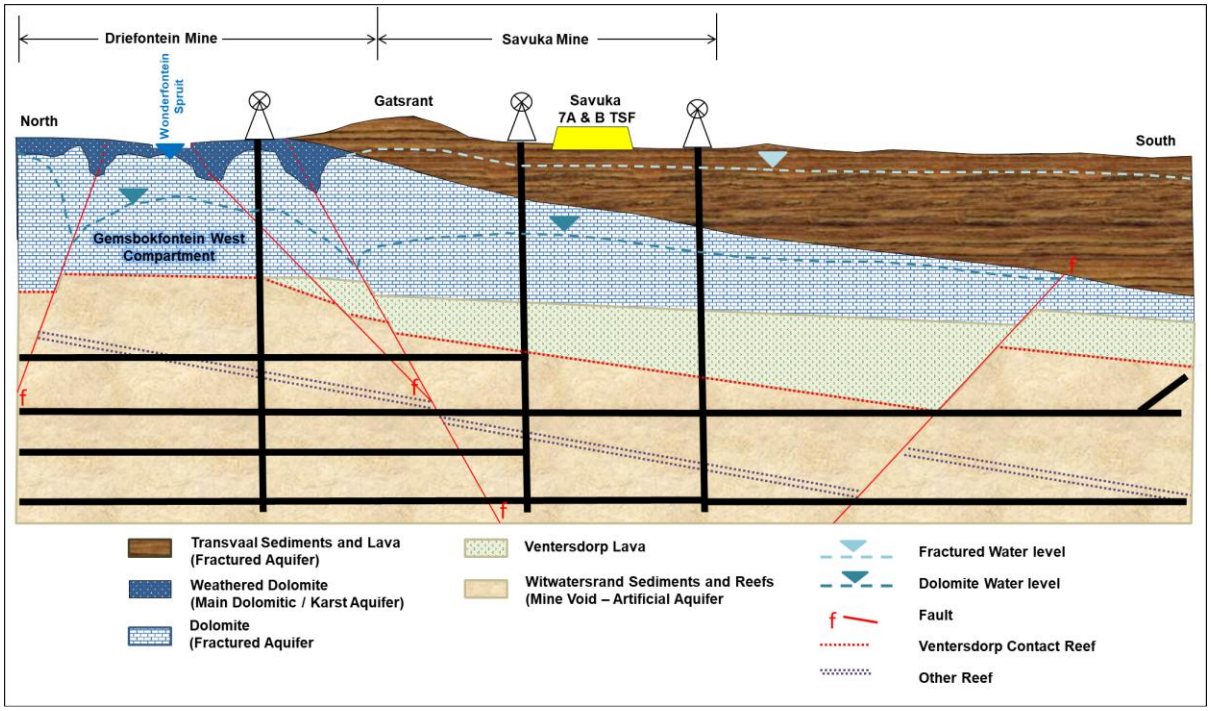

Figure 14: Schematic geological section showing the relationship between the aquifers in the study area (Van Biljon, 2018)

7.1.4.3 GROUNDWATER USE

There are no groundwater users downstream from the Savuka TSFs.

7.1.4.4 AQUIFER PARAMETERS

Important parameters that can be obtained from borehole or test pumping include Hydraulic Conductivity (K), Transmissivity (T) and Storativity (S). These parameters are defined as follows (Krusemann and De Ridder, 1991):

- Hydraulic Conductivity (K): This is the volume of water that will move through a porous medium in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. It is normally expressed in metres per day (m/day).
- Transmissivity (T): This is the rate of flow under a unit hydraulic gradient through a cross-section of unit width over the full, saturated thickness of the aquifer. Transmissivity is the product of the average hydraulic conductivity and the saturated thickness of the aquifer. Transmissivity is expressed in metres squared per day (m^2/day).
- Storativity (S): The storativity of a saturated confined aquifer is the volume of water released from storage per unit surface area of the aquifer per unit decline in the component of hydraulic head normal to that surface. Storativity is a dimensionless quantity.

Pump testing that was undertaken in the region (Van Biljon and Glendinning, 2013) estimated the aquifer parameters in the weathered and fractured aquifer was taken into account. The geometric mean transmissivity was calculated to be 0.5 m^2/day and hydraulic conductivity 0.02 m/day.

7.1.4.5 AQUIFER RECHARGE

Recharge is defined as the process by which water is added from outside to the zone of saturation of an aquifer, either directly into a formation, or indirectly by way of another formation. Groundwater recharge (R) for the study area was calculated using the chloride method (Bredenkamp et al., 1995) and is expressed as a percentage of the Mean Annual Precipitation (MAP).

According to Vegter (1995) the recharge in the fractured aquifer is 31 mm / annum with water occurring in the shallow weathered zone and water bearing fractures only. This is equal to approximately 4% of mean annual precipitation. The average rainfall in the area is approximately 646 mm / annum. The average chloride in rainfall for areas inland is approximately 1.0 mg/L and the harmonic mean of the chloride concentration values in groundwater samples obtained from the mining area is 25.88 mg/L. The recharge value is calculated to be 3.9%, which corresponds with Vegter's value.

7.1.4.6 GROUNDWATER GRADIENTS AND FLOW

The first important aspect when evaluating the geohydrological regime and groundwater flow mechanisms is the groundwater gradients. Groundwater gradients, taking into consideration fluid pressure, are used to determine the hydraulic head which is the driving force behind groundwater flow. The flow governs the migration of contaminants, and a detailed assessment of the flow was required to determine subsurface flow directions from the TSF or any other potential contaminant source. In most geological terrains, the groundwater mimics the topography and to test if this is the case within the study area the available groundwater levels were plotted against the topography (represented by the borehole collar elevations). The result indicated a very good correlation (96%) between the topography and the groundwater level, which suggests that groundwater flow will follow the topographical gradient. This relationship is known as the Bayesian relationship, and where this exists, the regional topography can be used to interpolate (Bayesian interpolation) a regional groundwater gradient map. Figure 15 depicts the groundwater level elevations, which is expected to mimic the surface contours. Groundwater flow is perpendicular to the groundwater contours and flows predominantly towards the south-west.

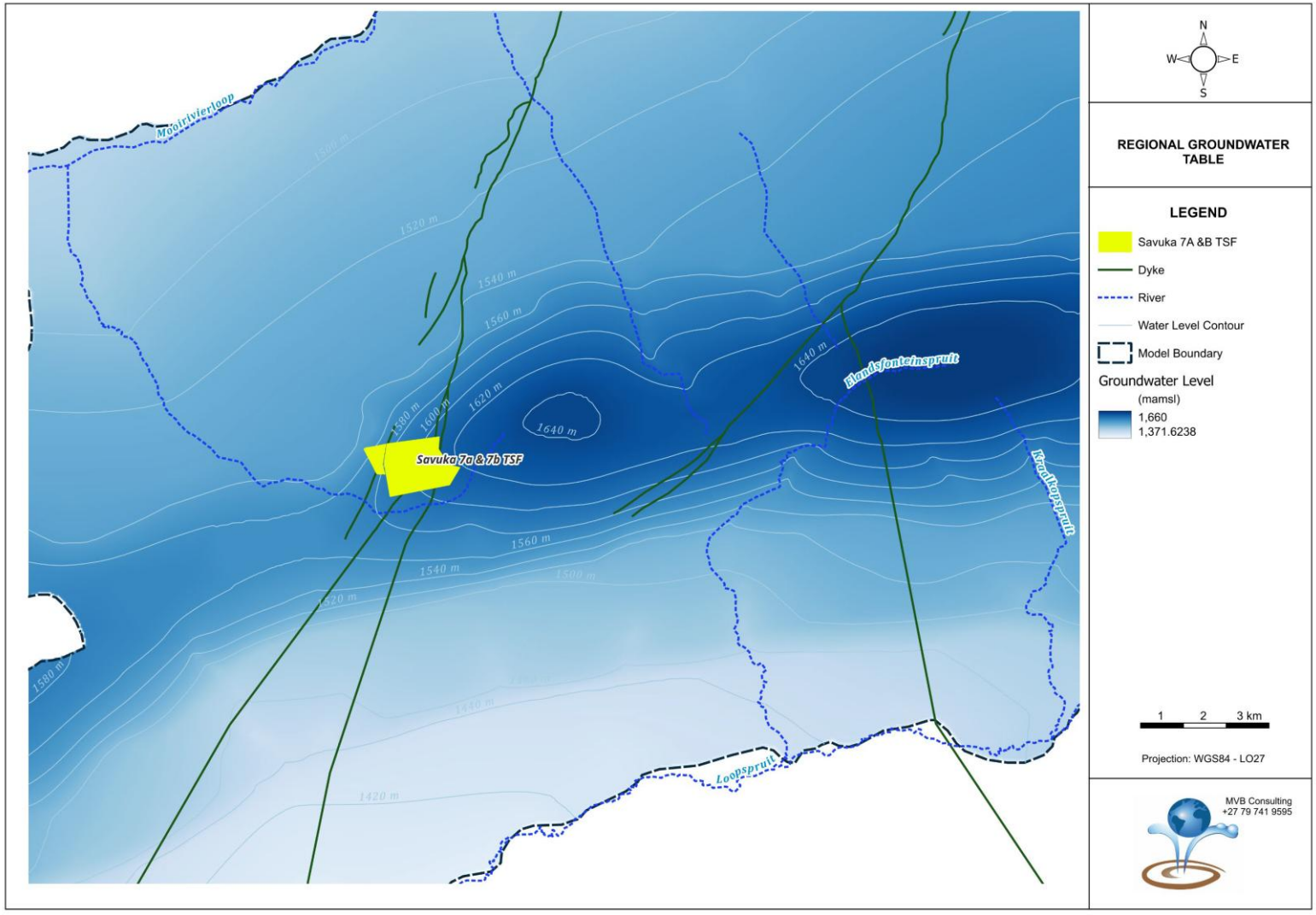

Figure 15: Regional Groundwater Gradient

7.1.4.7 GROUNDWATER QUALITY

Since there are no groundwater users downstream from the Savuka TSFs, the groundwater chemistry was compared to the South African Water Quality Guidelines (second edition) Volume 5: Agricultural Use: Livestock Watering (Department of Water Affairs and Forestry, 1996), as well as the SANS 241 (2015). The SANS 241 Drinking Water Specification is the definitive reference on acceptable limits for drinking water quality parameters in South Africa and provides guideline levels for a range of water quality characteristics. The SANS 241 (2015) Drinking-Water Specification effectively summarises the suitability of water for drinking water purposes for lifetime consumption. The guideline for livestock watering represents the target water quality specified in the guidelines. The target water quality guidelines were obtained from the Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering.

Selected monitoring boreholes were sampled to assess (in consultation with the mine monitoring data) the current groundwater quality in the vicinity of the TSF. From the results, the following was observed:

- The groundwater in the monitoring boreholes show a mining impact, with high Total Dissolved Solids (TDS) and sulphate concentrations.
- Several heavy metals exceed the SANS 241 and Livestock Watering guidelines. Apart from the Savuka 7a & 7b TSF's, there is also a larger impact from neighbouring tailings facilities.
- Borehole MB38 is anomalous and has much better quality than the other monitoring boreholes. This is attributed to this borehole being located within the phyto-remediation area.

7.1.4.8 AQUIFER CLASSIFICATION

An aquifer classification system provides a framework and objective basis for identifying and setting appropriate levels of groundwater resource protection. This would facilitate the adoption of a policy of differentiated groundwater protection.

Other uses could include:

- Defining levels of investigation required for decision making.
- Setting of monitoring requirements.
- Allocation of manpower resources for contamination control functions.

The aquifer classification system used to classify the aquifers is the proposed National Aquifer Classification System of Parsons (1995). This system has a certain amount of flexibility and can be linked to second classifications such as a vulnerability or usage classification. Parsons suggests that aquifer classification forms a very useful planning tool that can be used to guide the management of groundwater issues. He also suggests that some level of flexibility should be incorporated when using such a classification system.

The South African Aquifer System Management Classification is presented by five major classes:

- Sole Source Aquifer System.
- Major Aquifer System.
- Minor Aquifer System.
- Non-Aquifer System.
- Special Aquifer System.

The following definitions apply to the aquifer classification system:

- Sole source aquifer system: “An aquifer that is used to supply 50 % or more of domestic water for a given area, and for which there are no reasonable alternative sources should the aquifer become depleted or impacted upon. Aquifer yields and natural water quality are immaterial”.
- Major aquifer system: “Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good”.
- Minor aquifer system: “These can be fractured or potentially fractured rocks that do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although this aquifer seldom produces large quantities of water, they are both important for local supplies and in supplying base flow for rivers”.
- Non-aquifer system: “These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks does occur, although imperceptible, and needs to be considered when assessing risk associated with persistent pollutants”.
- Special aquifer system: “An aquifer designated as such by the Minister of Water Affairs, after due process”.

After rating the aquifer system management and the aquifer vulnerability, the points are multiplied to obtain a Groundwater Quality Management (GQM) index.

After rating the aquifer system management and the aquifer vulnerability, the points are multiplied to obtain a Groundwater Quality Management (GQM) index. Based on the above, the aquifers in the study area are classified as follows:

Table 9: Aquifer Classification

Description	Aquifer	Vulnerability	Rating	Protection
Weathered Aquifer	Minor (2)	1	2	Low
Fractured Aquifer	Minor (2)	1	2	Low

7.1.5 SURFACE WATER AND DRAINAGE

A hydrological assessment was conducted by Hydrologic Consulting (Pty) Ltd for the study area and proposed activities applied for. This section outlines a summary of the hydrological baseline relevant to the hydrological assessment as provided with the report. The baseline assessment included sourcing of baseline climatic and hydrological data. This included the interrogation of rainfall data, site-specific design rainfall (depth/duration/frequency), evaporation, soils, and land use, as well as a regional and local hydrological assessment.

The site is positioned within quaternary catchments C23E (Figure 16). Rivers near the site are unnamed, with the National Geospatial Information (NGI)’s 1:50,000 topographical map data illustrating two non-perennial river systems to the north and south, both of which converge to the west of the site (refer to Figure 16 and Figure 17). The southern system is larger than the northern system, however, neither area is sufficiently sized to enable perennial flows (per the NGI’s classification). The southern system is associated with a vlei and has upstream furrows directing runoff from part of the greater Mponeng Operation (south of the Old North Complex TSF). Two small dams are noted. The northern system is characterised by two larger dams, both of which appear to be return water dams when reviewing Google Earth imagery. A single non-perennial pan is noted to the north-east of the site. All hydrological features have been presented according to the NGI’s 1:50,000 topographical map data and this report does not intend to alter their classification. Also refer to Figure 17.

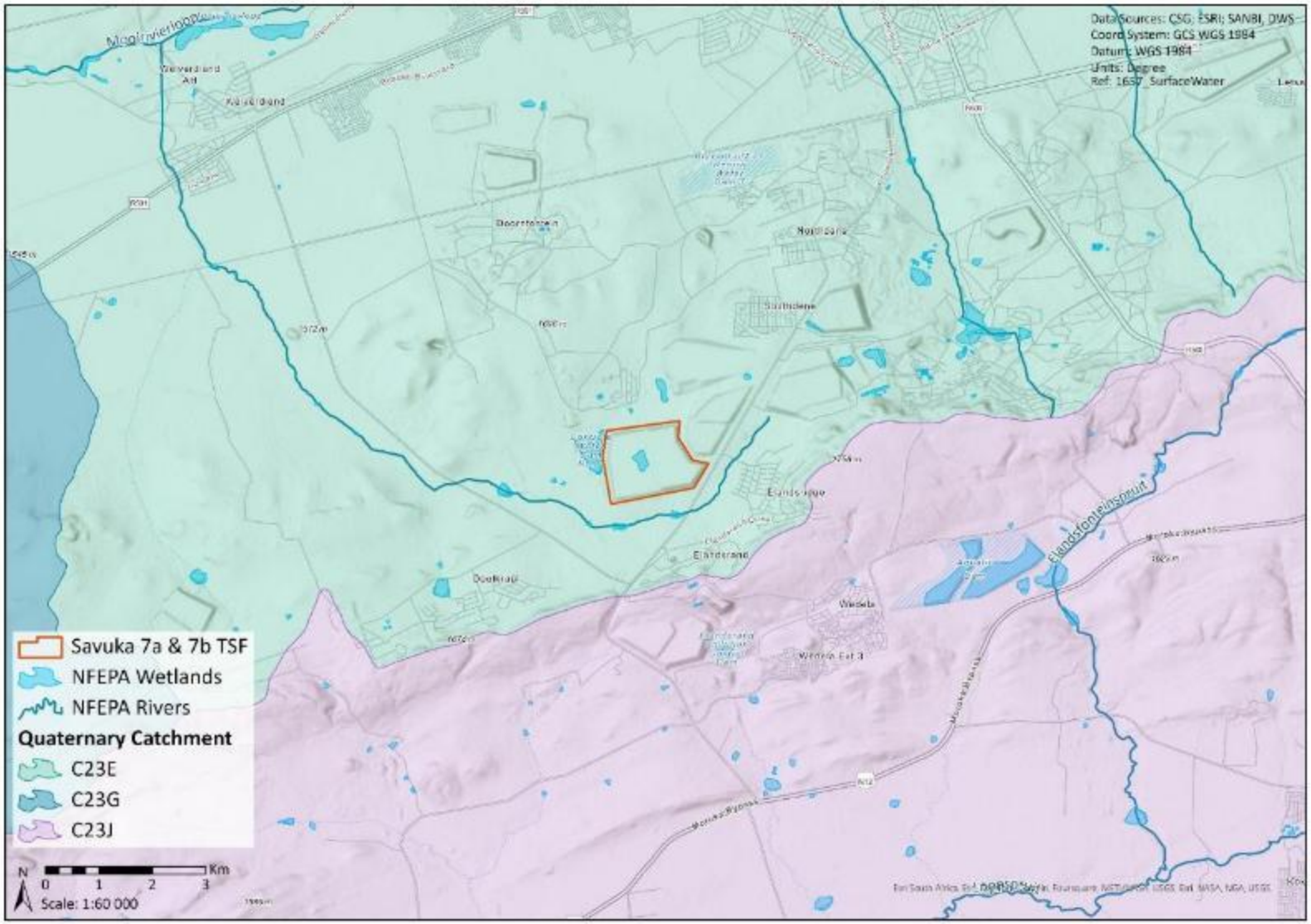

Figure 16: Surface Water Features

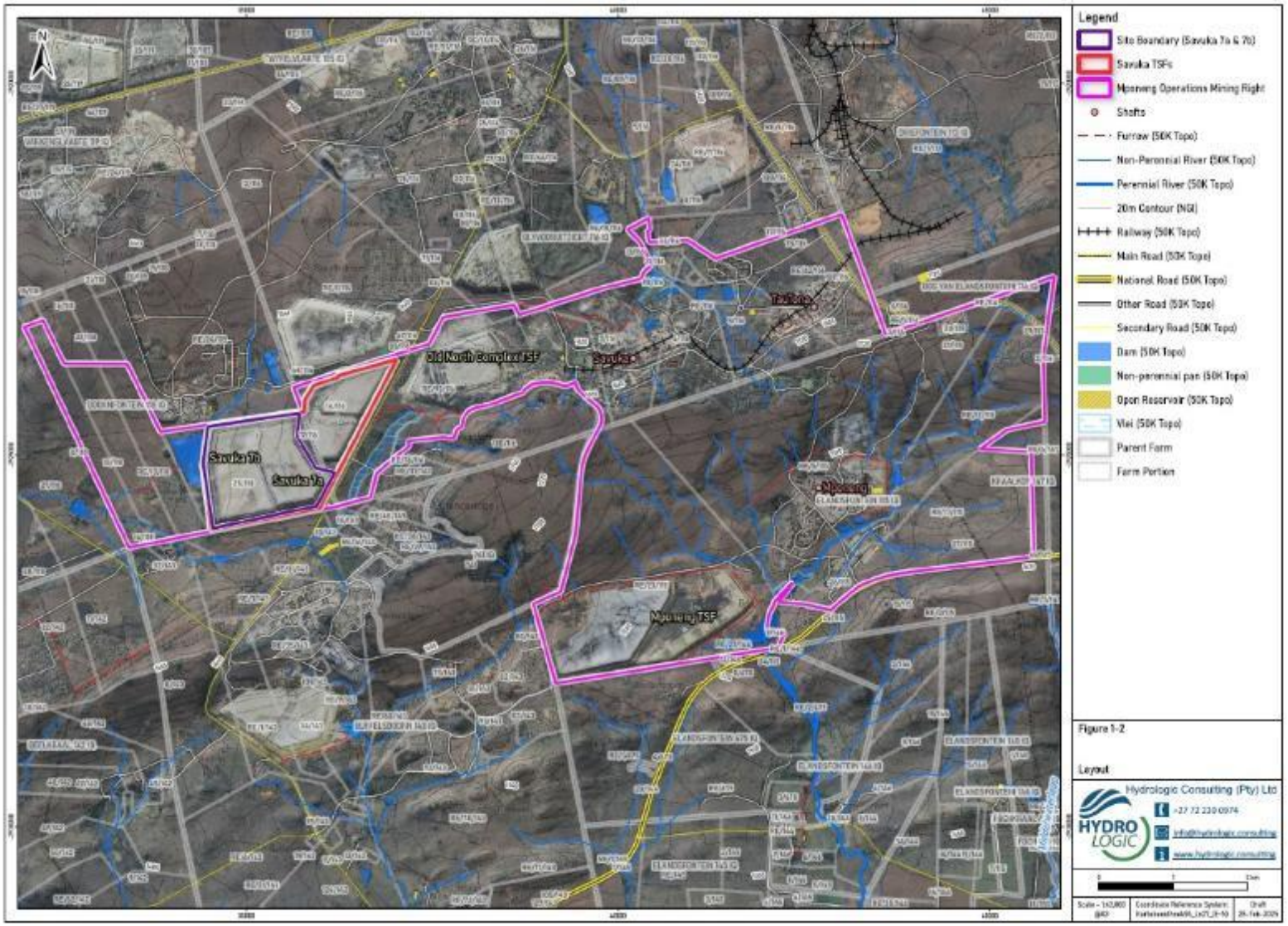

Figure 17: Terrain and Hydrology

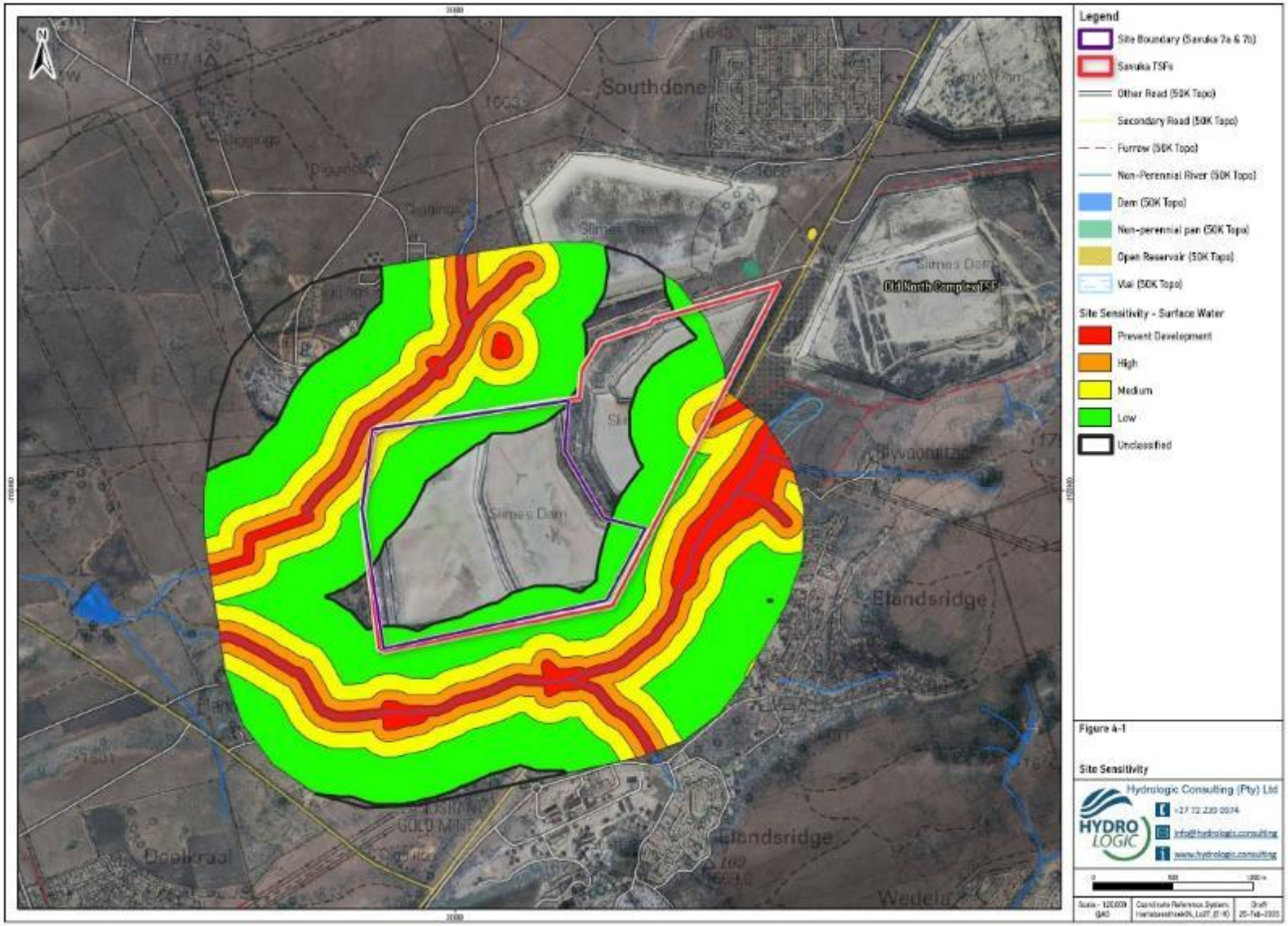

Figure 18: Site Hydrology Sensitivity

Sensitivity mapping was undertaken to identify sensitive features relating to the hydrological (surface water) environment within the site. A 1000 m buffer from the Savuka 7A & 7B TSFs was used as the area under consideration.

The Department of Water Affairs and Forestry (now the Department of Water and Sanitation), established Government Notice (GN) 704 to provide regulations on the use of water for mining and related activities aimed at the protection of water resources. This includes the following condition:

Condition 4 – Restrictions on locality – No person in control of a mine or activity may:

e) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked.

The 100 m watercourse buffer is consequently one of the main guiding aspects in the assessment of site sensitivities given its relevance to GN 704, and its applicability to both flooding and the potential for contaminants to enter a watercourse (i.e. a wider river buffer is more likely to keep infrastructure/works outside of areas prone to regular or irregular flooding while enabling more time for containments within runoff, to settle out before entering the watercourse). A 100 m watercourse buffer distance is, however, limited in its application since the proposed activities will either fall within or without this buffer distance, with no grading in site sensitivity possible. An expanded approach to the 100 m river buffer was consequently adopted utilising a variation in buffer distances modelled flooding and contour analysis.

The proposed activities lie between two non-perennial river systems as defined per the 1:50,000 topographical map. There is also constructed drainage present (furrows). Where furrows appear to manage larger areas or are otherwise extensions of non-perennial rivers, they are assumed to fall within the conceptual definition of a watercourse insofar as having the potential to cause flooding and route pollutants downstream.

Watercourse buffers have consequently been derived from the 1:50,000 topographical map features inclusive of dams, furrows, the non-perennial river, non-perennial pans and vleis. Open reservoirs have been excluded on the basis that inflows are managed (and that there is no significant upslope catchment area of relevance). Watercourse buffers are technically applicable from the edge (top of the bank) of the watercourse and not from the centreline (as in the case of rivers, drainage canals and furrows). The absence of a river survey means that the river centreline has nevertheless been used to define buffers.

The following sensitivity bands were classified:

- Prevent Development
    - A 32 m watercourse buffer (also applicable to NEMA activities) was used to define the functional area of the watercourse.
    - This 32 m buffer factors in the potential error in the 1:50,000 topographical map dataset.
    - All development should be prevented in this area, unless water-compatible or otherwise crossing over a watercourse (with flood risk factored in).
- High
    - A 100 m buffer distance matches GN 704's and DWS Notice 4167 of 2023 prescribed buffer distance and is the minimum distance to a watercourse requiring motivation if works/infrastructure are going to be permitted, including a written exemption from the Minister of the Department of Water and Sanitation.
    - There is a strong disincentive towards development within this area.

- Medium
    - A 200 m buffer distance was included as an intermediate buffer distance to the 100 m buffer distance above and the 500 m buffer distance below.
    - There is a medium disincentive towards development within this area.
- Low
    - A 500 m buffer distance is a reasoned maximum distance from a watercourse which in most instances will reflect the largest distance over which flooding would need to be considered.
    - DWS Notice 4167 of 2023 also outlines how a 500 m buffer distance is applicable to wetlands (which includes pans and vleis as present in this study area). The hydrologist, however, does not focus on wetlands and only considers the 1:50,000 topographical map rivers.
    - There is a low disincentive towards development within this area.
- Remainder
    - There is no sensitivity classification for the remainder of the site.

GN 704 restricts development within 100 m of a watercourse (e.g. dam or river) and the above outline does not attempt to remove this restriction but is instead a high-level 'scaled' version of this buffer distance. This classification only partly considers the 500 m wetland buffer that applies. This wetland buffer was more comprehensively assessed as part of a wetland survey of the site (refer to Section 7.2.3.1) and not the higher-level datasets present with the NGI's 1:50,000 topographical map dataset.

Figure 18 presents the results of the identified site sensitives as they relate to the surface water environment. As mentioned above, hydrological features have been defined according to the NGI's 1:50,000 topographical map data and the hydrologist does not intend to alter their classification. However, two of the larger dams to the north of the site are known to act as return water dams. They have, consequently been excluded from the sensitivity analysis. Figure 18 illustrates that there are parts of the TSFs that are within sensitive areas. This primarily includes the influence of the northern and southern river systems adjacent to the TSFs, since the 1:100 RI flood event (medium sensitivity) falls out of the site.

7.1.6 AIR QUALITY

An air quality impact assessment was undertaken by Airshed (refer to Appendix E) and the baseline information from that study is presented in this section.

7.1.6.1 CURRENT AND PROPOSED ACTIVITIES AND ASSOCIATED EMISSIONS

The current and proposed activities will result in emissions to air from a variety of activities and sources. These include ventilation shaft emissions (underground operations), bulldozing, material transfer (loading and off-loading), wheel entrainment from vehicles, wind erosion and activities at the processing plant. The main air pollution activities of the mine are listed in Table 10.

Table 10: Main current and proposed air pollution activities

Activities and associated air pollutants Activity	Associated pollutants
Underground Mining (emissions released via vent shafts)	
Drilling and blasting	particulate matter (PM)(a)(c), sulfur dioxide (SO_2); oxides of nitrogen (NOx); carbon monoxide (CO); Total Organic Compounds (TOC) and carbon dioxide (CO^2)(b)

Activities and associated air pollutants Activity	Associated pollutants
Loading and tipping of ore and waste	mostly PM, gaseous emissions from mining equipment (Diesel Particulate Matter [DPM], SO_2; NOx; CO; CO2)
Primary crusher (assumed to be underground)	mostly PM, gaseous emissions from machinery (PM, SO_2; NOx; CO; CO^2)
Materials handling (loading of ore and waste)	mostly PM, gaseous emissions from Front-end-Loaders (FELs) (PM, SO_2; NOx; CO; CO^2)
Surface Operations	
Secondary & tertiary crushing and screening	mostly PM(c), gaseous emissions from machinery (PM, SO_2; NOx; CO; CO^2)
Materials handling (loading & off-loading)	mostly PM(c) and windblown dust from storage piles
Trucks transporting ore and waste	PM from vehicle entrainment on unpaved road sections and gaseous emissions from truck exhaust (PM, SO_2; NOx; CO; CO^2)
Tailings Storage Facilities (TSFs)	PM(c) from windblown dust and radon
Marginal Ore Dumps (MOD)	PM(c) from windblown dust and radon
Processing plant stacks	PM(c), SO_2; NOx; CO; CO^2

7.1.6.2 POLLUTANTS OF INTEREST

Airborne PM is the most significant pollutant of concern from the proposed height extension of the Savuka 7a & 7b TSFs.

The impact of particles on human health is largely dependent on: (i) particle characteristics, particularly particle size and shape, and chemical composition; and (ii) the duration, frequency and magnitude of exposure. The potential of particles to be inhaled and deposited in the lung is a function of the particle size, shape and density. Airborne particulate matter may range from relatively uniform soil particles (e.g. during dust storms) to very complex mixtures of extremely small organic and inorganic particles and liquid droplets (e.g. industrial sites). These particles could be made up of a number of components, including salts and acids (such as sulfates and nitrates), organic chemicals, metals and radionuclides, and soil or dust particles. The nasal openings permit large dust particles (less than few mm's) to enter the nasal region, along with much finer airborne particulates. Larger particles are deposited in the nasal region by impaction on the hairs of the nose or at the bends of the nasal passages.

Smaller particles, typically less than 10 µm, pass through the nasal region and are deposited in the tracheobronchial and pulmonary regions. Particles are removed by impacting with the wall of the bronchi when they are unable to follow the gaseous streamline flow through subsequent bifurcations of the bronchial tree. As the airflow decreases near the terminal bronchi, the smallest particles (less than 2.5 µm) are removed by Brownian motion, which pushes them to the alveolar membrane (CEPA/FPAC Working Group, 1998; Dockery & Pope, 1994).

Ambient air pollution PM can therefore be divided into three classes based on their size:

- Inhalable coarse particulate matter (PM10) consists of particles with a diameter between 2.5 and 10 micrometres (µm) that deposit efficiently along the airways. Particles larger than 10 µm are generally not inhaled into the lungs. These particles are typically found near roadways and dusty industries.
- Fine particulate matter (PM2.5) consists of particles with a diameter less than 2.5 µm and can be inhaled deeply into the lungs. These particles can be directly emitted from sources such as vegetation fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.
- Ultrafine particles (PM1) consist of particles with a diameter smaller than 0.1 µm and have widespread deposition within the respiratory tract. These particles are typically a result of secondary chemical reactions in the atmosphere.

Air quality standards and guidelines for airborne particulates are given for various particle size fractions, including total suspended particulates (TSP), and thoracic (PM10) and respirable (PM2.5) particulates.

PM comprises a mixture of organic and inorganic substances. From gold mining and processing facilities the radioactive particles in the form of radionuclides and radon releases are of concern. These are addressed the radiation study conducted by AquiSim Consulting (Pty) Ltd (Appendix E).

7.1.6.3 STATUS QUO OF AMBIENT AIR QUALITY IN THE AREA

In order to assess the possible impacts from air pollutants on the surrounding environment and human health, a good understanding of the regional climate and local air dispersion potential of a site is essential. Meteorological characteristics of a site govern the dispersion, transformation, and eventual removal of pollutants from the atmosphere (Pasquill and Smith, 1983; Godish, 1990). The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer.

Dispersion comprises vertical and horizontal components of motion. The vertical component is defined by the stability of the atmosphere and the depth of the surface mixing layer. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness.

The wind direction and the variability in wind direction, determine the general path pollutants will follow, and the extent of crosswind spreading (Shaw and Munn, 1971; Pasquill and Smith, 1983; Oke, 1990).

Pollution concentration levels fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field. Spatial variations, and diurnal and seasonal changes, in the wind field and stability regime are functions of atmospheric processes operating at various temporal and spatial scales (Goldreich and Tyson, 1988). Atmospheric processes at macro- and meso-scales need therefore be considered to accurately parameterise the atmospheric dispersion potential of a particular area.

Use was made of three years (2021 – 2024) of simulated WRF hourly sequential data. This data was used to construct wind roses, general climatic information such as diurnal temperature variations, atmospheric stability estimates and for dispersion modelling. Refer to Section 7.1.1 for a description of the climate of the area.

- Current emission sources

The current air quality in the study area is mostly influenced by mining and reclamation activities at Savuka and Mponeng and other companies' mining operations, as well as farming activities, domestic fires, vehicle exhaust emissions and dust entrained by vehicles. These emission sources vary from activities that generate relatively course airborne particulates (such as farmland preparation, dust from paved and unpaved roads, and the mine sites) to fine PM such as that emitted by vehicle exhausts, diesel power generators and processing operations.

  - Domestic households are known to have the potential to be one of the most significant sources that contribute to poor air quality within residential areas. Individual households are low

volume emitters, but their cumulative impact is significant. It is likely that households within the local communities or settlements utilize coal, paraffin and/or wood for cooking and/or space heating (mainly during winter) purposes. Pollutants arising from the combustion of wood include respirable particulates, CO and SO2 with trace amounts of polycyclic aromatic hydrocarbons (PAHs), in particular benzo(a)pyrene and formaldehyde. Particulate emissions from wood burning have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons.

- Biomass burning includes the burning of evergreen and deciduous forests, woodlands, grasslands, and agricultural lands. Within the project vicinity, crop-residue burning and wildfires (locally known as veld fires) may represent significant sources of combustion-related emissions. The frequency of wildfires in the grasslands varies between annual and triennial. Biomass burning is an incomplete combustion process (Cachier, 1992), with carbon monoxide, methane and nitrogen dioxide gases being emitted. Approximately 40% of the nitrogen in biomass is emitted as nitrogen, 10% is left in the ashes, and it may be assumed that 20% of the nitrogen is emitted as higher molecular weight nitrogen compounds (Held, et al., 1996). The visibility of the smoke plumes is attributed to the aerosol (particulate matter) content.
- Emissions from unpaved roads constitute a major source of emissions to the atmosphere in the South African context. When a vehicle travels on an unpaved road the force of the wheels on the road surface causes pulverization of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong turbulent air shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed. Dust emissions from unpaved roads vary in relation to the vehicle traffic and the silt loading on the roads. Unpaved roads in the region are mainly haul and access roads. Emissions from paved roads are significantly less than those originating from unpaved roads, however they do contribute to the particulate load of the atmosphere. Particulate emissions occur whenever vehicles travel over a paved surface. The fugitive dust emissions are due to the re-suspension of loose material on the road surface. Paved roads in the region include the N12 to the south, the R501 to the north and R500 to the east.

- Sampled Dust fall Rates

Dust fallout sampling has been undertaken around the Savuka and Mponeng operations since April 2004 and includes a network comprising of 15 single Dust fall Monitoring Units (DMU) in accordance with ASTM D1739 (1970) (Figure 19). Ten (10) of these DMUs fall within the Savuka operations and five (5) within the Mponeng operations, with eight (8) DMUs located at residential areas (screened against the NDCR residential limit of 600 mg/m²/day) and nine in non-residential areas (screened against the NDCR non-residential limit of 1 200 mg/m²/day).

Monitoring data were made available to the specialist to analyse. During 2022 to 2024 both the residential and non-residential locations, the dust fall rates were below the respective NDCRs with no exceedances recorded.

7.1.6.4 DESCRIPTION OF OPERATIONS AT SAVUKA AND MPONENG MINES

- Ventilation shafts

Typical operations associated with underground mining include sub-surface drilling and blasting, sub-surface transferring ore and waste rock to surface with conveyors, material transfer points, stockpiling, and mobile equipment operations. There is one operational shaft at Savuka Mine and one at Mponeng Mine.

- Savuka and Mponeng Gold Plants

The only operational plant is the Mponeng Gold Plant, with only material handling, crushing and screening at the Savuka Gold Plant. The Mponeng Gold Plant comprises of three operational carbon regeneration kilns and a smelter. While the carbon regeneration kilns do not have any associated abatement equipment/control technology; the smelter off-gas is routed through a baghouse before being vented to the atmosphere.

- Tailings Storage Facilities

There are several active and dormant TSFs, with the focus of the study on the Savuka 7a & 7b TSFs. Tailings material is reclaimed from the dormant TSFs and loaded into trucks and transported by unpaved road to the Mponeng Gold Plant. The Savuka (5 and 7) TSFs and Mponeng TSF are in use as residue deposition sites. All these TSFs are subject to wind erosion.

Wind erosion is a complex process, including three different phases of particle entrainment, transport and deposition. It is primarily influenced by atmospheric conditions (e.g. wind, precipitation and temperature), soil properties (e.g. soil texture, composition and aggregation), land-surface characteristics (e.g. topography, moisture, aerodynamic roughness length, vegetation and non-erodible elements) and land-use practice (e.g. farming, grazing and mining) (Shao, 2008).

Windblown dust generates from natural and anthropogenic sources. For wind erosion to occur, the wind speed needs to exceed a certain threshold, called the friction velocity. This relates to gravity and the inter-particle cohesion that resists removal. Surface properties such as soil texture, soil moisture and vegetation cover influence the removal potential. Conversely, the friction velocity or wind shear at the surface is related to atmospheric flow conditions and surface aerodynamic properties. Thus, for particles to become airborne the wind shear at the surface must exceed the gravitational and cohesive forces acting upon them, called the threshold friction velocity (Shao, 2008).

The US EPA indicates a friction velocity of 5.4 m/s to initiate erosion from coal storage piles (US EPA, 2006). Liebenberg-Enslin (2014) estimated a wind erosion threshold of 8.8 m/s for gold tailings, and Mian & Yanful (2003) calculated a wind speed more than 9 m/s is required to initiate wind erosion from two tailings storage facilities in in New Brunswick and Ontario, Canada. Thus, the likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s.

As indicated, any binding properties would reduce the potential for wind erosion. One of the most effective measures of minimizing wind erosion emissions from tailings storage facilities is re-vegetation. The control efficiency of vegetation is given as 40% for non-sustaining vegetation and 90% for re-vegetation. Secondary rehabilitation would up the control efficiency to 60% for non-sustaining vegetation (NPI, 2012). The current active TSFs and proposed TSF would not be covered and therefore pose the largest risk for wind-blown dust

- Marginal Ore Dumps

The Savuka and Mponeng Marginal Ore Dumps (MOD) are being reclaimed. The recovery of a MOD involves bulldozing the rock from the top of the dump in successive layers. At the bottom of the slope the rock is loaded into trucks and transported by unpaved road to the Mponeng Gold Plant. The MODs are far less susceptible to wind erosion than the TSFs due to the material properties (mostly due to the size of the particles).

- Vehicles operations

Trucks transport the tailings and MOD material by unpaved road to the Mponeng Gold Plant. The operation of the trucks would result in both entrainment of dust along the unpaved roads and exhaust emissions. It has been found that of these two particulate matter sources associated with the truck operations the entrainment of dust as the trucks travel along the unpaved roads is far more significant than exhaust emissions and is often one of the most significant sources of elevated ground-level fine particulate matter concentrations and dust fall rates at and around mining operations.

7.1.6.5 AIR QUALITY SENSITIVE RECEPTORS

Air Quality Sensitive Receptors (AQSR) near the Savuka operations include Southdene (north of Savuka 5 TSF), Elandsridge (southeast of 7b TSF and southwest of 5 TSF), Harmony Hostel (southeast of 7b TSF) and Harmony Hospital (south of the Savuka Plant).

7.1.6.6 FINDINGS OF THE BASELINE AIR QUALITY ASSESSMENT

The main sources associated with the Savuka and Mponeng operations likely to contribute to baseline PM emissions include mining and reclaiming operations, processing operations, vehicle entrained dust from roads, vehicle exhaust and windblown dust from exposed areas on existing TSFs.

Other sources of PM within the area include other companies mining, transport and processing activities, farm activities, occasional biomass burning, household fuel burning in the residential areas, vehicle entrained dust from public roads and vehicle exhaust.

The wind field is dominated by winds from the northerly sector with the strongest winds (>6 m/s) mostly from the north-northeasterly sector. The predominant northerly wind field remains similar throughout the seasons.

Dust fallout results from the 10 DMUs at Savuka for the period January 2023 to October 2024 show compliance with the NDCR at both the residential and non-residential sites.

The main findings of the receiving environment assessment are:

- AQSRs near the Savuka operations include Southdene (north of Savuka 5 TSF), Elandsridge (southeast of 7b TSF and southwest of 5 TSF), Harmony Hostel (southeast of 7b TSF) and Harmony Hospital (south of the Savuka Plant).
- The main sources associated with the Savuka and Mponeng operations likely to contribute to baseline PM emissions include mining and reclaiming operations, processing operations, vehicle entrained dust from roads, vehicle exhaust and windblown dust from exposed areas on existing TSFs.
- Other sources of PM within the area include other companies mining, transport and processing activities, farm activities, occasional biomass burning, household fuel burning in the residential areas, vehicle entrained dust from public roads and vehicle exhaust.
- The wind field is dominated by winds from the northerly sector with the strongest winds (>6 m/s) mostly from the north-northeasterly sector. The predominant northerly wind field remains similar throughout the seasons.
- Dust fallout results from the 10 DMUs at Savuka for the period January 2023 to October 2024 show compliance with the NDCR at both the residential and non-residential sites.

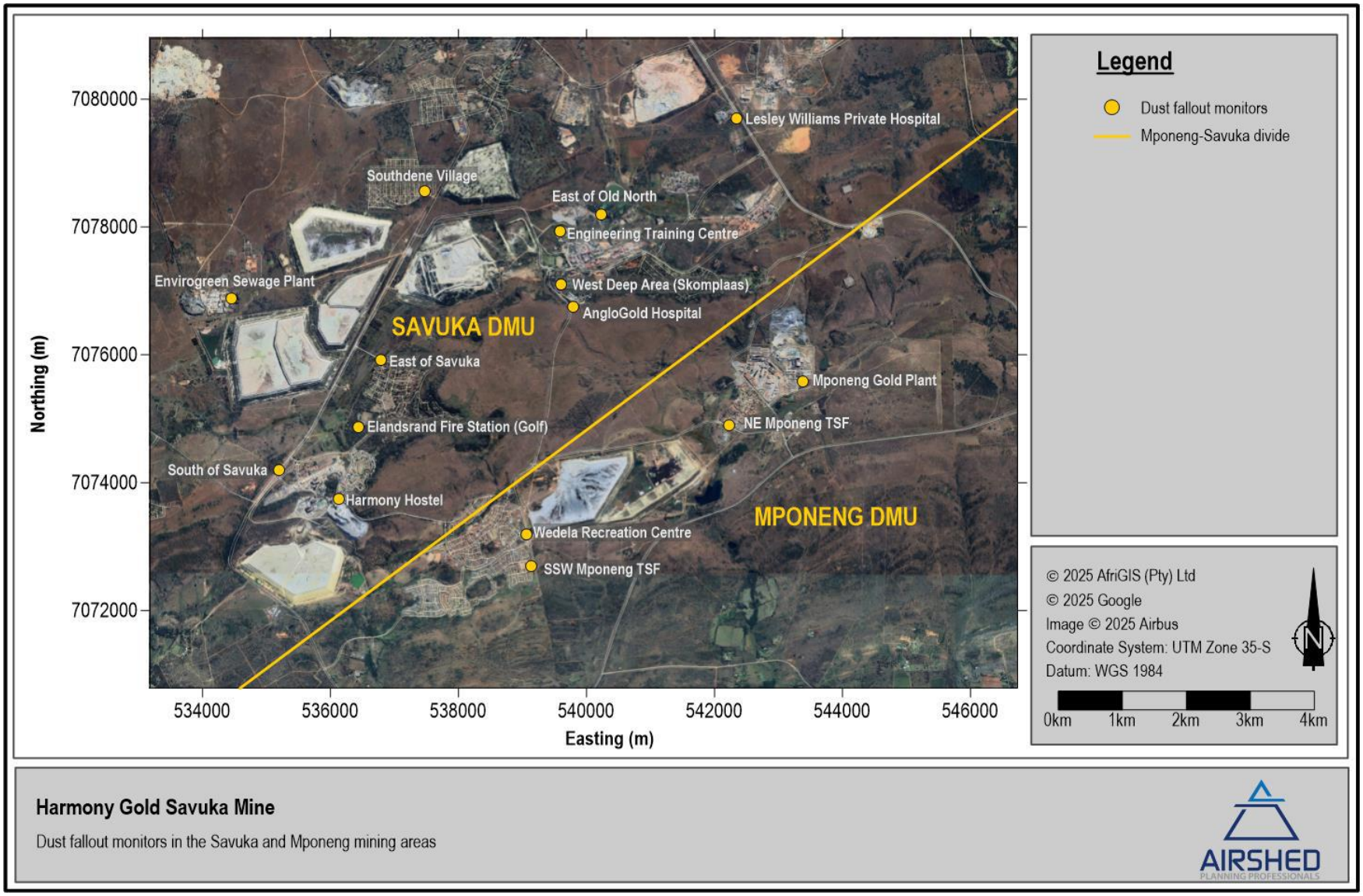

Figure 19: Savuka and Mponeng Dust fall Monitoring Units (DMU)

7.1.7 NOISE BASELINE

The area surrounding the project area consists predominately of mining development and other industrial activities. Other dominant land uses in the project area include the local access roads, dirt roads, tar national road and existing pipeline and powerline servitudes. The proposed properties are expected to be generally flat, with a few steep TSFs in adjacent properties. The area is predominantly characterised by TSFs and other infrastructure related to the mining activities from the Harmony Savuka Mine and other Harmony mining activities in the area. There are some residential areas including schools and community facilities further away from the TSFs. However, the increase in height of the TSF and extension of mining will not have an impact on the noise baseline conditions of the area. Deposition of tailings and other activities associated with the operation of the TSFs is fairly noiseless, especially from ground level.

7.1.8 TOPOGRAPHY

The northwestern and western sections of the study area comprises gently undulating land that slopes to the west and south to drainage lines that flow to the west and northwest, as well as some *Eucalyptus* plantations. At the residential area associated with Deelkraal, the topography rises to low west-to-east-orientated savannah-covered hills that cross the southern sections of the study area. Refer to Figure 20.

7.1.9 LANDSCAPE QUALITY AND VISUAL

A visual impact assessment was undertaken by Graham Young (refer to Appendix E) and the baseline information from that study is presented in this section.

7.1.9.1 LANDSCAPE CHARACTER

The site is located within an area that is predominantly surrounded by existing mining infrastructure. There are no protected areas in the vicinity of the proposed site. The existing visual condition of the landscape that may be affected by the proposed activity has been described. The study area's scenic quality has been rated low to high within the context of the subregion. The project footprint is in a landscape type with a low scenic quality. Sensitive receptors, viewing areas and landscape types have been identified and mapped, indicating a potentially low sensitivity to the project. However, the results of the public participation process must confirm this assumption.

The study area has a mixed aesthetic and visual landscape, with mining activities dominating. The northwestern and western sections of the study area comprises gently undulating land that slopes to the west and south to drainage lines that flow to the west and northwest, as well as some *Eucalyptus* plantations. At the residential area associated with Deelkraal, the topography rises to low west-to-east-orientated savannah-covered hills that cross the southern sections of the study area. East of the R501 and N12 connector road are mostly mining activities and associated infrastructure, including residential areas associated with the mines. The Savuka TSFs occur in this mining belt. The areas between the mines comprise mostly disturbed highveld rolling scrubby grassland, associated with the Gauteng Shale Mountain Bushveld (Mucina & Rutherford, 2006, p. 467) landscape type.

The study area's (study site and a 5 km radius around the site) landscape characteristics can roughly be divided into five landscape types.

- *Savannah-covered slopes* – high scenic quality – high visual sensitivity to change.
- *Open grassland on higher land* – moderate scenic quality – moderate visual sensitivity to change.
- *Eucalyptus plantations* – moderate scenic quality – moderate to low visual sensitivity to change.
- *Urbanization and settlements* – moderate to low scenic quality – moderate to low visual sensitivity to change
- *Mining and degraded land* - low scenic quality – low visual sensitivity to change (the project occurs in this landscape type).

7.1.9.2 VISUAL RESOURCE VALUE, SCENIC QUALITY, AND LANDSCAPE SENSITIVITY

The value of the visual resource and its associated scenic quality using specific criteria, assigned to the landscape character types described above is determined through the value of "individual contributors to landscape character, especially key characteristics, which may include individual elements of the landscape, particular landscape features, notable aesthetic, perceptual or experiential qualities, and combinations of these contributors" (LiEMA, 2013, p. 89). These primary features give the area typical characteristics and a sense of place. The sensitivity of the study area's various landscape types is defined as high, moderate or low (as indicated below) and is dependent on the following four factors:

- Character (does it contribute to the area's sense of place and distinctiveness?)
- Quality – in what condition is the existing landscape?
- Value – is the landscape valued by people, the local community, and visitors, and is the landscape recognised locally, regionally, or nationally?
- Capacity – what scope is there for change (either negative or positive) in the existing landscape character? (LiEMA 2013).

When the criteria are considered and understood within the context of the subregion, the landscape types are assigned a visual resource value, as indicated in Table 11 below.

Table 11: Value of the Visual Resource

High **Savannah covered slopes**	**Moderate** **Urbanisation and settlements**	**Low** **Mines and associated infrastructure and degraded land**
This landscape type is considered to have a high value because it is a: A distinct landscape that exhibits a positive character with valued features that combine to give the experience of unity, richness, and harmony. It is a landscape that may be important to conserve and has an intense sense of place. Sensitivity: It is extremely sensitive to change in general. It will be detrimentally affected because the key characteristics of the landscape, considering its existing character and quality, have limited ability to accommodate change without adverse effects.	These landscape types are considered to have a moderate/low to moderate scenic value because they are: Common landscape that exhibits some positive character but which has evidence of alteration/degradation/erosion of features resulting in areas of more mixed character. Sensitivity: It is moderately sensitive to change in general, and change may be detrimental because the key characteristics of the landscape have some ability to accommodate change, considering the existing character and quality of the landscape.	This landscape type is considered to have a low scenic value because it is a: Minimal landscape negative in character with few, if any, valued features. Sensitivity: It is generally less susceptible to change because the relevant characteristics of the landscape can accommodate change without adverse effects, considering its existing character and quality.

7.1.9.3 SENSE OF PLACE

According to Lynch (1992), a sense of place is the extent to which a person can recognise or recall a place as distinct from other places - as having a vivid, unique, or at least particular, character of its own. The sense of place for the study area derives from a combination of the local landscape character types described above, their relative 'intactness,' and their impact on the senses.

The activities and land uses are common within the sub-region. The dominance of mining infrastructure defines the general sense of place of the study area, although the natural areas create a sense of natural harmony between the various mining activities. However, the proposed height extension to the Savuka 7a and 7b TSFs would not appear out of place in this mixed aesthetic environment. The proposed activities would appear to 'fit' (be visually contextual) into the scene, especially as they would be incorporated into the existing infrastructure that dominates much of the study area. The Project would, therefore, not appear at odds with the visual characteristics of the baseline landscape.

Impacts on views are the highest when receptors are identified as sensitive to change in the landscape, and their views are focused on and dominated by these changes. The results of the public participation process were not known at the time of writing this report, and generic sensitivities were ascribed to indicate that visual issues would be of low concern to the I&APs.

The project will introduce an activity currently occurring in the subregion and cause a low cumulative alteration to the baseline's key features and characteristics during the operational phase. The pre-development landscape and views will not be significantly affected by the introduction of an activity characteristic of the mining subregion when set within the attributes of the receiving landscape. The project would primarily affect receptors travelling through the study area on the connector road west of the project site and people living in the Deelkraal residential area as indicated on Figure 21.

Figure 20: Topography.

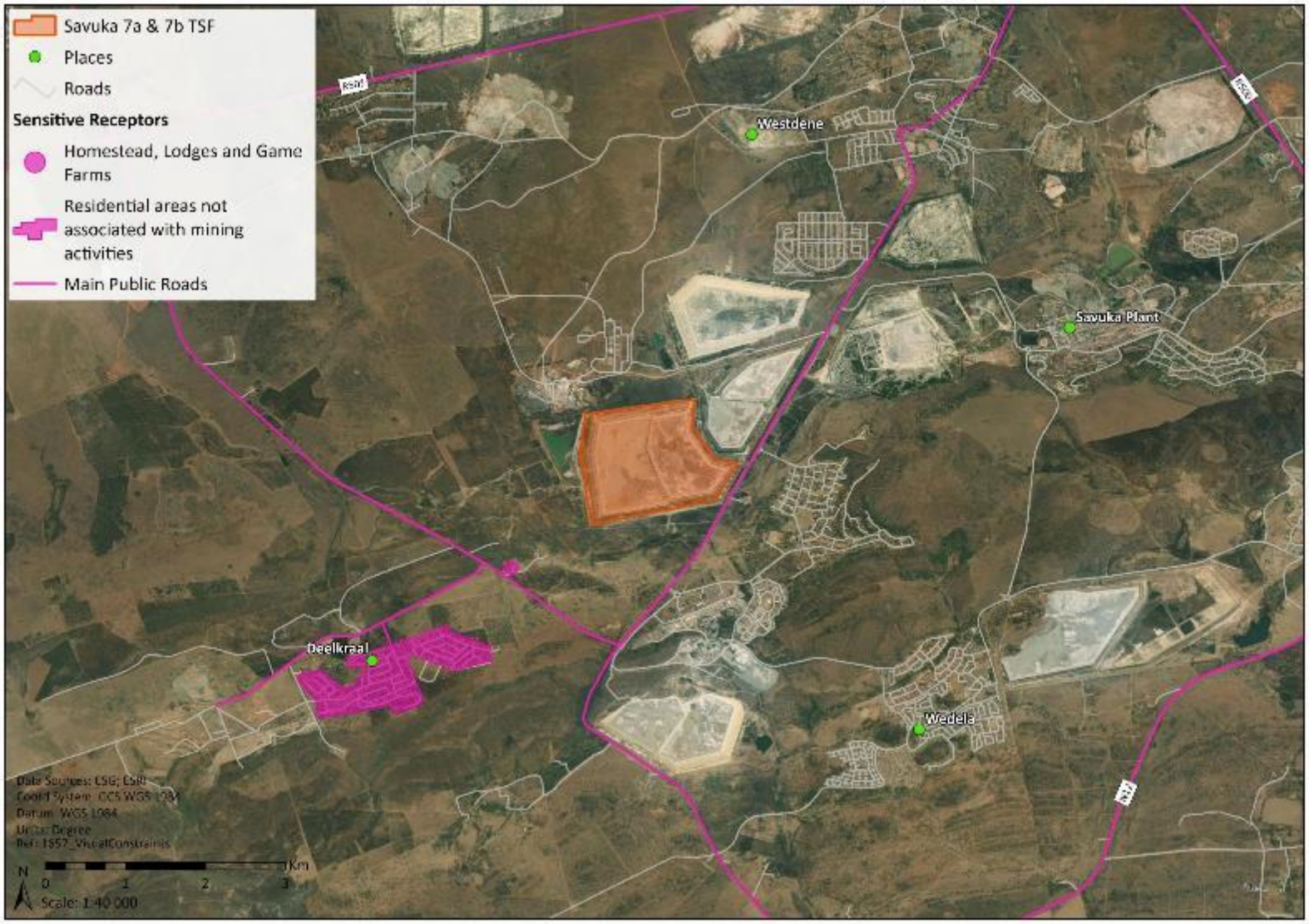

Figure 21: Visual Sensitive Receptors.

7.2 BIOLOGICAL ENVIRONMENT

The biological environment comprises the terrestrial and aquatic vegetation and habitats, as well as fauna living in these habitats.

7.2.1 FLORA

The project area is situated within the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

- Seasonal precipitation; and
- The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grasslanad biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees. The project area spans across the Gauteng Shale Mountain Bushveld Vegetation Type of this biome (Figure 23).

There is negligible natural vegetation occurring on the study area, as the study area is mainly comprised of the TSFs. The habitat close to the area is described in Section 7.2.3. TSFs has been established decades ago and covers the entire study area. Most of the surrounding land uses are associated with mining. The complete study area and most of the directly adjacent area is already disturbed with mining activities such as the TSFs. During the site visit, the EAP did not encounter any terrestrial biodiversity sensitive features or species on the study area.

7.2.2 FAUNA

No fauna were observed during the site screening verification visit to the site. The TSFs have been established decades ago and covers the entire study area. Most of the surrounding land uses are associated with mining. The complete study area and most of the directly adjacent area is already disturbed with mining activities such as the TSFs. During the site visit, the EAP did not encounter any terrestrial biodiversity sensitive features or species on the study area.

7.2.3 HABITATS

7.2.3.1 WETLANDS

An aquatic impact assessment was conducted by The Biodiversity Company specialists that included a site visit. Four (4) Hydrogeomorphic (HGM) units were identified within the encompassing 500 m Savuka TSF Project Area Of Influence (PAOI). These were classified as; one (1) channelled valley-bottom, two (2) unchannelled valley-bottoms and one (1) artificial wetland. Several dams were identified within the PAOI, most of which were off-channel features. Furthermore, the one HGM unit has been identified as an artificial depression. In addition, two non-perennial drainage features were identified where one has connectivity to the larger perennial river, namely the Mooiriver. A summary of the wetland features is provided in the table below and photographic evidence in Figure 22.

Table 12: Summary of the identified Savuka 7a & 7b TSF watercourses Wetland Type

Wetland Type	Wetland Name
Channelled valley-bottom	HGM 1
Unchannelled valley-bottom	HGM 2 HGM 4
Artificial Wetland	HGM 3
Artificial watercourses	Artificial
Dams	Artificial Dams

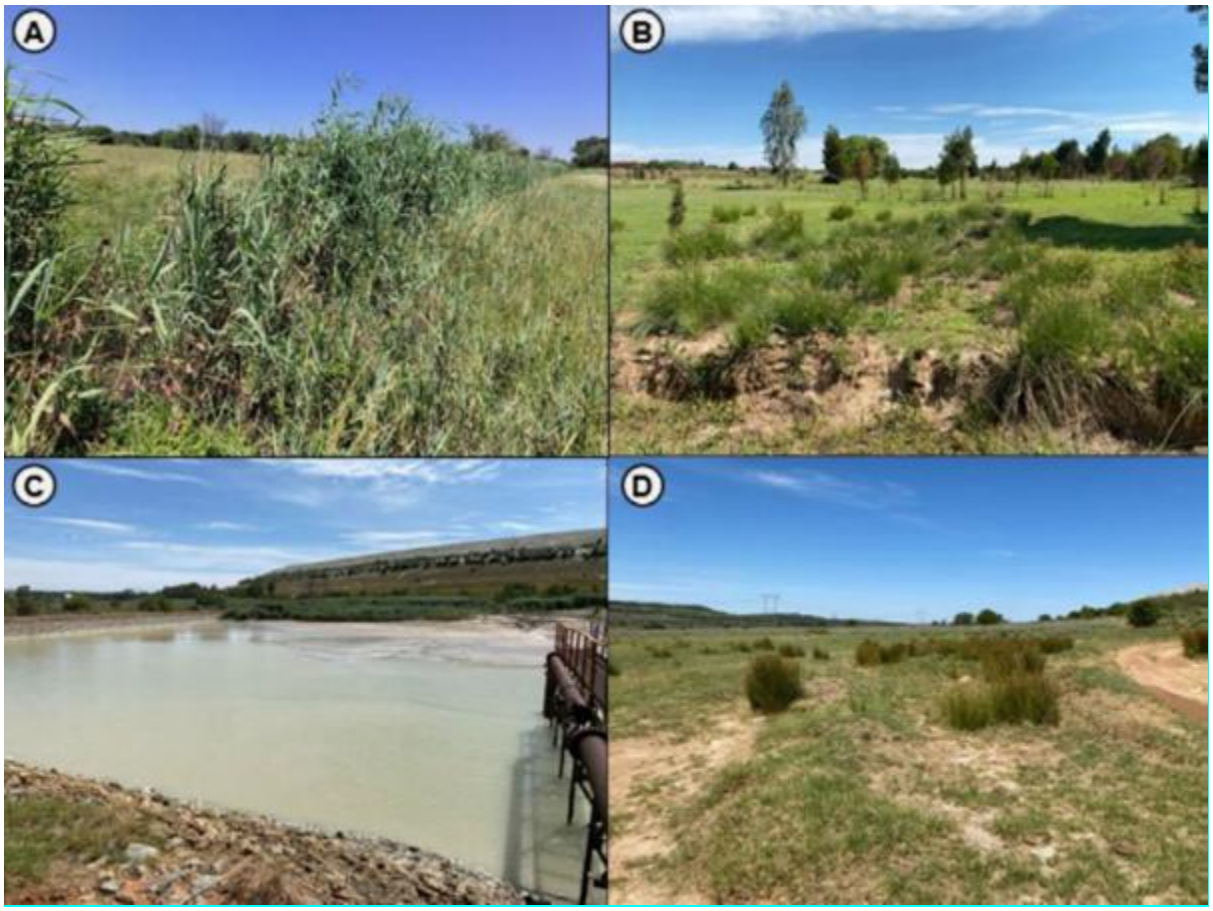

Figure 22: Representative photographs of the various freshwater features within the Savuka project area. A) Channelled valley-bottom (HGM 1); B) Unchannelled valley-bottom (HGM 4); C) Dam and D) Artificial Depression

HGM 4 is characterized as “at risk” from the development and the other delineated wetlands as “not at risk” from the proposed development.

The ecosystem services provided by the HGM units on site were assessed and rated using the WET-EcoServices method (Kotze et al., 2009). For Savuka 7a & 7b TSF, the average ecosystem scores ranged from “Moderately High” (HGM1) to “Intermediate” (HGM2 and HGM4). Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation,

provisioning of water for human use, erosion control, and the maintenance of biodiversity. HGM 1 was scored as Moder

The wetlands exhibited different degrees of modification resulting from natural physical changes as well as anthropogenically induced impacts at both the local and catchment level. Resultingly, the wetlands have scored an average Present Ecological State (PES) score of either “D – Largely Modified”(HGM 4) or “E – Seriously Modified” (HGM 1 and 2) PES class.

The Ecological Importance and Sensitivity (EIS) assessment was applied to the HGM units in conjunction with the ecosystem service scores in the preceding section, to assess the levels of sensitivity and ecological importance of the wetland. Various components pertaining to the protection status of a wetland is considered for the EIS, including Strategic Water Source Areas (SWSA), the NFEPA wet veg protection and threat status and the protection and threat status of the wetland type itself considering the NBA wetland dataset. It should be noted that where the dataset did not identify a wetland and one was identified on site, the closest wetland of the same type within the dataset was used to extrapolate findings for the purpose of this assessment. The wetlands average EIS scores were in the “B – High” EIS class.

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) for the wetland areas was determined from the results of the PES and EIS assessments. These assessments indicated that the wetland feature within the site, had underwent transformation as a result of historical and current impacts. Nevertheless, despite the altered ecological integrity of the systems, they are considered to provide ecological services. The REC for wetland units HGM 1 and 2 is E/F and for HGM 4 C/D. The RMO for both wetlands is to improve the current PES.

The buffer requirements for the wetlands were calculated using the Site-Based Tool: Determination of buffer zone requirements for wetland ecosystems (Macfarlane *et al*., 2014). The advised pre-mitigation buffer zone for all wetlands within the Savuka 7a & 7b TSF PAOI is 32 m, which is reduced to 15 m following mitigation measures. The buffers considered the sensitivity of the wetlands and the level of modification to the wetland’s periphery (buffer intactness) in relation to the type of development or proposed activities. Figure 24 indicates the delineated wetlands with recommended buffers and Figure 25 illustrates the freshwater sensitivity of the project area of influence.

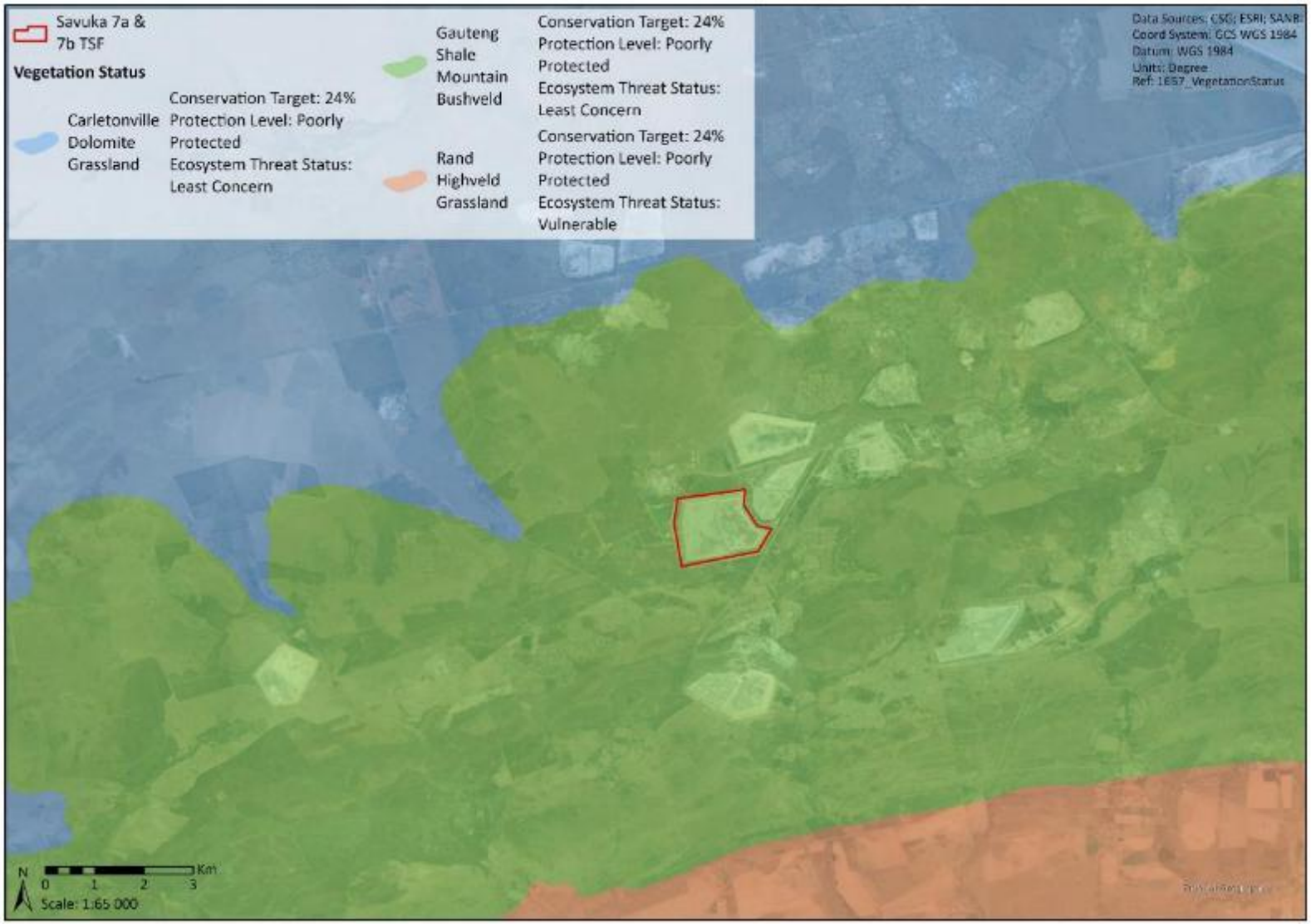

Figure 23: Map illustrating the vegetation type and status of the project area.

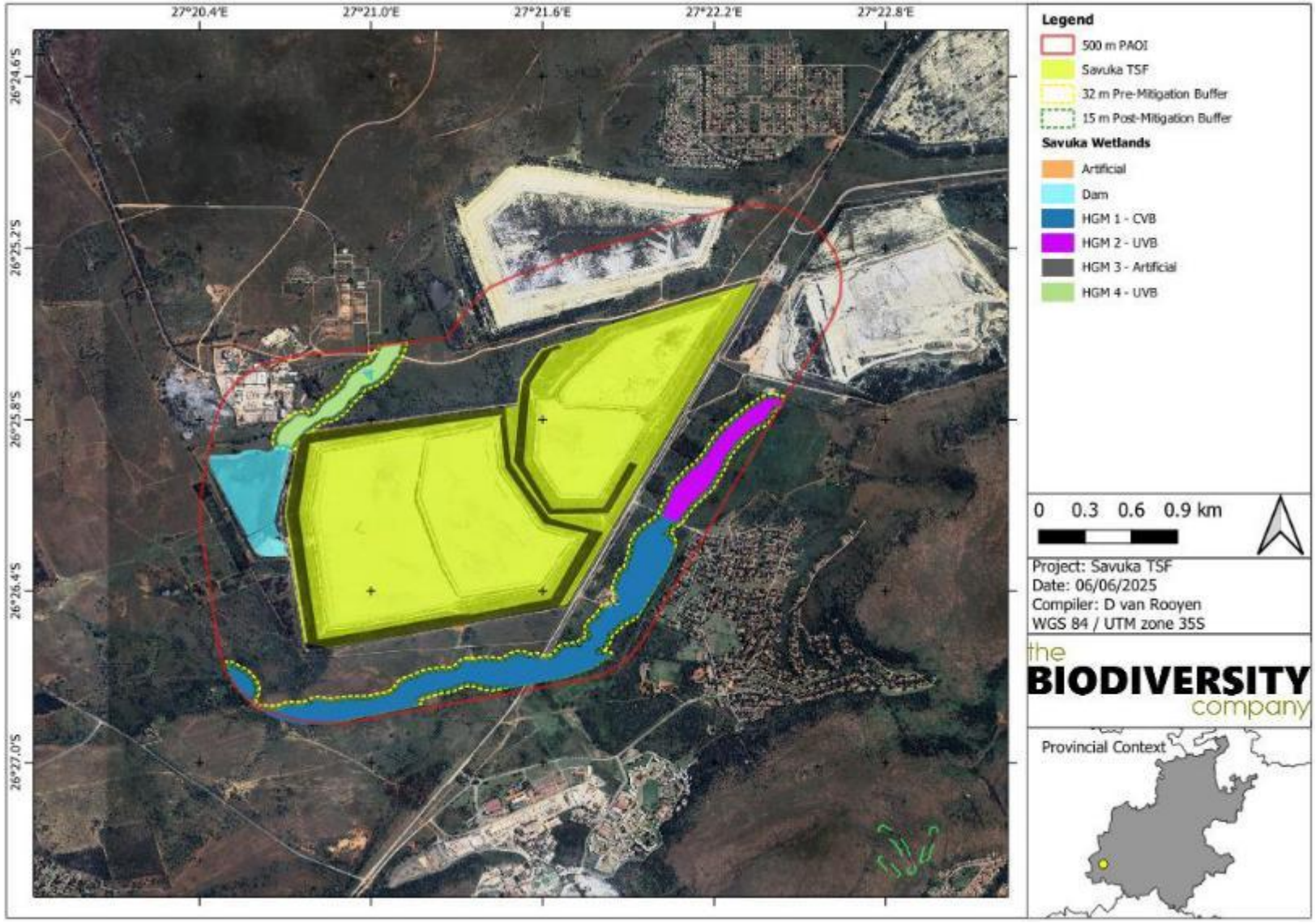

Figure 24: Map illustrating the delineated wetland units within the project area with recommended buffers.

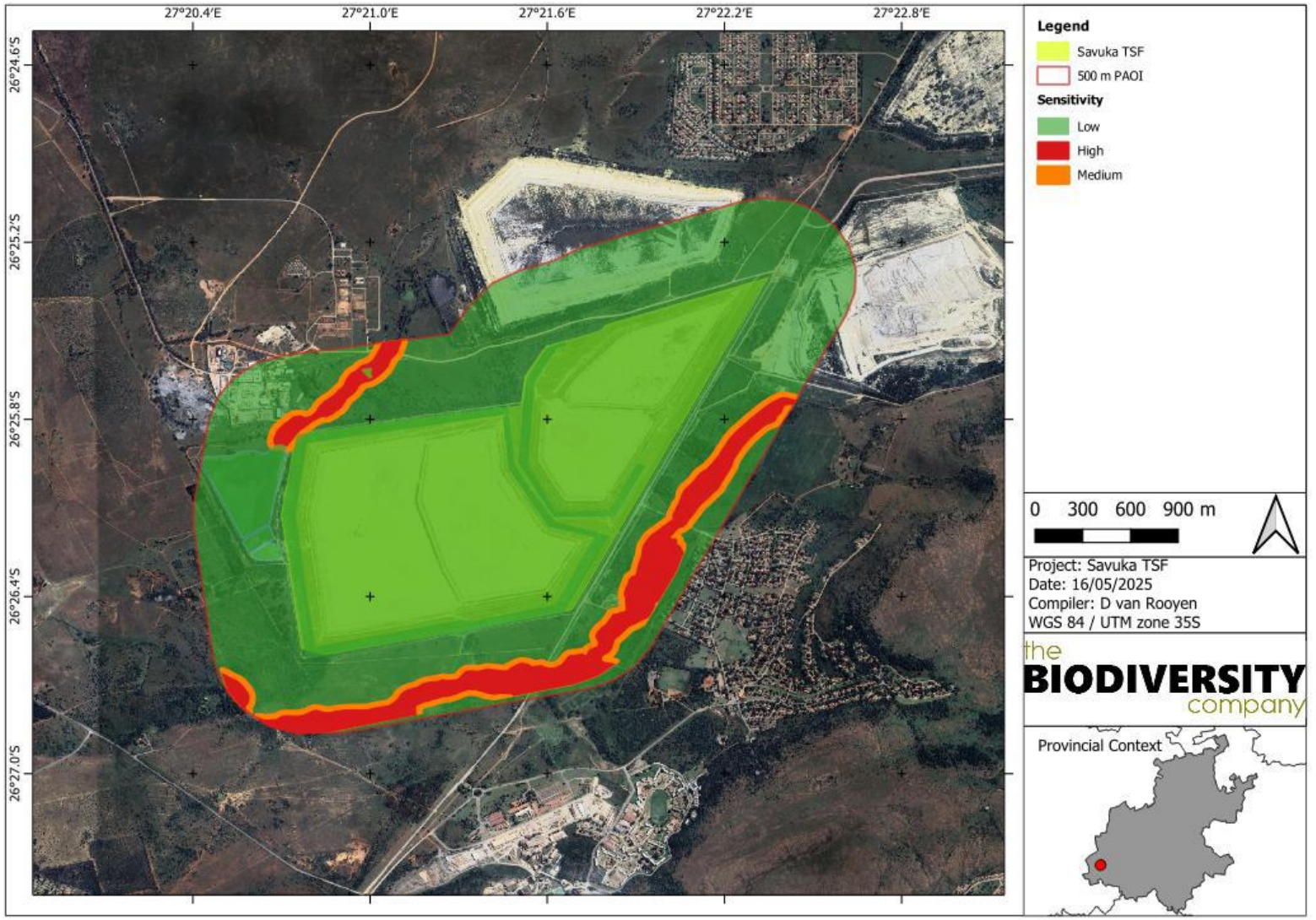

Figure 25: Map illustrating the freshwater sensitivity for the Savuka 7a & 7b TSF Project Area of Influence

7.3 SOCIO-ECONOMIC ENVIRONMENT

The socio-economic baseline conditions relevant to the Project area are described in Equispectives (2015; 2020). The radiological health specialist (Aquisim Consulting), presented this report as a detailed summary of the conditions that serve as a basis for human behavioural conditions and their interaction with the environment, in his report, Radiological Impact Assessment (Appendix E). This information provides input into the definition of receptor groups and their behaviour within the public exposure conditions.

7.3.1 COMMUNITY TYPES

Communities can be classified as belonging to one of the following groups (Equispectives, 2024):

- Formal Residential Structure Communities

A formal dwelling can be described as "A structure built according to approved plans, i.e., house on a separate stand, flat or apartment, townhouse, a room in a backyard or rooms or flatlet elsewhere" (Statistics South Africa, 2012). In some areas, there may be a formal as well as an informal dwelling on a stand, creating a community with mixed dwelling types.

- Informal Residential Structure Communities

An informal dwelling can be described as "A makeshift structure not approved by a local authority and not intended as a permanent dwelling. Typically built with found materials (corrugated iron, cardboard, plastic, etc.), and is contrasted with formal dwelling and traditional dwelling" (Statistics South Africa, 2012).

- Commercial Agricultural Communities

Commercial agriculture includes farms where the farmer earns a livelihood from agriculture, such as crop, livestock, or game farming. Areas with smallholdings are categorised according to their character. If the residents of the smallholdings practise agriculture, they are grouped with commercial agriculture; if they just reside in the area or have a business on the smallholding not related to agriculture, the area is classified as formal residential.

- Small-scale Subsistence Farming

Small-scale subsistence farming can be described as food gardening taking place on a large scale on a piece of land that is not in someone's backyard. The land is usually cultivated by different members of the community, and they may belong to a formalised group. Food gardens in the backyard of an organisation, like a school or crèche, would also be grouped in this category. Keeping livestock in the community or on the outskirts of the community would form part of this group.

Agricultural projects conducted as part of a Social and Labour Plan of a mine can contain characteristics of both commercial agriculture and subsistence farming. To classify these projects, the following guideline is used: if the projects have reached a stage where it is sustainable and function with minimal to no input from the mine, they are classified as commercial agriculture. However, if the mine is still heavily involved, it is classified as small-scale subsistence farming, as the Project has not yet proved its sustainability.

Figure 26 shows a 5 km radius around the Project surface infrastructure, as well as the potentially sensitive receptors within a 5 km radius. The following residential areas were identified in 2015 near the Project:

AngloGold Ashanti residences (now part of GCTI operations)

The West Wits (GCTI) Operations had four residences for employees in 2015, namely Ntshonalanga, Matabong, Ekhayalihle and Numba Wani, which were converted to single rooms or family quarters. The family quarters were at Ekhayalihle and could host up to 25 people who became paraplegic after injuries on duty. Matabong housed employees from the TauTona mine, while Ntshonalanga housed employees who worked at the Savuka mine, which was integrated with the TauTona mine. Numba Wani hosted employees from the Mponeng mine. The operations also had facilities for visiting wives.

The TauTona and Savuka mines were placed in orderly closure in 2017, and as such, the only residence where the activity is expected is the Numba Wani residence. The Merafong City Local Municipality (2019/2020) has

indicated that Mponeng has a good locality relative to the N12 that could be exploited once mine closure looms, and that there is possibly good potential for non-residential uses.

West Wits Village

In 2015, the West Wits Village housed employees of AngloGold Ashanti. The 2019/2020 IDP of the Merafong City Local Municipality indicates that township establishment is underway. The municipality is looking into the feasibility of a Mining Industrial Park as part of the second phase of Mining Phakisa implementation. The re-use potential of the area is considered good, with the possibility of developing into a significant node.

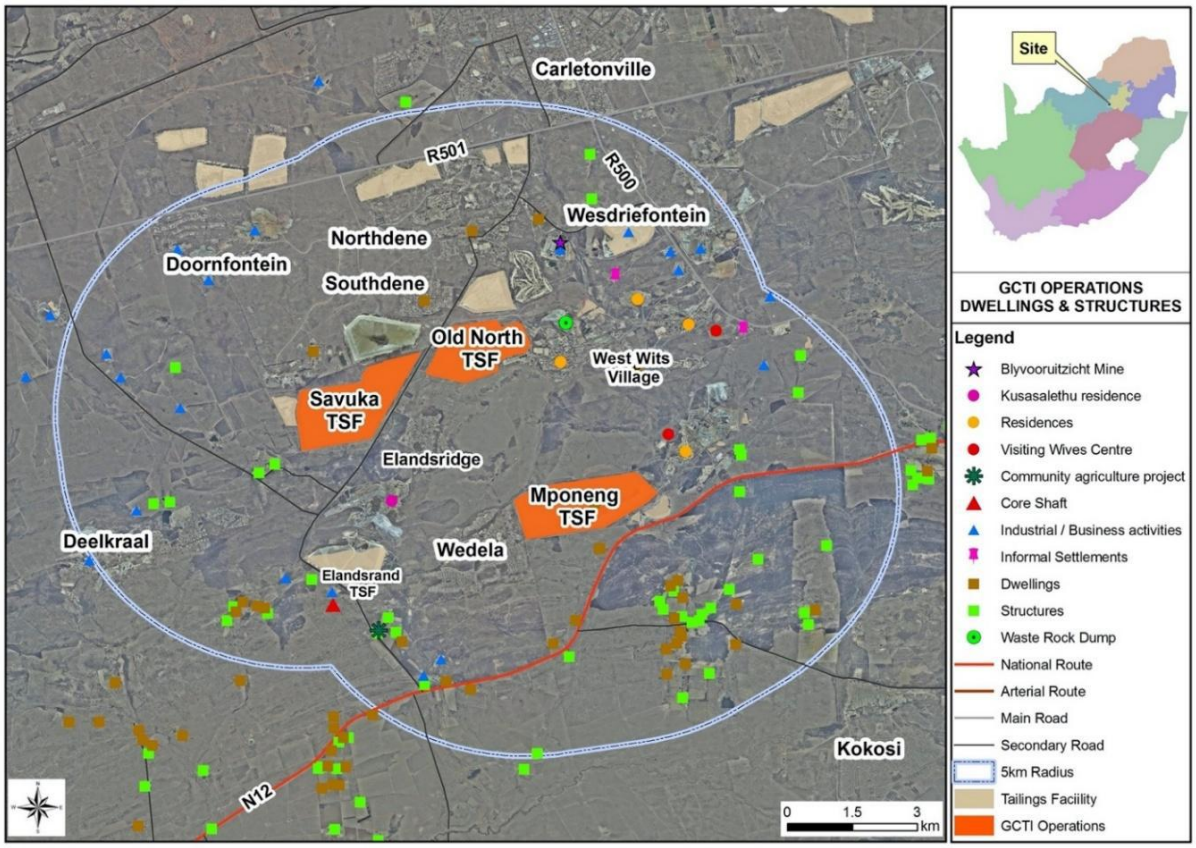

Figure 26: Map indicating the study area used for the Project Baseline Social and Land Use Assessment (Equispectives, 2020).

- Deelkraal Estate

Deelkraal Estate used to be a mining village, but was in private ownership in 2015, with the owners being in the process of having the estate declared as a township. In the 2019/2020 IDP document of the Merafong City Local Municipality, Deelkraal is still indicated as a mining village with limited supportive land uses and limited economic potential. Although most residences are in fair condition, the municipality anticipates that the market for rental or buying in Deelkraal to collapse within the next few years due to new rental options in Carletonville and Fochville, as well as the mineshaft closure at Kusasalethu mine. The municipality will not take over services in the area and anticipates that Deelkraal will be demolished and that the area will be rehabilitated.

- Elandsridge

Elandsridge/Elandsrand is a mining village where employees of Harmony's Kusasalethu mine reside. The Merafong City Local Municipality (2019/2020 IDP) has indicated that the Kusasalethu mine is expected to close within a few years, and if it does open again, it would be operated through mechanisation and automation. The municipality would not take over services, and the residential viability is regarded as low due to the lack of a new economic foundation, few facilities and the isolated location. It is anticipated that the area will be demolished and rehabilitated, possibly for agriculture or renewable energy.

- Wedela

Wedela is situated between Harmony's Kusasalethu Operations and the Mponeng tailings storage facility. It was established in 1978 and granted municipal status in January 1990. Wedela is mostly a formal settlement, but there is an informal settlement on the edge of Wedela, and many houses have backyard shacks. It is currently located close to mining operations that will not be sustained indefinitely.

- Mohaleshoek Informal Settlement

This informal settlement is located on private land adjacent to the R500, between the TauTona and Mponeng mines. Many residents are rumoured to be illegal immigrants. The Merafong City Local Municipality (IDP 2019/2020) has indicated that the informal settlements located at Blyvooruitzicht and Western Deep Levels can be accommodated at the West Wits township, either through subsidised housing or a CRU (Community Residential Units) project. The CRU programme aims to facilitate the provision of secure, stable rental tenure for lower-income individuals (www.gov.za).

- Farming Community

The farming community consists of farms and smallholdings that are located in the Deelkraal area as well as adjacent to the Mponeng mine. Farming activities consist of crop farming, livestock, game breeding and hunting. Some of the farms offer tourist activities. Some farms have workers residing on the farm, while the workers from other farms do not reside on the farm, but somewhere else in the vicinity.

- Residential areas around the Blyvooruitzicht mine

In 2015 people living in the area around the Blyvooruitzicht mine that was put in provisional liquidation in August 2013 lived in dire socio-economic conditions. The Merafong City Local Municipality (2019/2020 IDP) has indicated that the mine's gold mining component has been revived recently. According to the municipality, the village has significant potential to be integrated into Carletonville although buildings and infrastructure have been stripped and vandalised. The lawlessness that marked the area in 2015, seems to have been resolved by the new mine owner. There are dolomitic constraints in the area and the Housing Development Agency is conducting a feasibility study on the potential of reviving the village.

Figure 26 also shows the location of dwellings and structures relative to the Project that are not located in a town or a village. The number of dwelling groups has remained more or less the same, as observed through aerial photography. At some of the dwelling clusters, new buildings have been observed.

Table 13 presents the breakdown for households according to geo types as per Census 2011.

Table 13: Breakdown of households according to geo types (source: Census 2011) (Equispectives, 2020).

Geo Type	Merafong City Local Municipalit	Mining Wards				Mixed Wards			
		Ward 5	Ward 11	Ward 14	Ward 27	Ward 12	Ward 20	Ward 22	Ward 23
Urban Area	68,199	2,431	3,586	4,575	3,827	1,475	3,234	2,040	2,402
Traditional Area	0	0	0	0	0	0	0	0	0
Farm Area	2,207	0	0	75	0	68	0	0	0
Total	70,406	2,431	3,586	4,650	3,827	1,543	3,234	2,040	2,402

It can be concluded that the land use near the Project is dominated by open grassland, agricultural (cultivated cropland), mining and residential land use conditions. Equispectives (2020) divided communities into those living in formal structures, communities living in informal structures, commercial agricultural communities, and small-scale subsistence farming communities.

7.3.2 DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

7.3.2.1 POPULATION AND HOUSEHOLD SIZE

The population in the Merafong City Local Municipality showed a decrease in population (from 197,520 to 188,843) of 4.39% and an increase of 19.83% in households (from 66, 624 to 79,834) between 2011 and 2016. This is much lower than on the provincial level, while average household sizes have decreased from 2.96 to 2.37%. This suggests an increased demand for housing and infrastructure, as well as open space that can be converted to residential areas. More people moved out of the area than moved into the area. According to the Merafong City Local Municipality IDP (2019/2020), this is due to the low quality of life and low economic growth in the area.

The research also shows that in most Wards, the majority of the population belongs to the Black population group. In Ward 12 more than half of the population belonged to the White population group, while in Ward 14 just over a third of the population belonged to the White population group. Ward 12 includes Deelkraal as well as Welverdiend (which is located outside the 5 km radius). Ward 14 includes West Wits Village, a portion of Fochville, the Numba Wani Residence and the Mohaleshoek Informal Settlement. Between 2011 and 2016, the proportion of residents belonging to the Black population group decreased in the Merafong City Local Municipality from 86.52% to 83.43% while the proportion for the White population increased from 11.79% to 15.07%.

7.3.2.2 SOCIO-ECONOMIC CONDITIONS

Census 2011 data shows that in 2011 the employment levels for the economically active part of the population (aged 15 to 64 years) varied. Ward 11, Ward 14 and Ward 27 (all three are mining wards) have the highest levels of employed people, higher than on local, district and provincial levels. It must be noted that large-scale retrenchments have taken place in the gold mining industry since 2012. Given the decline in employment in the gold mining industry over the past decade it is anticipated that the proportion of unemployed people in the area has increased since 2016.

7.3.2.3 POPULATION COMPOSITION, AGE, AND GENDER

Census 2011 data shows that in 2011, more than half of the households on provincial, regional, local and ward levels consisted of 1 to 2 people, except in Ward 12 and Ward 22, where the incidence was just under half. Ward 5 (64.85%), Ward 11 (68.34%), Ward 14 (71.55%) and Ward 27 (75.89%) had the highest incidence of households consisting of only one person. All these areas contain mining residences or mining villages. The proportion of single-person households decreased at all levels between 2011 and 2016. In Merafong City Local Municipality, it decreased from 40.11% to 30.72%. This can be indicative of people trying to cut their living expenses by sharing a dwelling, given the shrinking number of employment opportunities in the area. Average household sizes decreased between 2011 and 2016.

Census 2011 data also shows that more than two-thirds of households in Merafong City Local Municipality were headed by males. On a ward level, this proportion varied between two-thirds and more than 90%. Community Survey 2016 shows that between 2011 and 2016, the proportion of female-headed households remained more or less the same. Female-headed households are often financially less well-off than similar male-headed households and can be considered more vulnerable.

Census 2011 data shows a bias towards males on a district, local and ward level, except in Ward 12, Ward 20, Ward 22 and Ward 23, where the split between males and females was more or less equal. These are the wards that do not mainly consist of mining residences and villages and include Wedela, Deelkraal and farming areas. The split between males and females remained more or less the same between 2011 and 2016, with a slight increase in the proportion of females.

Census 2011 data presented in Figure 27 shows that Ward 5, Ward 14 and Ward 27 had the highest proportion of people older than 17 years of age, while Ward 22 had the lowest. Between 2011 and 2016, the proportion of people older than 17 years of age in Merafong City Local Municipality increased slightly, while the proportion of people under 2 years decreased slightly.

Child-headed households are considered extremely vulnerable as there is usually no adult who can provide them with food and other necessities, and often these households need to rely on the kindness of neighbours and other family members for survival. A child who heads a household often does not have the experience and maturity required to raise his or her siblings and often has to drop out of school to do this.

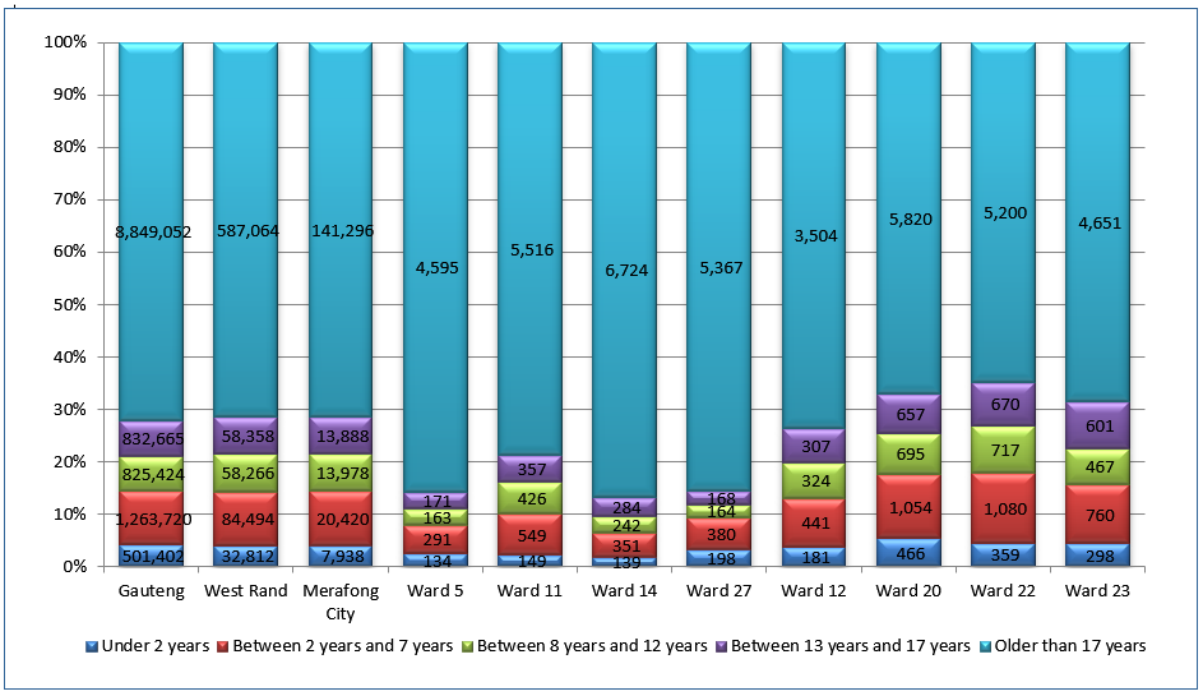

Figure 27: Age distribution of the population (shown in percentage; source: Census 2011) (Equispectives, 2020).

Census 2011 data shows that Ward 20 (1.1%), 22 (1.4%) and Ward 23 (1.2%) had the highest incidence of child-headed households with the age of the heads of household between 10 and 19 years. This was still slightly above the incidence on the municipal level for Merafong City Local Municipality (1%). The area with the highest incidence of heads of household that have reached retirement age was Ward 12 (9.7%) and Ward 22 (8.9%). Between 2011 and 2016, the incidence of heads of households that are 19 years or younger increased marginally, but the proportion of household heads that have reached retirement age (65+ years) in Merafong City Local Municipality increased from 6.4% to 7.9%. This suggests that many people stay in the area after they have retired.

7.3.2.4 HOUSEHOLD STRUCTURES

The different residential areas in the area can be grouped according to the settlement types and the housing structures present in each area. Table 14 summarises the settlement types and representative residential areas that are included in the discussions.

Table 14: A summary of community types and representative residential areas inside the study are identified for the Project.

Settlement Type	Representative Area
Formal Residential	Deelkraal, Elandsridge and Wedela
Informal Residential	Mohaleshoek informal settlement, Wedela

Settlement Type	Representative Area
Mine Workers Residences	Anglo Gold Ashanti residences and West Wits village
Agricultural areas	The surrounding farming community and the Matlosana agricultural project

Census data shows that Ward 12 (90.1%) and Ward 20 (79.4%) had the highest incidence of households living in dwellings that are brick or concrete structures, such as a dwelling in a separate yard, a block of flats, a cluster house or townhouse in a complex, or a semi-detached house. Ward 22 (30.4%) and Ward 5 (11.3%) had the highest incidence of informal dwellings that were not in someone's backyard, while Ward 23 (21.0%) had the highest incidence of households living in informal dwellings in someone's backyard. Ward 11, Ward 14 and Ward 27 had the highest incidence of households living in a flat or apartment in a block of flats or a dwelling that could be described as 'Other'. Given the high incidence of mining activities in these wards, these refer most likely to households living in mine residences.

Community Survey 2016 shows that the number of households living in formal dwellings or houses on a separate stand has increased in Merafong City Local Municipality from 59.7% in 2011 to 64.5% in 2016. The proportion of households living in any type of informal dwelling decreased between 2011 and 2016. In 2016, about a quarter (24.8%) of households in Merafong City Local Municipality indicated that they lived in RDP or government-subsidized dwellings. Almost two-thirds (61.3%) of those living in RDP or government-subsidized dwellings have rated the overall quality of the dwellings as good. According to the Merafong City Local Municipality IDP (2019/2020), the following urban developments are in the pipeline:

- Ward 12: Elija Barayi Village – west of Carletonville, next to Welverdiend. This development is planned to consist of about 8,150 RDP (Reconstruction and Development Programme)/BNG (Breaking New Ground) houses and 2,900 Gap houses.
- Ward 12: Khutsong South – expansions in the current Khutsong South area.
- Ward 14: Fochville Extension 7 – an undeveloped township area next to Fochville that is located on a hilltop and is regarded as more suited for high-income development.
- Ward 22, Ward 23: Wedela Extension 4 – undeveloped area next to Wedela (furthest away from mining infrastructure and located in the area where currently agricultural activities are taking place). This development will consider the need for additional business and institutional activities. A strip of multi-use business is envisioned, and the design and layout will focus on an 'Agri village' type of theme.
- Ward 27: West Wits Village Extension – forms part of the formalisation of West Wits Village and is intended to provide housing to informal dwellers within the area. Approximately 279 low-income (RDP/BNG) units are planned.

7.3.2.5 SOCIAL INFRASTRUCTURE AND SERVICES

Activities that take place in a community differ from community to community. Based on similar studies over time in other areas, people who live in areas where there are high levels of unemployment tend to spend more time outside. They socialise outside, children tend to play outside for most of the day, as many households in these areas cannot afford to send their children to daycare. Informal housing tends to be very cold in winter and hot in summer, and is usually quite small inside; as such, these residents prefer to be outside. In many lower-income areas, there are usually make-shift sports fields where residents can play soccer or other sports. Incidents of food gardens in areas with high levels of poverty and unemployment are usually higher than in other areas, as many residents do not have the means to buy all their food, and a higher proportion of people have time available to tend to a food garden.

In 2015, Equispectives (2015) stated that the residents of West Wits Village and the then AngloGold Ashanti residences were employed and would spend time outside when off duty. Those living in the residences would

socialise or do chores like washing, while those in West Wits Village most likely spent more time outside over weekends for recreational purposes. In Deelkraal, people were observed outside, and there were some recreational facilities.

In Wedela, time spent outside depended to a great extent on individual circumstances. Some women spent the whole day outside with chores, while many small children were playing outside. Some people hunted in the fields around the township, where some religious activities also took place. Given the high levels of unemployment, many people in Mohaleshoek were outside during the day, some just sat outside and socialised. On the farms, the farmers and their workers would spend most of the day outside, while their family members either farmed with them or spent less time outside. Community Survey 2016 shows that 14.85% of Merafong City Local Municipality have indicated that they walk to their place of education. As a result of the downscaling activities in the gold mining industry, it is anticipated that in certain residential areas, the number of people spending time outside would have increased, as they are no longer employed.

Census 2011 data shows that more than 90% of households in the area have access to water from a regional or local water scheme that is operated by the municipality or other water services providers, except in Ward 22, where only 77% of households have access to water from a local or regional water scheme. Ward 22, which consists mostly of farms and smallholdings, has the highest incidence (13.5%) of households that access water through boreholes. Ward 5 (4.4%) and Ward 14 (2.7%) have the highest incidence of households getting their water from water tankers.

The data also shows that more than half of households had access to piped water inside their dwellings in 2011, except in Ward 14 (30.7%), Ward 22 (33.3%) and Ward 27 (28.0%). Ward 14 (3.4%) and Ward 22 (2.5%) had the highest incidence of households that did not have access to piped water. Community Survey 2016 2016 shows that the incidence of households with access to piped water inside the dwelling in Merafong City Local Municipality has increased from 51.0% to 62.1%.

In the Community Survey 2016, approximately 6.7% of households in Merafong City Local Municipality have indicated that they do not have access to safe drinking water, while about 12.6% of people rate the overall quality of water services as poor. Approximately 22.2% of households have indicated that they have experienced municipal water interruptions in the past three months, while 15.0% of households have indicated that they had water interruptions that lasted for longer than two days. In Merafong City Local Municipality, 40.8% of the households that experienced water interruptions have indicated that they used water from a water tanker, 22.6% an 'other' water source (it is not specified what the alternative sources are), and about 28% used no other alternative water source during interruptions. The majority of people (80.9%) who do not have access to piped water inside their dwellings or yards have access to a source of water within less than 200 m.

7.3.3 CULTURAL HERITAGE

The proposed activity is within the existing footprint and as such it will not effect any tangible heritage (archaeology, palaeontology, historic structures) and intangible heritage (local indigenous peoples traditions).

8 ENVIRONMENTAL IMPACT ASSESSMENT

8.1 IMPACTS IDENTIFIED

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

When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. The identification of impacts is an objective iterative process of considering the project components and activities and how these may interact with the different environmental components. An activity/ environmental component matrix is presented in the table below.

The proposed extension of the TSFs will result in a maximum approved height of 70 m of the TSFs at full capacity. This could increase the existing negative impacts on air, surface and groundwater quality and sense of place. Furthermore, the proposed project could result in increased visual and economic impacts and health and safety risks.

A positive impact associated with the proposed activity is that it will allow Harmony Savuka Gold Mine to continue operations without interruption and sustain employment opportunities and poverty alleviation and other social and economic influences it delivers to the local community.

It should be noted that this report has been made available to I&APs for review and comment and their comments and concerns have been taken into account in the final BAR. Refer to Section 8.2 for the Methodology used in determining and ranking the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks.

The following section provides a description and assessment of the potential impacts identified in the impact assessment process. Refer to Appendix G for the full impact scoring calculations. A summary of the positive and negative impacts of the proposed activity are provided in Table 15 and Section 8.3.

Table 15: Impact identification matrix.

Phase	Activity	Environmental Component													
		Climate and Air Quality (AQ)	Geology and soils (G)	Hydropedology (HP)	Groundwater (GW)	Surface water/ wetlands (W)	Noise (N)	Topography (T)	Visual/ Landscape (V)	Flora (FL)	Fauna (FA)	Ecosystems/ habitats (EH)	Social (S)	Cultural Heritage (C)	Economic (E)
Operation	Deposition of tailings onto existing TSFs with the cyclone method.	-	-	-	-	-	-		-			-	-		+
	Maintenance and management of stormwater system		-	-	-	-	-					-			
	Water management		-	-	-	-	-					-	-		
Decommissioning, Rehabilitation and Closure	Revegetation	-	-	-	-	-	-		-			-	+		
	Erosion control	-	-	-	-	-	-		-			-	+		
Post Closure	Initiate maintenance and monitoring programmes	-	-	-	-	-						-	-		
	Environmental aspect monitoring	-	-	-	-	-						-	-		

Table 16: Impacts Identified and Assessed during the BA.

#	Impact	Activity/ Aspect	Phase
AQ1	Emissions and dust	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	Operation Decommissioning, Rehabilitation and Closure and Post-closure
AQ2	Exhalation and dispersion of radon gas into the atmosphere	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
AQ3	Emission and dispersion of particulate matter that contains radionuclides	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
AQ4	Implementation of the NNR-approved decommissioning plan	Revegetation Erosion control	Decommissioning, Rehabilitation and Closure and Post-closure
AQ5	Emission and dispersion of particulate matter that contains radionuclides and radon gas	Initiate maintenance and monitoring programmes Environmental aspect monitoring	Post-closure
HP1	Decrease in subsurface lateral flow and return flow	Maintenance and management of stormwater system Water management Initiate maintenance and monitoring programmes	Operation Post-closure
GW1	Leaching and migration of radionuclides from the TSF during the post-closure phase	Initiate maintenance and monitoring programmes Environmental aspect monitoring	Post-closure

#	Impact	Activity/ Aspect	Phase
GW2	Groundwater contamination - (Alternative 3 mitigation - phyto-remediation), particularly sulphates.	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	Operation Decommissioning, Rehabilitation and Closure and Post-closure
W1	Erosion of soils and sedimentation of surface water features	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	Operation Decommissioning, Rehabilitation and Closure and Post-closure
W2	Pollutants entering the surface water environment	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	Operation Decommissioning, Rehabilitation and Closure and Post-closure
W3	Decrease in run-off	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control	Operation Decommissioning, Rehabilitation and Closure and Post-closure

#	Impact	Activity/ Aspect	Phase
		Initiate maintenance and monitoring programmes Environmental aspect monitoring	
W4	Flood risk	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	Operation Decommissioning, Rehabilitation and Closure and Post-closure
N1	Nuisance and impact on sense of place due to noise	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control	Operation and Decommissioning, Rehabilitation and Closure
V1	Visual impact and impact on sense of place	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	Operation Decommissioning, Rehabilitation and Closure and Post-closure
EH1	Siltation of water resources	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation

#	Impact	Activity/ Aspect	Phase
EH2	Erosion of water resources	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
EH3	Altering of hydrological regime	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
EH4	Proliferation of alien vegetation	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
EH5	Impaired Water Quality	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
EH6	Wetland disturbance and decrease in functionality	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
EH7	Phytoremediation for groundwater pollution	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation
S1	Safety aspects related to radiation and health as well as stability.	Deposition of tailings onto existing TSFs with the cyclone method. Maintenance and management of stormwater system Water management Revegetation	Operation Decommissioning, Rehabilitation and Closure and Post-closure

#	Impact	Activity/ Aspect	Phase
		Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	
S2	Impact on livelihoods	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management Revegetation Erosion control Initiate maintenance and monitoring programmes Environmental aspect monitoring	Operation Decommissioning, Rehabilitation and Closure and Post-closure
E1	Employment opportunities continue for another few years and the associated economic benefits for the local area	Deposition of tailings onto existing TSFs with the cyclone method Maintenance and management of stormwater system Water management	Operation

8.2 THE IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations, 2014. The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

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

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

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

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

Table 17: Criteria for determination of impact consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e., limited to the area applicable to the specific activity)
	2	Site (i.e., within the development property boundary)
	3	Local (i.e., the area within 5 km of the site)
	4	Regional (i.e., extends between 5 and 50 km from the site)
	5	Provincial / National (i.e., extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction)
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural, and social functions and processes are not affected)

Aspect	Score	Definition
	2	Low (where the impact affects the environment in such a way that natural, cultural, and social functions and processes are slightly affected)
	3	Moderate (where the affected environment is altered but natural, cultural, and social functions and processes continue albeit in a modified way, moderate improvement for +ve impacts)
	4	High (where natural, cultural, or social functions or processes are altered to the extent that it will temporarily cease, high improvement for +ve impacts)
	5	Very high / do not know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts)
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact.

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

Table 18: Probability scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

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

$$ER = C \times P$$

Table 19: Determination of environmental risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

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

Table 20: Significance classes

ER Score	Description
<9	Low (i.e., where this impact is unlikely to be a significant environmental risk/ reward).
≥9 ≤17	Medium (i.e., where the impact could have a significant environmental risk/ reward),
>17	High (i.e., where the impact will have a significant environmental risk/ reward).

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

In accordance with the requirements of Appendix 13. (1) of the EIA Regulations, 2014, and further to the assessment criteria presented above it is necessary to assess each potentially significant impact in terms of:

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

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

Table 21: Criteria for Determining Prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.

Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

TABLE 21: CRITERIA FOR DETERMINING PRIORITISATION

The impact priority is therefore determined as follows:

Priority = PR + CI + LR

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

Table 22: Determination of prioritisation factor

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

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

Table 23: Environmental Significance Rating

Significance Rating	Description
<-17	High negative (i.e., where the impact must have an influence on the decision process to develop in the area).
≥-17, ≤-9	Medium negative (i.e., where the impact could influence the decision to develop in the area).

Significance Rating	Description
>-9, < 0	Low negative (i.e., where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
>0, <9	Low positive (i.e., where this impact would not have a direct influence on the decision to develop in the area).
≥9, ≤17	Medium positive (i.e., where the impact could influence the decision to develop in the area).
>17	High positive (i.e., where the impact must have an influence on the decision process to develop in the area).

8.3 DESCRIPTION AND ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

This section describes each identified environmental impact in the context of the activity and associated aspect and provides reasons why specific ranking/ rating of the component attributes of the impact assessment are given.

8.3.1 AIR QUALITY AND HEALTH

Impacts on air quality was identified through documentation received from the applicant including air quality and dust monitoring reports, as well as the specialist air quality and radiology and health impact assessment reports.

8.3.1.1 EMISSIONS AND DUST - OPERATION DECOMMISSIONING, REHABILITATION AND CLOSURE AND POST-CLOSURE (AQ1)

Sources of emissions from the baseline include active ventilation shafts, materials handling points, crushing and screening, vehicle entrainment on unpaved roads, and windblown dust from the TSFs and MODs. These sources were identified from a previous West Wits Study and Google Earth locations provided by EIMS. Sources of emissions for the project include the current operations at Savuka and Mponeng Mines and the proposed height extension of the 7a & 7b TSFs.

The height extension of the Savuka 7a & 7b TSFs will have an increase in PM emissions of 5.1% (PM2.5), 6.1% (PM10) and 7.9% (TSP). Cumulatively, including the Mponeng mining and processing operations, the increase in PM emissions will be less at 0.7% (PM2.5), 1.5% (PM10) and 3.4% (TSP).

The simulated PM2.5 24-hour concentrations are within compliance with the NAAQS (4 days of exceedance of 40 µg/m^3) at all the AQSRs, for both current and future operations (Figure 28). The annual PM2.5 concentrations for current (Figure 29) and future (Figure 30) operations are also within compliance with the NAAQS.

The increase in height of the Savuka 7a and 7b TSFs would result on average in a 2.4% increase in daily GLCs at the various AQSRs, and a 0.6% increase annually.

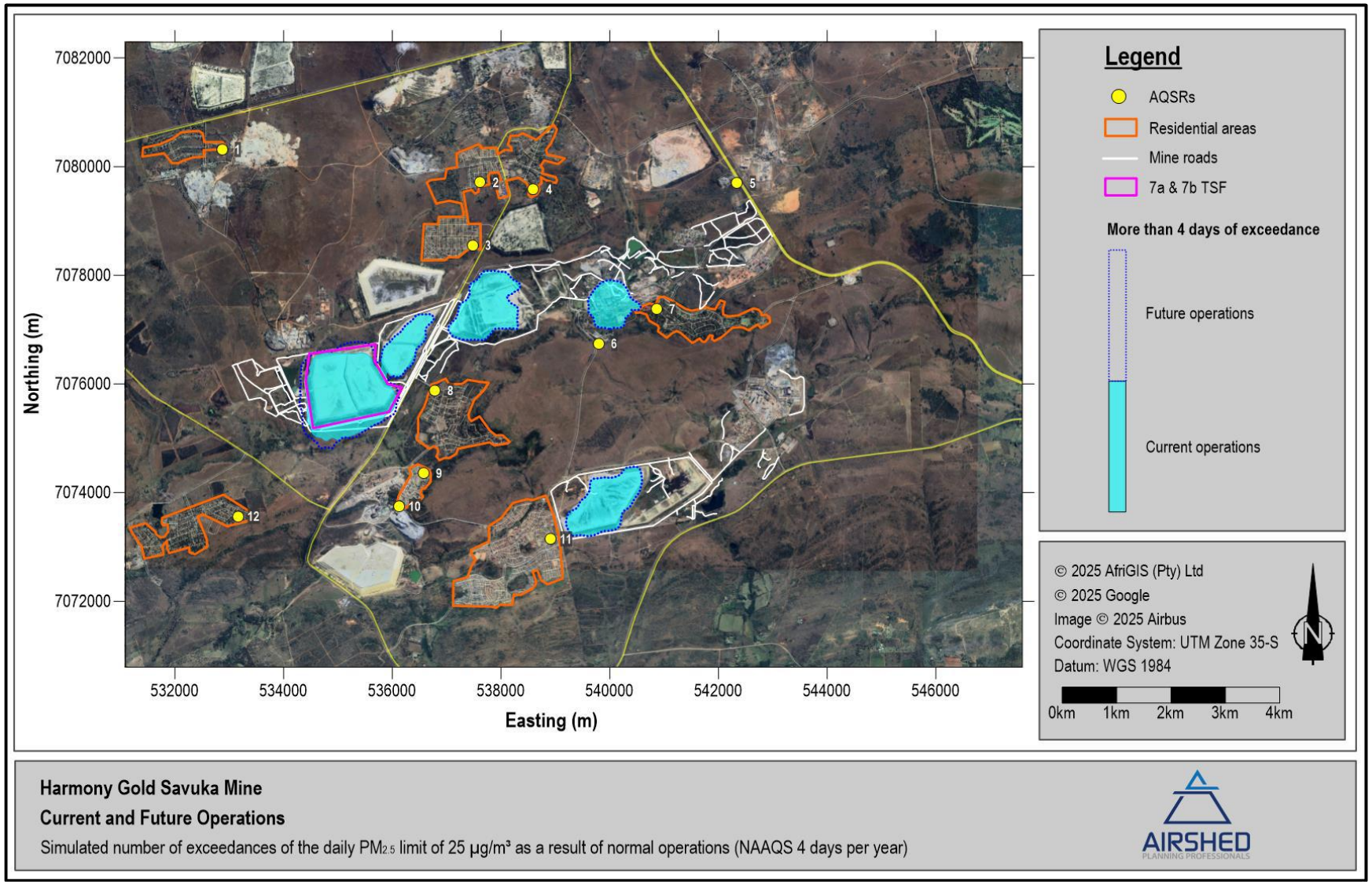

Figure 28: Simulated area of exceedance of the 24-hour PM2.5 NAAQS as a result of current and future operations with mitigation measures applied

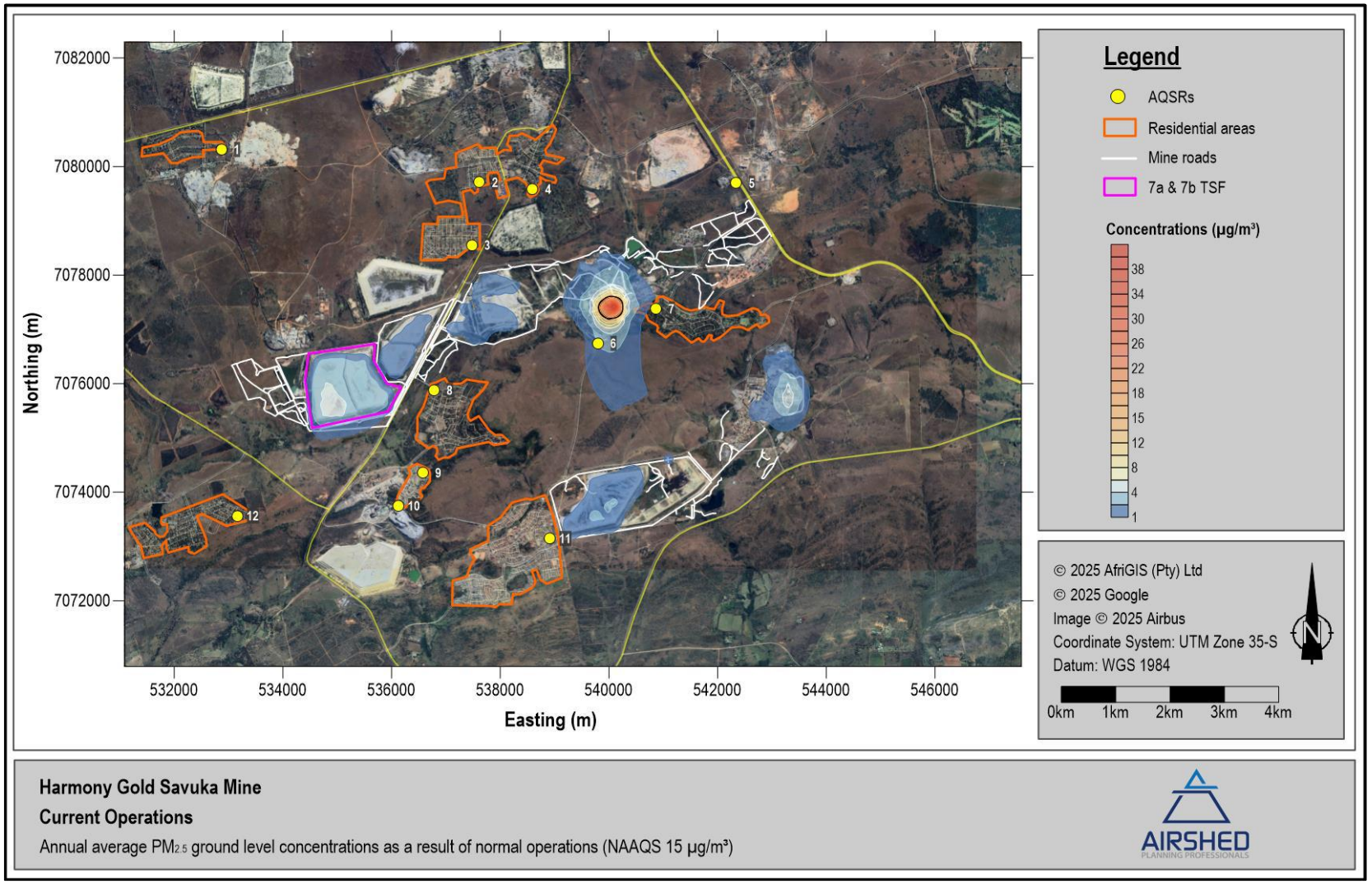

Figure 29: Simulated annual average $PM_{2.5}$ concentrations as a result of current operations with mitigation measures applied

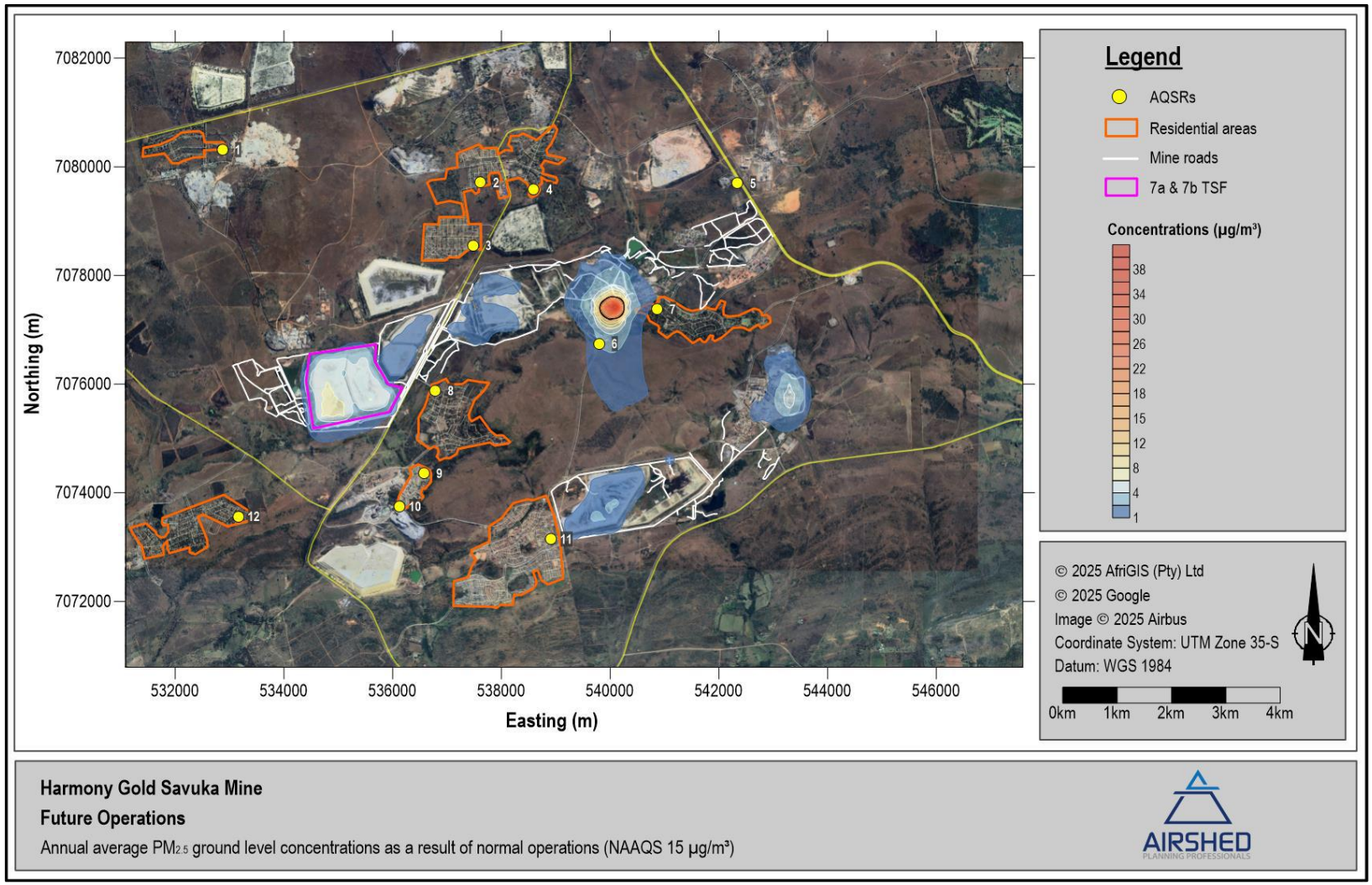

Figure 30: Simulated annual average PM2.5 concentrations as a result of future operations with mitigation measures applied

The simulated PM10 24-hour GLCs are within compliance with the NAAQS (4 days of exceedance of 75 µg/m^3) at all the AQSRs, for both current and future operations (Figure 31). The annual PM10 concentrations for current and future (Figure 32) operations are also within compliance with the NAAQS.

The increase in height of the Savuka 7a and 7b TSFs would result on average in a 3.9% increase in daily GLCs at the various AQSRs, and a 1.4% increase annually.

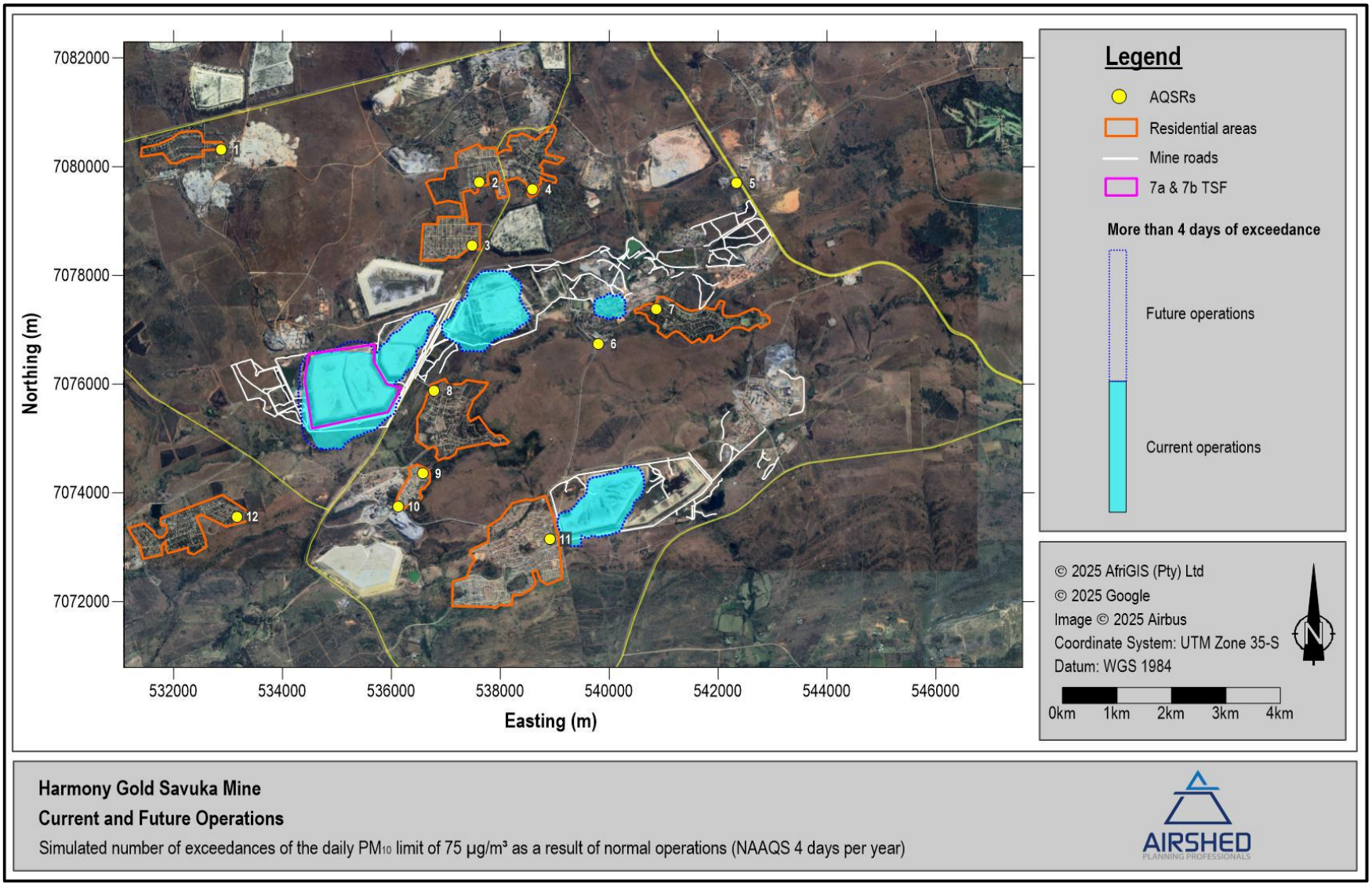

Figure 31: Simulated area of exceedance of the 24-hour PM10 NAAQS as a result of current and future operations with mitigation measures applied

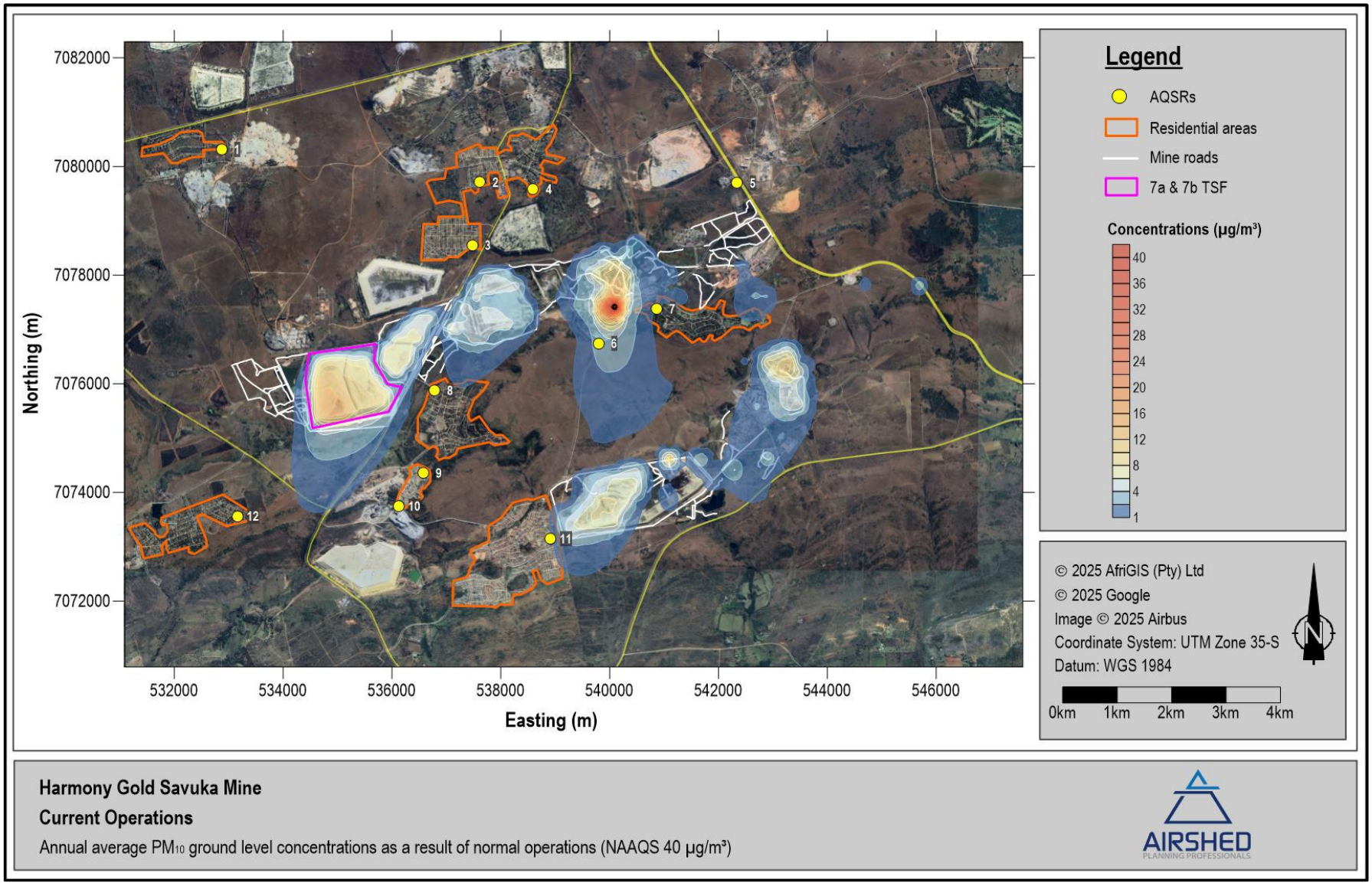

Figure 32: Simulated annual average PM10 concentrations as a result of current operations with mitigation measures applied

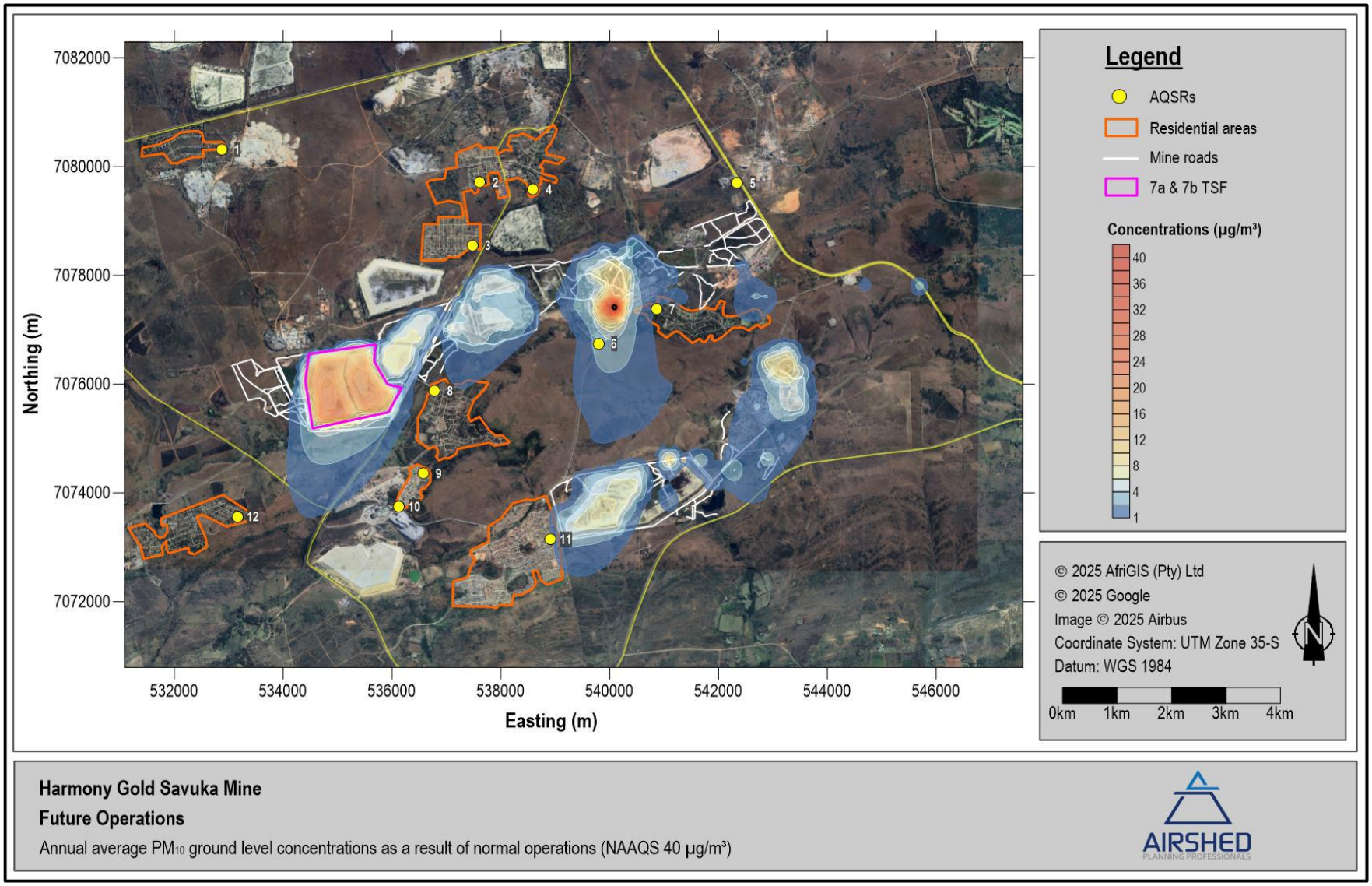

Figure 33: Simulated annual average PM10 concentrations as a result of future operations with mitigation measures applied

The simulated daily average dust fall rates with mitigation measures applied to the current operations exceed the NDCR limit for residential areas (600 mg/m²-day) at one AQSR (Elandsridge) but are below the NDCR limit for non-residential areas (1 200 mg/m²-day). The limit for agricultural areas is exceeded for up to 3.5 km to the south-southwest from the active TSFs at Savuka and Mponeng (Figure 34). The simulated daily average dust fall rates for the future operations show similar impact areas to the current operations, and average increase of 2.5% in dust fall rates (Figure 35).

Measured dust fall rates are however below the NDCR limit for residential areas (600 mg/m²-day) at all AQSRs, including Elandsridge, which implies a possible overprediction of simulated dust fall rates.

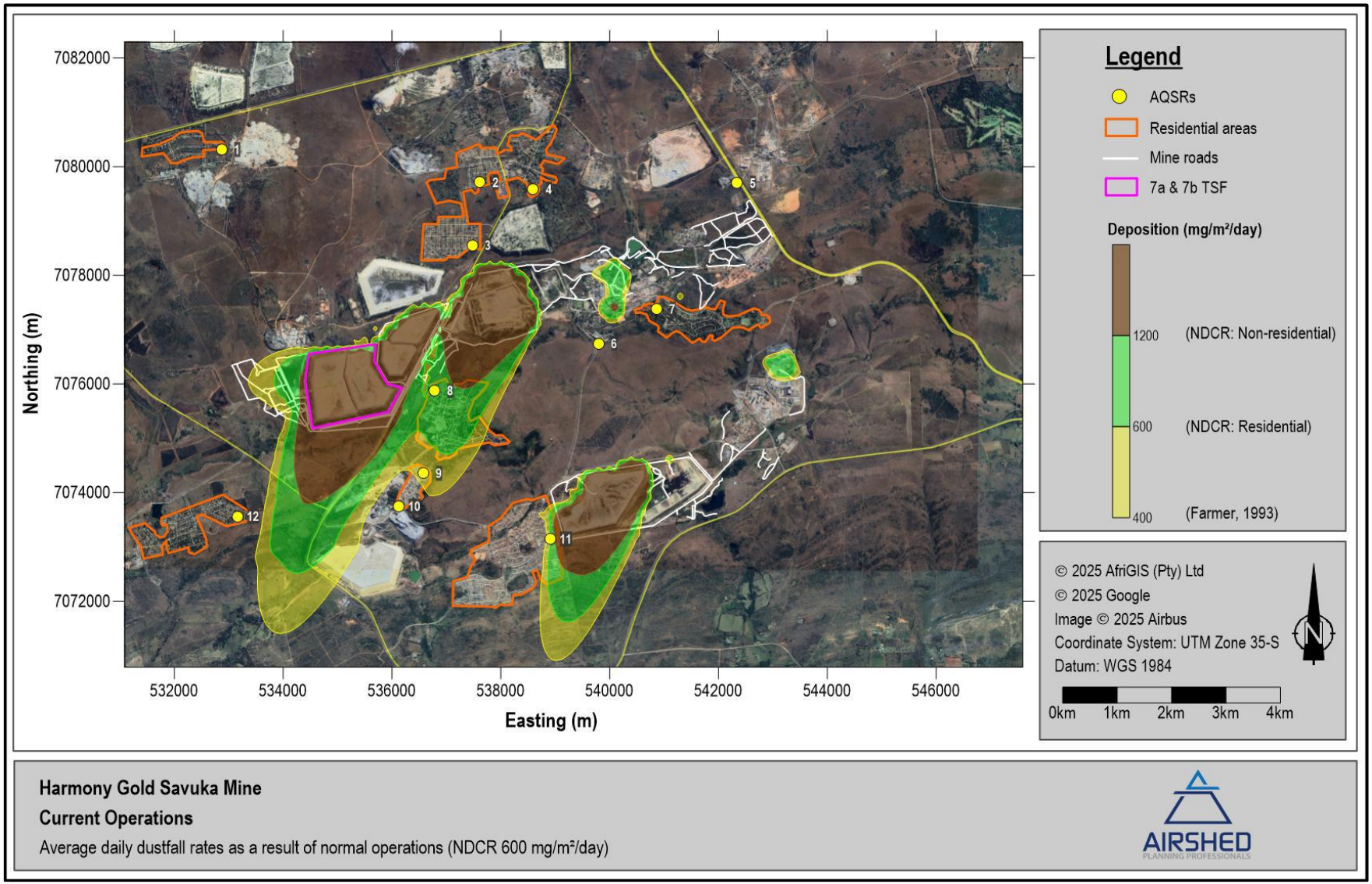

Figure 34: Simulated average daily dust fall rates as a result of current operations with mitigation measures applied

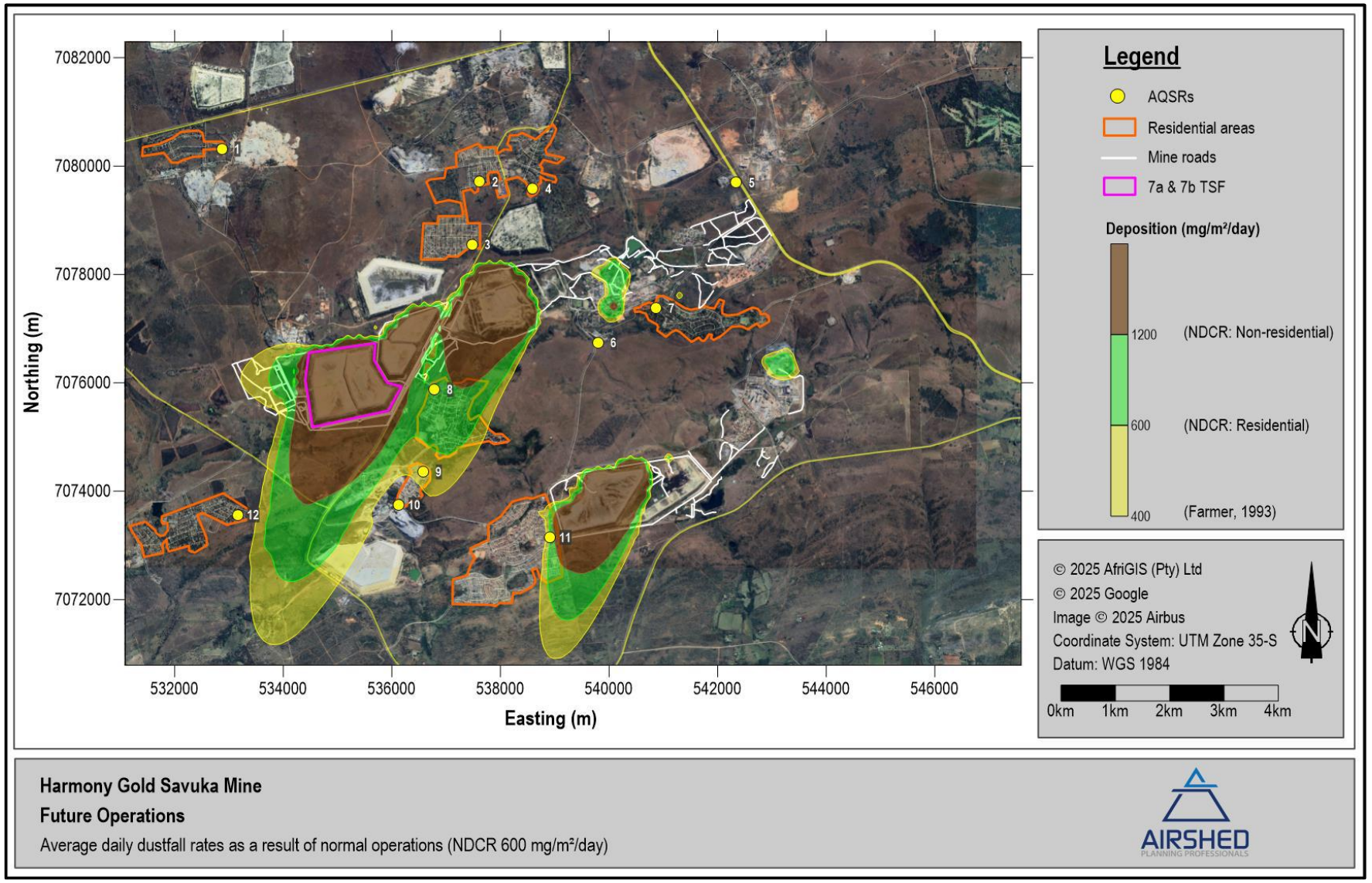

Figure 35: Simulated average daily dust fall rates as a result of future operations with mitigation measures applied

The main findings of the impact assessment for current and future operations are as follows:

- Simulated PM2.5 concentrations comply with the NAAQS at all AQSRs, both for current and future operations.
- Simulated PM10 concentrations comply with the NAAQS at all AQSRs, both for current and future operations.
- Simulated dustfall rates were above the NDCR limits for residential areas at one AQSR (Elandsridge) both during current and future operations, with a 3.5 km area of exceedance of the agricultural limit (400 mg/m²-day). Measured dustfall rates are however below the NDCR limit for residential areas at all AQSRs, including Elandsridge for the past three years, implying a possible overprediction of simulated dustfall rates.
- The environmental risk due to unmitigated future operations is classified as Medium. With mitigation (80% CE through grassing of TSF side slopes and wet slurry deposition) the risk is classified as Low.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Emissions and dust (AQ1)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Potential cumulative/ confounding effects	Cumulative air quality impacts would be related to the in-combination effects of the Project's air emissions with existing emission sources and planned emissions in the immediate area around the Project site, which could result in an elevation of ground level concentrations of pollutants and have an impact on the health of workers and local communities. Considering the baseline conditions (below the limits set by the normative for all the pollutants) and the modelling results, which highlighted that the contribution of the Project to the ground level concentrations of pollutants is negligible, the cumulative impacts on air quality are expected to be of minor priority. As such, no additional measures are proposed to manage cumulative effects. Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.			
Alternatives	Any alternative to the proposed activity discussed in this report will have similar or higher impacts than the proposed alternative and impact is rated as low.			
Mitigation Measures				
• Dust fall monitoring ensuring dust fall rate in compliance with the NDCR limits. • Mitigation measures aimed at reducing wind erosion from the active TSFs, i.e. the grassing of TSF side slopes. • A Dust Management Plan (DMP) for the Savuka 7a & 7b TSFs should follow an iterative process, including: implementation, monitoring, reporting, reviewing and adjustment to the necessary steps. o The establishment of objectives and targets with regards to fugitive emissions are important to minimise the impacts of these emissions on the surrounding environment. The objective of the DMP generally is to reduce dust emissions within specific target ranges, by employing appropriate dust suppression strategies. o Windblown dust from the current and future Savuka 7a & 7b TSFs could be significant sources of dust emissions if not managed.			

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance

- Dust Management Measures**:** Target control efficiencies are presented for the main dust emission sources identified in the emissions inventory, so that the overall objective is achieved.

- Wind Erosion
  - Any approach that either binds the particles together and make it more resistant to wind erosion or reduce to the force of the wind will result in a reduction in windblown dust emissions.
  - Surface treatment techniques to reduce dust generation include: wet suppression, chemical stabilisation, covering of surface with less erodible aggregate material and the vegetation of open areas. Wet suppression (the use of sprinklers) can achieve results in the short-term but will require constant maintenance and management to remain effective.
  - Substantial research has been done on erosion from gold mine tailings. Parameters which have the potential to impact on the rate of emission of fugitive dust include the extent of surface compaction, moisture content, ground cover, the shape of the storage pile, particle size distribution, wind speed and precipitation. Any factor that binds the erodible material or otherwise reduces the availability of erodible material on the surface, decreases the erosion potential of the fugitive source. High moisture contents, whether due to precipitation or deliberate wetting, promote the aggregation and cementation of fines to the surfaces of larger particles, thus decreasing the potential for dust emissions. Surface compaction and ground cover similarly reduces the potential for dust generation (Burger et al., 1997).
  - Rock cladding or armouring of the sides of tailings dams has been shown in various international studies to be effective in various instances in reducing wind erosion of slopes. Cases in which rock cladding has been found to be effective in this regard generally involve rock covers of greater than 0.5 m in depth (Ritcey, 1989; Jewell and Newson, 1997). The application of a 300 mm layer of fine rock was found to be the most successful of the non-vegetative measures, resulting in an erosion control efficiency of 90% if the base is levelled and compacted – wind erosion is considered to reduce by 100% through the addition of such a rock cover.
  - In addition, screens could be installed on the crest of the tailings dam walls mainly to act as windbreaks and to reduce the potential for dust deposition on the vegetated side walls, hence curbing the growth of the grass.
  - Vegetal cover retards erosion by binding the residue with a root network, by sheltering the residue surface and by trapping material already eroded. Sheltering occurs by reducing the wind velocity close to the surface, thus reducing the erosion potential and volume of material removed. Vegetation is also considered the most effective control measure in terms of its ability to also control water erosion. In investigating the feasibility of vegetation types the following properties are normally taken into account: indigenous plants; ability to establish and regenerate quickly; proven effective for reclamation elsewhere; tolerant to the climatic conditions of the area; high rate of root production; easily propagated by seed or cuttings; and nitrogen-fixing ability. The long-term effectiveness of suitable vegetation selected for the site will be dependent on (a) the nature of the cover, and (b) the availability of aftercare. Multi-layer covers are frequently being used to ensure the best results (Dixon, 1997; Jewell and Newson, 1997; Ritchey, 1989). Erosion losses from grassed slopes measured by Blight (1989) were found to be in the order of 100 t/ha/year compared to uncontrolled slopes from which losses of up to 500 t/ha/year were recorded.
  - The removal of the TSF would be the most effective mitigation measure, providing the exposed footprint be vegetated and rehabilitated.
  - Performance indicators are usually selected to reflect both the source of the emission directly (source monitoring) and the impact on the receiving environment (ambient air quality monitoring). Ensuring that no visible evidence of windblown dust exists represents an example of a source-based indicator, whereas maintaining off-site dust fall levels, at

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
		the identified AQSRs, to below 600 mg/m²-day represents an impact- or receptor-based performance indicator. Source monitoring at operational activities can be challenging due to the fugitive and wind-dependent nature of particulate emissions. The focus is therefore rather on receptor-based performance indicators i.e. compliance with ambient air quality standards and dust fall regulations. ▪ It is recommended that the current dust fall monitoring network be maintained and the monthly dust fall results used as indicators to tract the effectiveness of the applied mitigation measures. Dust fall collection should follow the ASTM method as per the NDCRs. The ASTM method covers the procedure of collection of dust fall and its measurement and employs a simple device consisting of a cylindrical container exposed for one calendar month (30 ±2 days). o Periodic inspections and external audits are essential for progress measurement, evaluation, and reporting purposes. It is recommended that site inspections and progress reporting be undertaken at regular intervals (at least quarterly), with annual environmental audits being conducted. Annual environmental audits should be continued at least until closure. Results from site inspections and monitoring efforts should be combined to determine progress against source- and receptor-based performance indicators. Progress should be reported to all interested and affected parties (I&APs), including authorities and persons affected by pollution. The criteria to be taken into account in the inspections and audits must be made transparent by way of minimum requirement checklists included in the management plan. Corrective action or the implementation of contingency measures must be proposed to the stakeholder forum in the event that progress towards targets is indicated by the quarterly/annual reviews to be unsatisfactory. o Stakeholder forums provide possibly the most effective mechanisms for information dissemination and consultation. Management plans should stipulate specific intervals at which forums will be held and provide information on how people will be notified of such meetings. Given the proximity of the study site to the nearby communities and farmsteads, it is recommended that such meetings be scheduled and held at least on an annual basis. A complaints register must be kept at all times.			

8.3.1.2 RADIATION AND HEALTH (AQ)

The main objective of the radiological public safety assessment is to assess the potential impact on members of the public that may occur during the operational phase of the Projects, with due consideration of the impact that may occur during the post-closure phase. How members of the public are exposed to ionising radiation induced by the Projects may be different depending on the operational conditions and the specific point in time (either present or future).

Sources of radiation exposure to members of the public associated with mining and mineral processing facilities are often advertently induced. Although the key elements responsible for radiation exposure are naturally occurring radionuclides, human-induced conditions and activities may enhance concentrations of naturally occurring radionuclides in the accessible environment. Alternatively, the potential for human exposure to naturally occurring radionuclides in products, by-products, residues, and other wastes may be enhanced by moving these radionuclides from inaccessible locations to locations where humans can be subject to radiation exposure.

To pose a radiological risk to members of the public and the environment, the naturally occurring radionuclides must first be released from the sources of radiation exposure into the environment. As used here, sources refer to any entity that contains radioactivity and has the potential to release radioactivity into the environment. Release mechanisms can be generalised into the following natural and human-induced conditions:

- The release of radionuclides through natural conditions:
  - Solid release (e.g., windblown dust);

- Water-mediated release (e.g., leaching through tailings storage facility); and
- Gas-mediated release (e.g., radon gas exhalation).

- Direct gamma radiation; and
- Controlled or uncontrolled releases of radionuclides as solids or liquids into the environment.

Controlled releases are human-induced as part of the normal operating conditions, while uncontrolled releases are associated with accidents and incidents that are outside the scope of normal operating conditions (e.g., excessive water erosion, pipeline bursts, releases from storage dams overflowing their capacity, or the breaking of dam walls).

A distinction can be made between primary and secondary sources of radiation exposure. The primary sources are associated with physical features or entities at a mining and mineral processing operation, with the potential of naturally occurring radionuclides to be released into the environment. Examples of primary sources that are generally associated with mining and mineral processing operations include:

- Tailings Storage Facilities (TSFs), Waste Rock Dumps (WRDs) or any other stockpile facility used to store waste or other residue material on the surface, from which naturally occurring radionuclides may be dispersed in solid (dust), liquid (seepage), or gaseous (radon gas) form;
- Open pits that developed following open cast mining to extract rock or minerals from the orebody, from which naturally occurring radionuclides may be dispersed in solid (dust), liquid (seepage), or gaseous (radon gas) form;
- Mineral processing activities, where radioactive gasses and dust may be released from the commination (e.g., crushing, milling, and screening) and beneficiation of ore containing radionuclides;
- Water management facilities (e.g., return water dams, process control dams, and evaporation ponds), used to manage excess water generated through mining, mineral processing, and residue disposal activities, and where water may be released to the environment;
- Materials handling activities (e.g., the transfer of material containing naturally occurring radionuclides from one point or facility to another), during which radioactive dust may be released to the environment; and
- Mine ventilation shafts increase airflow in underground workings, where gasses and dust generated underground may be released with the outflowing air.

Radioactivity released from the primary sources into the environment may accumulate in the physical compartments of the environmental system (e.g., groundwater, surface water bodies, surface soils, sediments, etc.), potentially resulting in what can be termed secondary sources of radiation exposure. The following serve as examples of secondary radiation sources:

- Continuous deposition and accumulation of naturally occurring radionuclides associated with airborne dust or contaminated irrigation water on surface soils, resulting in the development of a secondary source at the soil surface;
- Continuous deposition of naturally occurring radionuclides associated with airborne dust in a surface water body, resulting in the development of a secondary source in the sediments and surface water body;
- Uncontrolled release of contaminated mine residue (e.g., tailings material) through surface water erosion of existing TSFs or other stockpile facilities;
- Uncontrolled release (e.g., spillage) of contaminated mine residue (e.g., tailings material) or water on surface soils from pipelines or storage dams, resulting in the development of a secondary source at the soil surface; or

- Uncontrolled release (e.g., spillage) of contaminated mine residue (e.g., tailings material) or water in a surface water body from pipelines or storage dams (as appropriate), resulting in the development of a secondary source in the sediments and surface water body.

Members of the public may potentially be subject to radiation exposure from both primary and secondary sources at a mining and mineral processing operation, with expected differences in modes and duration of exposure.

- **Operational Phase Impacts**

The radiological impact assessment for the operational phase considers the potential contribution through all three environmental pathways (i.e., surface water, groundwater and atmospheric). However, due to the slow-moving nature of any radionuclide contaminant plume that originates from the facilities through the groundwater system, the potential radiological impact through the groundwater pathway will only occur during the post-closure phase.

During the operational phase, the following activities and associated impacts were identified that may result in a radiological impact on members of the public:

  - Emission and dispersion of particulate matter containing radionuclides from the existing and proposed TSFs. Radon gas generated in the tailings due to the presence of Ra-226 will be exhaled into the atmosphere. Inhalation of the radon gas contributes to the total effective dose. During the operational phase, radon gases are generated in the tailings material at the TSF areas due to the presence of Ra-226 This means that these gases are exhaled continuously from this facility into the atmosphere. Following the exhalation and subsequent dispersion of the radon gas into the atmosphere, inhalation of the airborne gas contributes to the total effective dose to receptors; and
  - Exhalation and dispersion of radon gas from the existing and proposed Savuka 7A and 7B TSF. Wind erosion at the TSF areas will cause particulate matter containing radionuclides to be emitted into the atmosphere. The airborne dust (PM10) and deposited dust (TSP) contribute to the total effective dose through inhalation, ingestion, and external radiation exposure routes. During the operational phase, the TSF areas will serve as a source of windblown dust (i.e., wind erosion) to the atmosphere for the duration of the operational period. These particulate matter containing radionuclides are dispersed into the environment through the atmospheric pathways. The emission and subsequent dispersion of the particulate matter into the atmosphere results in an airborne radionuclides concentration associated with the PM10, and a soil radionuclides concentration following the deposition of the TSP. Through secondary pathways, the radionuclides in the soil may be transferred to crops and animal products. Contributions to the total effective dose to receptors identified for the Project include inhalation of airborne dust, ingestion of contaminated soil, crops and animal products, and external gamma radiation through cloud shine and ground shine.

- **Post-closure Phase Impacts**

Before the actual closure of the proposed Savuka 7A and 7B TSF and as part of the anticipated licensing conditions and requirements, a decommissioning and closure plan will be prepared for submission and approval by the regulatory authorities. Amongst others, this plan will define in detail all the activities that will be performed and how the associated radiological impact during the decommissioning and closure phase will be managed.

Considering that a decommissioning plan of the proposed Savuka 7A and 7B TSF is not available at present but will be defined and implemented, the following activities were identified that may result in a radiological impact on the receptors during the post-closure phase:

  - Implementation of the approved decommissioning plan: The implementation of the NNR-approved decommissioning plan will result in a positive impact in the sense that surface

infrastructure that contained or that is contaminated with radionuclides is demolished, decontaminated (to the extent possible) and removed from the site and compliance with clearance criteria has been demonstrated. Generally, this would involve performing a gamma radiation survey supplemented with full-spectrum radio analysis of soil samples performed at the infrastructure sites, followed by appropriate rehabilitation and clean-up operations for conditional or unconditional clearance from the regulatory authority. However, in this case for the TSF that would remain at the surface during the post-closure period, the level of clean-up that can be performed is limited to areas outside the TSF footprint area that may have become contaminated during or because of operational activities. These areas outside the TSF footprint can still be rehabilitated and cleaned-up for conditional or unconditional clearance. In addition, any area that may have become contaminated during or because of operational activities will also be rehabilitation and clean-up for conditional or unconditional clearance. The execution of the decommissioning plan involves a site-wide plan to demolish, decontaminate and remove all the surface infrastructure that may contain or that is contaminated with radionuclides. These areas and any other area that was contaminated will be rehabilitated and cleaned for clearance by the regulatory authority.

- Exhalation of radon gas and the emission of particulates matter (PM10 and TSP) that contain radionuclides from the remaining facilities (e.g., TSF). During the post-closure phase, some of the facilities (e.g., TSF) will remain at the surface and continue to serve as sources of radiation exposure to members of the public. These facilities will serve as a source of windblown dust (i.e., wind erosion) to the atmosphere during the post-closure period. During the same period, radon gas generated in the tailings materials due to the presence of Ra-226 will continue to be exhaled into the atmosphere. The emission and subsequent dispersion of the particulate matter into the atmosphere results in an airborne radionuclides concentration associated with the PM10, and a soil radionuclides concentration following the deposition of the TSP. Through secondary pathways, the radionuclides in the soil may be transferred to crops and animal products. Contributions to the total effective dose to receptors include inhalation of airborne dust, ingestion of contaminated soil, crops and animal products, and external gamma radiation through cloud shine and ground shine. Following the exhalation and subsequent dispersion of the radon gas into the atmosphere, inhalation of the airborne gas contributes to the total effective dose to receptors. Radon gas generated in the remaining facilities (e.g., tailings material) due to the presence of Ra-226 will be exhaled into the atmosphere. Inhalation of the radon gas contributes to the total effective dose. Wind erosion at the remaining facilities will cause particulate matter containing radionuclides to be emitted into the atmosphere. The airborne dust (PM10) and deposited dust (TSP) contribute to the total effective dose through inhalation, ingestion, and external radiation exposure routes; and
- From the commissioning of a TSF, radionuclides contained in the tailings material leach from the TSF to the underlying strata. The rate of leaching is controlled by complex geochemical and hydrological processes but generally is a slow process. Once in the underlying strata, migration of these radionuclides is equally slow along the groundwater flow path. Abstraction of groundwater for personal or agricultural purposes may result in a radiological impact on receptors through direct ingestion of water or the ingestion of crops and animal products as secondary pathways. The radiological impact along the groundwater pathway only manifests itself during the post-closure period hundreds to thousands of years after closure. Radionuclides will leach from the TSF into the underlying aquifer, after which they will migrate in the general groundwater flow direction. Abstraction and use of the contaminated water contribute to the total effective dose through the ingestion and possible external radiation exposure routes.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Exhalation and dispersion of radon gas into the atmosphere (AQ2)	Operation	Low	Low	Low
Emission and dispersion of particulate matter that contains radionuclides (AQ3)	Operation	Low	Low	Low
Implementation of the NNR-approved decommissioning plan (AQ4)	Decommissioning, Closure and Post-Closure	High	High	High
Emission and dispersion of particulate matter that contains radionuclides and radon gas (AQ5)	Post-Closure	Low	Low	Low
Leaching and migration of radionuclides from the TSF during the post-closure phase (GW1)	Post-Closure	Low	Low	Low
Potential cumulative/ confounding effects	The cumulative radiological impact associated with a mining operation can be considered at different levels. Firstly, the radiological safety assessment process considers the cumulative contribution from all relevant exposure pathways including the surface water, groundwater, and atmospheric pathways, as appropriate. This means that the radiological impact assessment includes the cumulative impact of the exposure pathways, as appropriate and justified. Secondly, the radiological safety assessment process considers the cumulative contribution from all relevant exposure routes and for each relevant exposure pathway. These include radon gas inhalation, dust inhalation, external gamma radiation (ground shine and cloud shine) as well as the ingestion routes for soil, water, crops, and animal products as appropriate and justified for each public exposure condition. This means that the radiological impact assessment includes the cumulative impact of the exposure routes, as appropriate and justified. Thirdly, the radiological safety assessment process considers the cumulative contribution from all relevant sources of radiation exposure associated with the proposed Savuka 7A and 7B TSF, such as the existing TSFs in the area. This means that the radiological impact assessment includes the cumulative impact of these sources, as appropriate and justified. Finally, on a more regional scale, the assessment context makes provision for a cumulative impact from all contributing operations (or practices) in the area that			

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
	may contribute to the total effective dose to members of the public. This is important since the public dose limit of 1,000 µSv.year-1 is from all contributing sources and operations. However, the scope of the assessment was limited to the Project and did not make provision for a regional assessment to evaluate cumulative effects from all contributing operations.			
Mitigation Measures				

Operational Phase:

- *Exhalation and dispersion of radon gas into the atmosphere (AQ2):*
    - The management objective would be to first ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint), and secondly to optimise the radiation protection by applying the ALARA principle (As Low As Reasonable Achievable, economic, and social factors taken into consideration).
    - The total effective dose as a contribution from radon gas released from the tailings material at the TSF areas is well below the regulatory compliance criteria, which means that from a compliance perspective, no additional management or mitigation measures are required for radon inhalation. From a dose optimisation perspective, the following can be noted:
        - The radon exhalation rate from the surface of tailings material is determined by several factors, of which moisture content is one. This means that for the area at a TSF that is wet (i.e., beach area), the radon exhalation rate will be reduced marginally. However, it is not effective to wet the TSF deep enough (2 to 4 m) to reduce the radon exhalation rate marginally.
        - The most effective way to reduce the radon exhalation rate for the TSF is to provide a covering layer. This will increase the diffusion length to allow for the decay of the radon progeny before being released from the tailings surface.
- *Emission and dispersion of particulate matter that contains radionuclides (AQ3)*
    - The contribution of dust inhalation is less than 0.2% (on average) of the total effective dose for all age groups at selected receptor locations. This means that from a regulatory compliance perspective, no additional management or mitigation measures are required for dust inhalation. The contribution of external exposure (cloud shine and ground shine) is less than 1% (on average) of the total effective dose for all age groups at selected receptor locations. This means that from a regulatory compliance perspective, no additional management or mitigation measures are required for external gamma radiation. The contribution of animal and crop ingestion is less than 11% (on average) of the total effective dose for all age groups at selected receptor locations. This means that from a regulatory compliance perspective, no additional management or mitigation measures are required for the ingestion pathways. In addition, the total effective dose at the same locations is less than 13% (on average) of the dose constraint of 250 µSv.year-1 for public exposure. From a dose optimisation perspective, the following mitigation measures can be applied. These measures, which are in line with the measures proposed in the air quality impact assessment (Airshed, 2025), will contribute to a reduction in the total effective dose if applied for the duration of the operational period:
        - Develop an air quality management plan for the proposed Savuka 7A and 7B TSF, including air quality monitoring to ensure compliance at upwind and downwind locations; and
        - Vegetation of exposed areas of the TSF and wind barriers to reduce wind erosion and/or the application of dust suppressants.

Post-Closure Phase:

- *Emission and dispersion of particulate matter that contains radionuclides and radon gas (AQ5)*
    - The total effective dose as a contribution from the windblown dust, as well as radon gas released from the remaining facilities, is well below the regulatory compliance criteria

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance

(dose constraint), which means that from a compliance perspective, no additional management or mitigation measures are required. From a dose optimisation perspective, the following mitigation measures that are in line with the measures proposed by the air quality impact assessment (Airshed, 2025) can be applied for the post-closure phase:

- Vegetation of exposed areas of the TSF and wind barriers to reduce wind erosion and/or the application of dust suppressants; and
- Covering layer over the exposed area of the TSF areas to reduce wind erosion and radon exhalation.

- *Leaching and migration of radionuclides from the TSF during the post-closure phase (GW1)*
  - The management objective would be to first ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint), and secondly to optimise the radiation protection by applying the ALARA principle.
  - The total effective dose from the ingestion of groundwater as a contribution from the TSF was hypothetically illustrated to be below the regulatory compliance criteria (i.e., dose limit), which means that from a compliance perspective, no additional management or mitigation measures are required.
  - From the optimisation of radiation protection perspective for the post-closure period, the following management/mitigation measures can be implemented if it is assumed that the facility remains at the surface:
    - Implementation of a passive groundwater remediation system downstream of the TSF to capture the contaminant plume.
  - *Note that active remediation systems, such as cut-off trenches or a pump and treat system, might also be effective in the short to medium term. However, the timescales of concern are beyond what can be considered active institutional control periods.*

8.3.2 HYDROPEDOLOGY

Extension of the Savuka TSFs will have an acceptable impact on the recharge and lateral soils in proximity to the site`s catchment as dominant vertical and sub-dominant lateral flows towards the water table recharge stores (shallow and deep recharge) will be minimally impeded see Figure 12. Limited impacts can also be expected where the expansion of the TSFs intercept the hillslopes with lateral flows. Flow impediments due to impermeable layers can occur promoting surface return flows. Usually, flow changes in the hillslopes will respond to vertical flow paths still recharging the catchment water stores sufficiently. It is however worth-noting that, even though the impact is minimal, due to the presences of vertic topsoils, lateral flows from the interflow (A/B) soils (Arcadia soil form) associated with the project area should also be properly managed. This can minimise surface return flows or drainage problems which commonly promote loss of water as surface run-off or evaporation demands increasing the total catchment deductible water losses. The areas with responsive saturated soils (i.e., Rensburg soil forms) mostly associated with saturation or wetlands in the project area will be avoided.

When comparing the size of the project area with that of the combined sub-basins responsible for providing moisture content to the wetland systems, it is clear that the potential worst-case scenario loss of moisture to the wetland is approximately < 2% of the total water regime on a catchment scale. Therefore, when considering a percentage loss of total streamflow and groundwater recharges, negligible losses are expected, predominantly due to the fact that the bulk of the moisture and waterflows already originates well upstream of the project area and around the catchment. a

The planned plantation is intended as a passive mitigatiaon measure to reduce potential groundwater contamination by promoting evapotranspiration and uptake of water potentially carrying contaminants. The establishment of deep-rooted, water-demanding vegetation (e.g. eucalyptus or similar species, if applicable) will enhance vertical water uptake from the vadose zone, thereby reducing percolation and potential contaminant transport toward the groundwater table.

From a hydropedological perspective, the plantation is not expected to negatively affect the regional water balance or the functioning of adjacent wetlands and watercourses. This is due to:

- The dominant **recharge-type soils** (Glenrosa, Mispah, Hutton) which promote vertical infiltration and are well-drained.
- The **limited lateral connectivity** between the plantation zones and watercourses, as responsive (saturated) soil zones (e.g. Rensburg) are being avoided.
- The **plantation area being minor in size** relative to the catchment, thus its evapotranspirative draw will not significantly impact the baseflow or moisture availability in surrounding hydropedological units.

Therefore, the plantation enhances groundwater protection while having a negligible impact on the overall site hydrology.

The existing TSFs, particularly compartments 7A and 7B, currently contribute minimally to catchment hydrology through limited lateral seepage and episodic surface runoff during rainfall events, which are largely managed via engineered containment systems. These contributions are constrained by the dominant hydropedological setting, which is characterised by vertical recharge patterns through well-drained soils such as Glenrosa and Hutton. The proposed height extension of these TSFs is not anticipated to significantly alter this status. Catchment-scale modelling confirms that the overall impact on water regime stores is negligible, with potential losses accounting for < 2% of the total catchment water budget. Importantly, the footprint expansion avoids responsive saturated zones, and the hydropedological flow regime, particularly vertical infiltration, remains largely intact. Consequently, the TSF height extension will not materially affect the subsurface or surface water contributions to adjacent watercourses, provided that current seepage and stormwater controls are maintained.

Therefore, it is the specialist's opinion that the proposed Savuka TSF height extension project and associated infrastructure will not result in a significant loss of total streamflow and groundwater recharge water regime stores. It is therefore recommended that the proposed activities proceed as have been planned and no further hydropedology assessments are necessary.

The impact decrease in subsurface lateral flow and return flow was rated as low pre- and post-mitigation, with a slight decrease in impact rating as a result of mitigation.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Hydropedology (HP1) **Decrease in subsurface lateral flow and return flow.**	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Potential cumulative/ confounding effects	The cumulative impacts of the preferred method of mitigation is rated as low, which means considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.			
Mitigation Measures				
• Lateral flows from the interflow (A/B) soils (Arcadia soil form) associated with the project area should be properly managed. • The planned plantation is intended as a passive mitigation measure to reduce potential groundwater contamination by promoting evapotranspiration and uptake of water potentially carrying contaminants. The establishment of deep-rooted, water-demanding vegetation (e.g. eucalyptus or similar species, if applicable) will enhance vertical water uptake from the vadose zone, thereby reducing percolation and potential contaminant transport toward the groundwater table.				

8.3.3 GROUNDWATER (GW)

8.3.3.1 GROUNDWATER CONTAMINATION - (ALTERNATIVE 3 MITIGATION - PHYTO-REMEDIATION), PARTICULARLY SULPHATES (GW2)

- ***Do Nothing Scenario***

According to records the Savuka TSF was commissioned in 1979 / 1980. The impact from the existing dams were therefore modelled, based on this assumption. The current impact is mainly to the south and west, towards the Wonderfonteinspruit tributary (Figure 36). Assuming that the existing facility is 44 years old, the average plume migration can be estimated based on Darcy's law. Contaminants are transported in groundwater by advection, that is, the movement of a solute at the speed of the average linear velocity of groundwater (Anderson, *et. al*., 1992).

The hydraulic conductivity for the weathered aquifer is estimated as 0.231 m/day. The groundwater gradient averages 0.64 in the study area. The porosity of the aquifer material is estimated to be between 3 - 7%. Applying the above formula to the study area assuming a porosity of 5% it is calculated that the groundwater velocity averages a rate of 0.030 m/day or 10.79 m per annum. Over the 44-year period the plume migration is estimated at 475m, which is supported by the numerical modelling.

The current impact from the existing Savuka TSF was used as the base case and future impacts over 50-and 100-year periods were simulated as the "do-nothing" scenario. The impacts from adjacent tailings facilities were excluded for this assessment and focus was only on the Savuka TSF and RWD. The TSF and RWD are unlined for the do-nothing scenario. The results from these simulations are presented in Figure 37 and Figure 38.

Based on the modelling the impact from the TSF has already reached the Wonderfonteinspruit tributary, albeit still at low concentrations (Figure 36). The concentrations are expected to increase during the next 50 - 100 years if nothing is done. The tributary acts a groundwater boundary and the plume will not extent beyond the stream. Groundwater contributes to the baseflow of the stream and will therefore impact on the water quality in the stream.

Future impacts from the TSF are compared against the "do-nothing" scenarios.

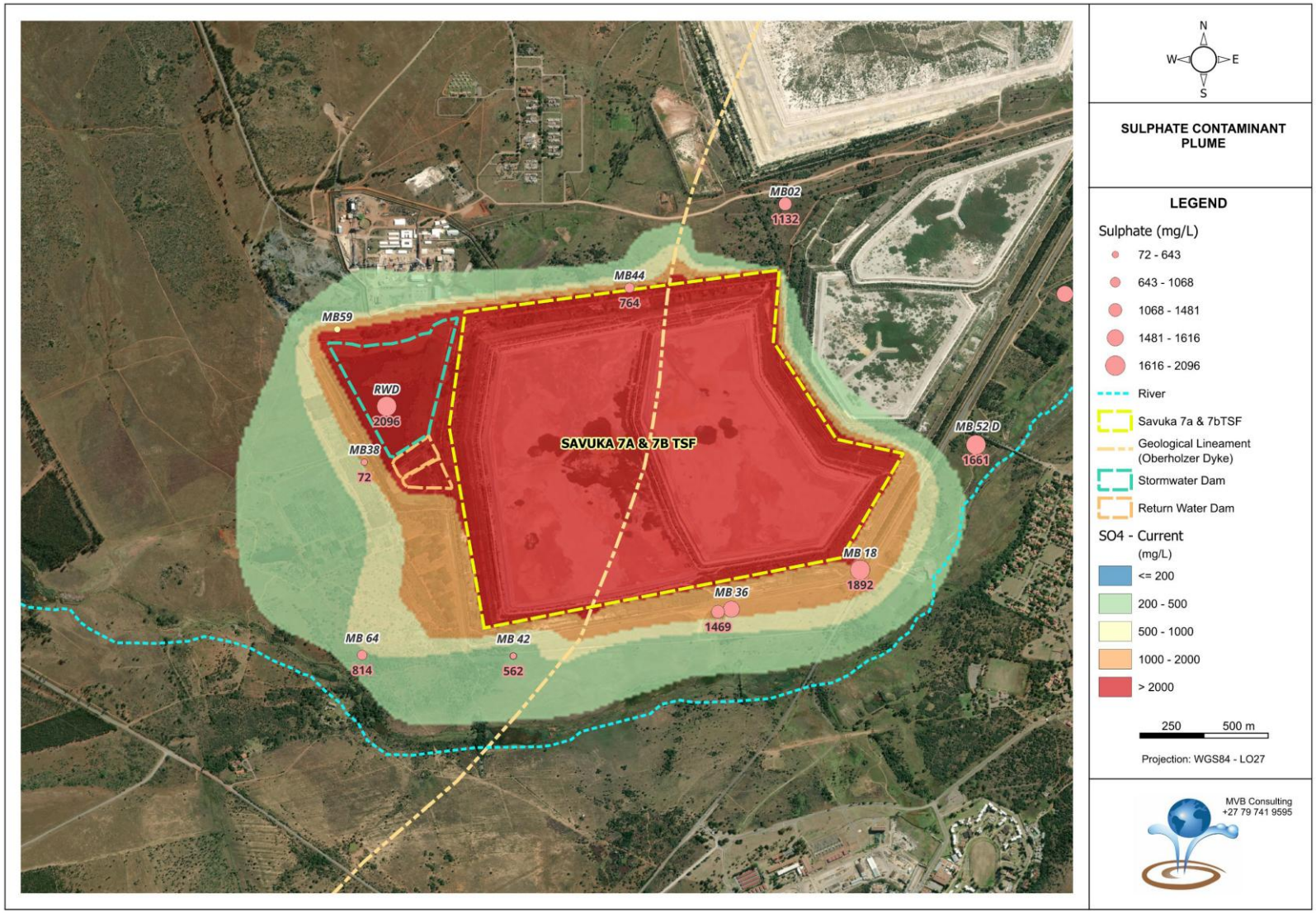

Figure 36: Current simulated plume compared to the measured SO_4 concentrations

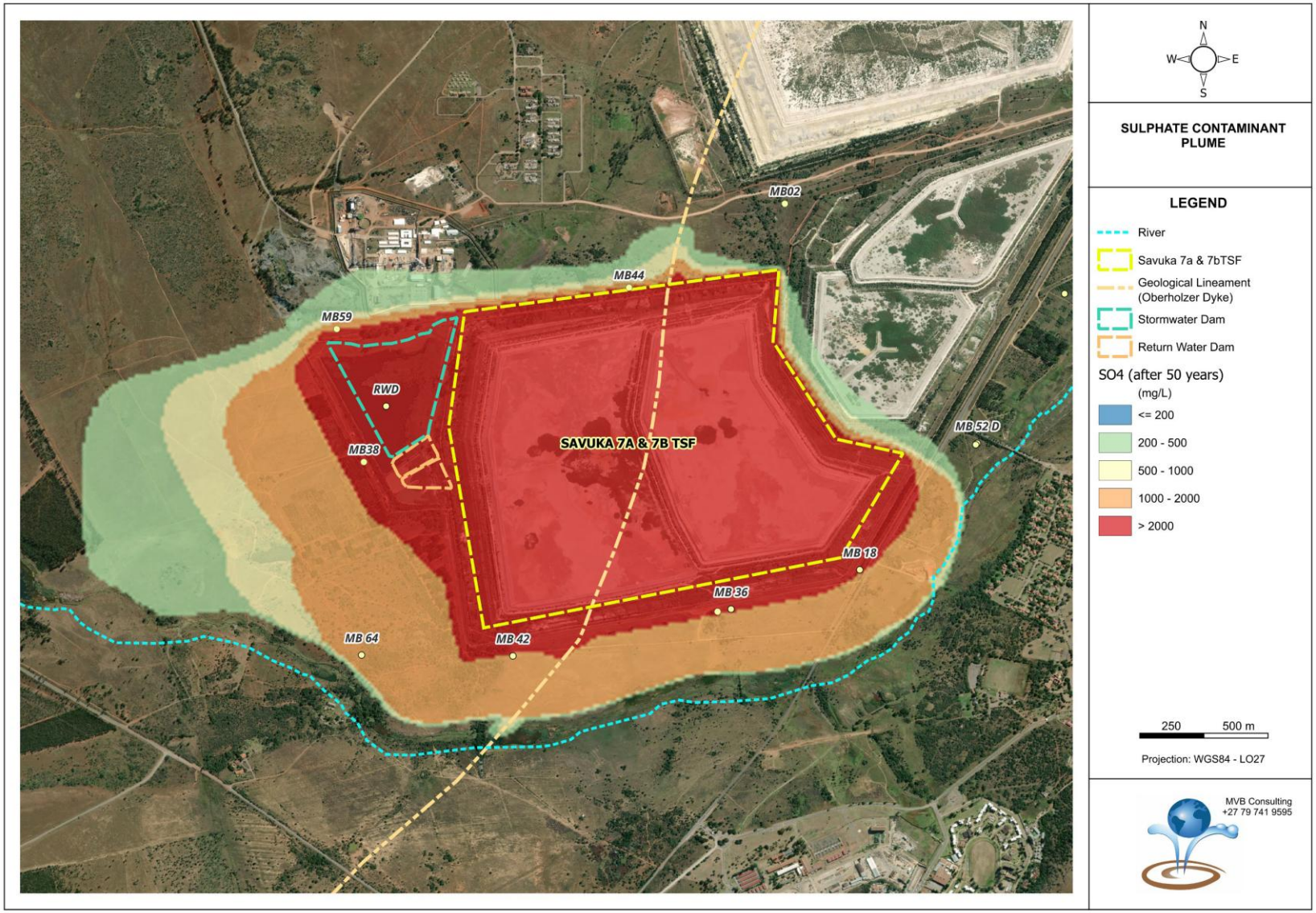

Figure 37: Simulated sulphate plume after 50 years

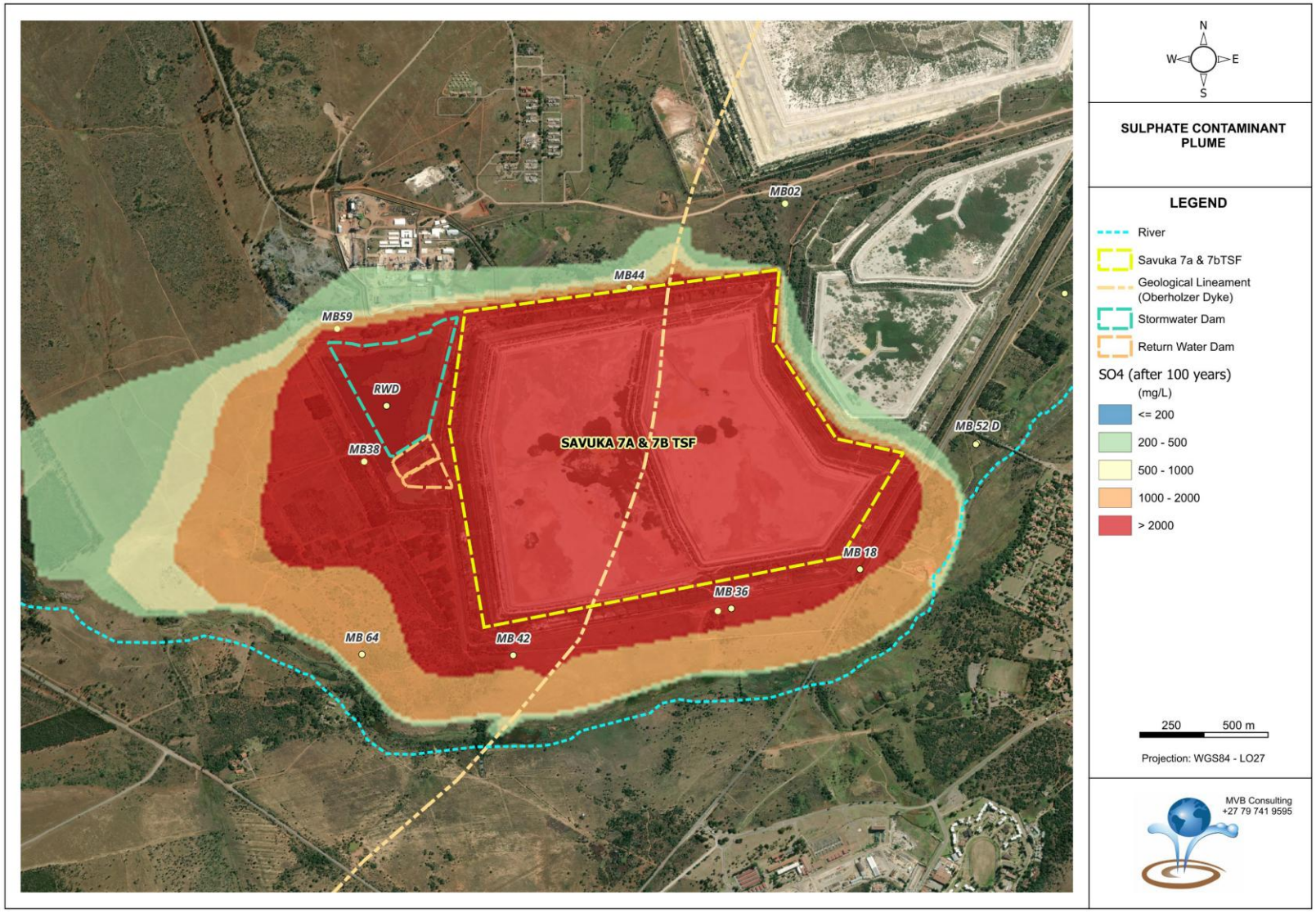

Figure 38: Simulated sulphate plume after 100 years

- ***Effectiveness of Potential Management Options***

The "do-nothing" scenario indicated that the contaminant plume from the RWD will migrate in a westerly direction towards the Wonderfonteinspruit tributary. The figures above do not include the phyto-remediation that is already in place. Based on the sulphate concentration in borehole MB64, the phyto-remediation is not yet as effective as it is in the vicinity of borehole MB38. As the plants grow it is expected that this remediation method will be very successful.

The numerical model was used to simulate the effectiveness of the following management options:

- Lining of the RWD. The TSF will remain unlined.
- Effectiveness of the existing and proposed phyto-remediation over time.
- Implementation of a containment system downgradient from the RWD. This includes interception boreholes, supplementing the phyto-remediation.
- The last option is supplementing the existing phyto-remediation with lining of the RWD.

The gold tailings are typically classified as a Type 3 waste in terms of the NEMWA Regulations 2013 requiring a Class C containment barrier performance. The Class C single composite barrier system comprises of underdrainage; a base preparation layer; a 300 mm thick compacted clay liner (CCL); a 1.5mm thick geomembrane; a dual purpose ballast and protection layer of at least 100mm thickness, and above liner drainage system. The performance of such a barrier is largely influenced by the design specifications and associated Construction Quality Assurance (CQA). The nature and extent of wrinkles influences the containment performance, with an expected seepage rate to be in the order of 140 litres / hectare / day (Legge, 2024).

By making use of an "inverted barrier system" comprising of underdrainage and a base preparation layer; a 1.5mm thick geomembrane ; and covered tailings the barrier system performance is improved by (a) seepage losses are reduced from about 140 l/ha/day to about 3 l/ha/day due to the change from Bernoulli flow at discontinuities to D'Arcian flow controlled by the tailings permeability at these points (Legge, 2024).

The expected leakage rates through the "inverted barrier system" were included in the model and the impact simulated. Leakage will continue only during the operational phase. Thereafter the RWD will be rehabilitated.

The effectiveness of lining the RWD is illustrated in Figure 39. Plume migration from the TSF continues towards the south, but the westerly migration from the RWD, is contained and the existing impact dissipates over time.

Alternatives to a liner includes the phyto-remediation, with and without supplementary scavenger or interception boreholes. The simulations assumed the following:

- Each tree uses 5 litres / day and there are 1 333 trees / hectare.
- Each scavenger borehole is pumped at 1.5 lit / sec for 24-hours / day.

The effectiveness of the phyto-remediation is remarkable, and it contains the contaminant plume effectively (Figure 40). Supplementing the phyto-remediation with scavenger boreholes improves the effectiveness of the phyto-remediation, but with very small margins (Figure 41).

In addition, the effects of combining the lining of the RWD and the phyto-remediation on the pollution plume were modelled. Again, the lining of the RWD improved the effectiveness of the phyto-remediation, but only with very small margins (Figure 42). Consider the high costs of installing and maintaining a liner and or scavenger boreholes and comparing it to the very limited improvement in effectiveness, it is not a feasible option.

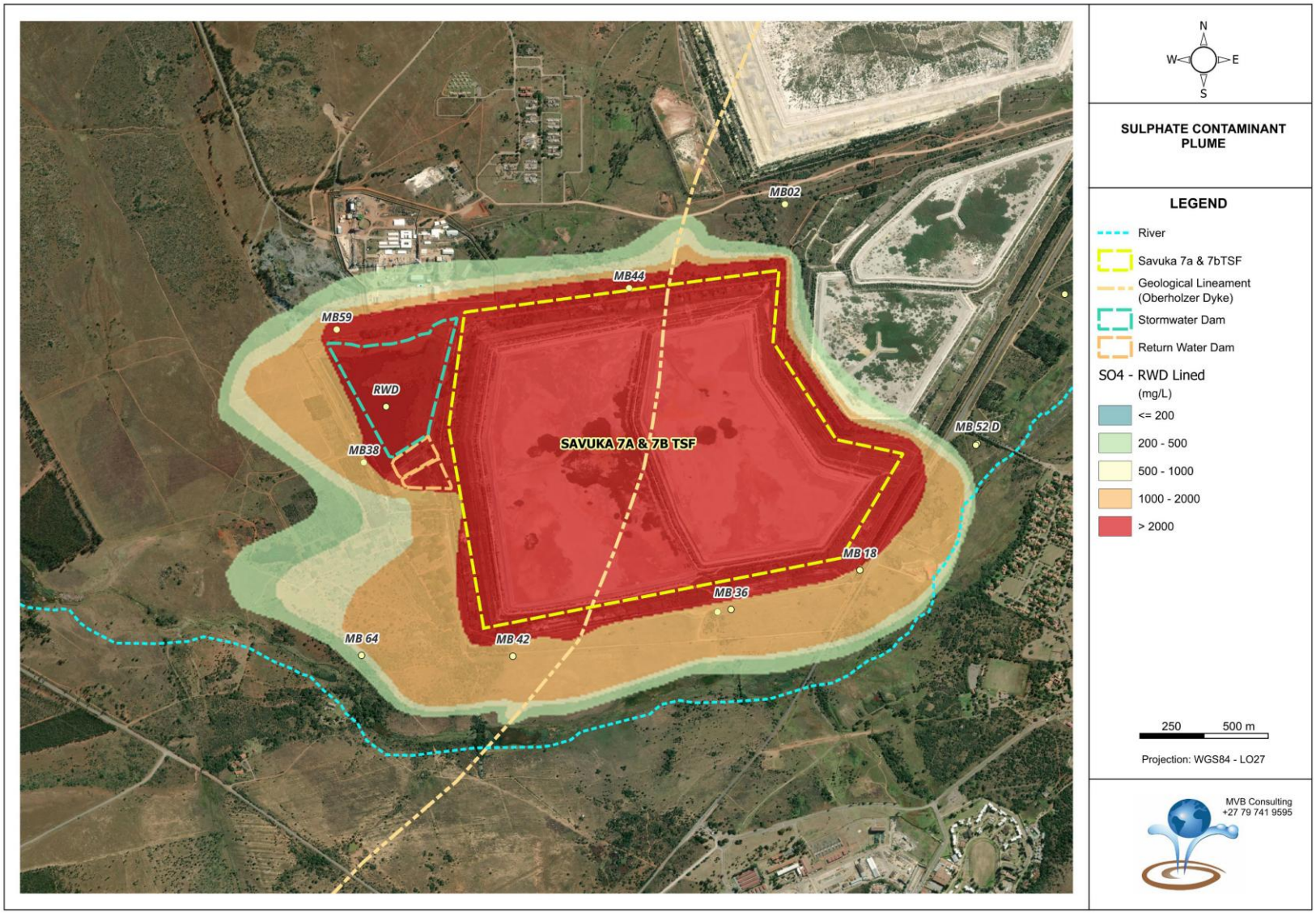

Figure 39: Simulated sulphate plume after 50 years with a liner in the RWD

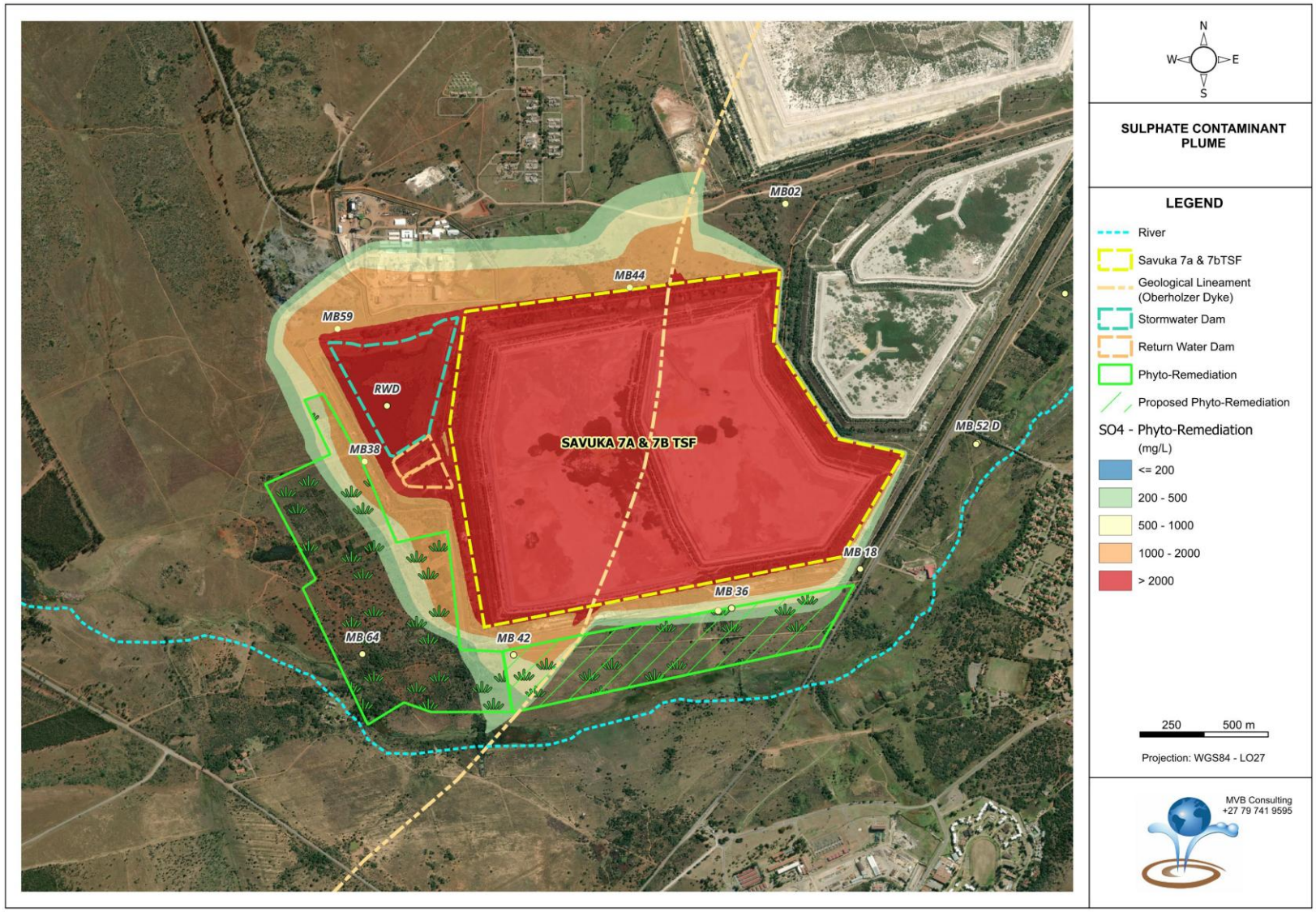

Figure 40: Simulated sulphate plume after 50 years with phyto-remediation fully functional

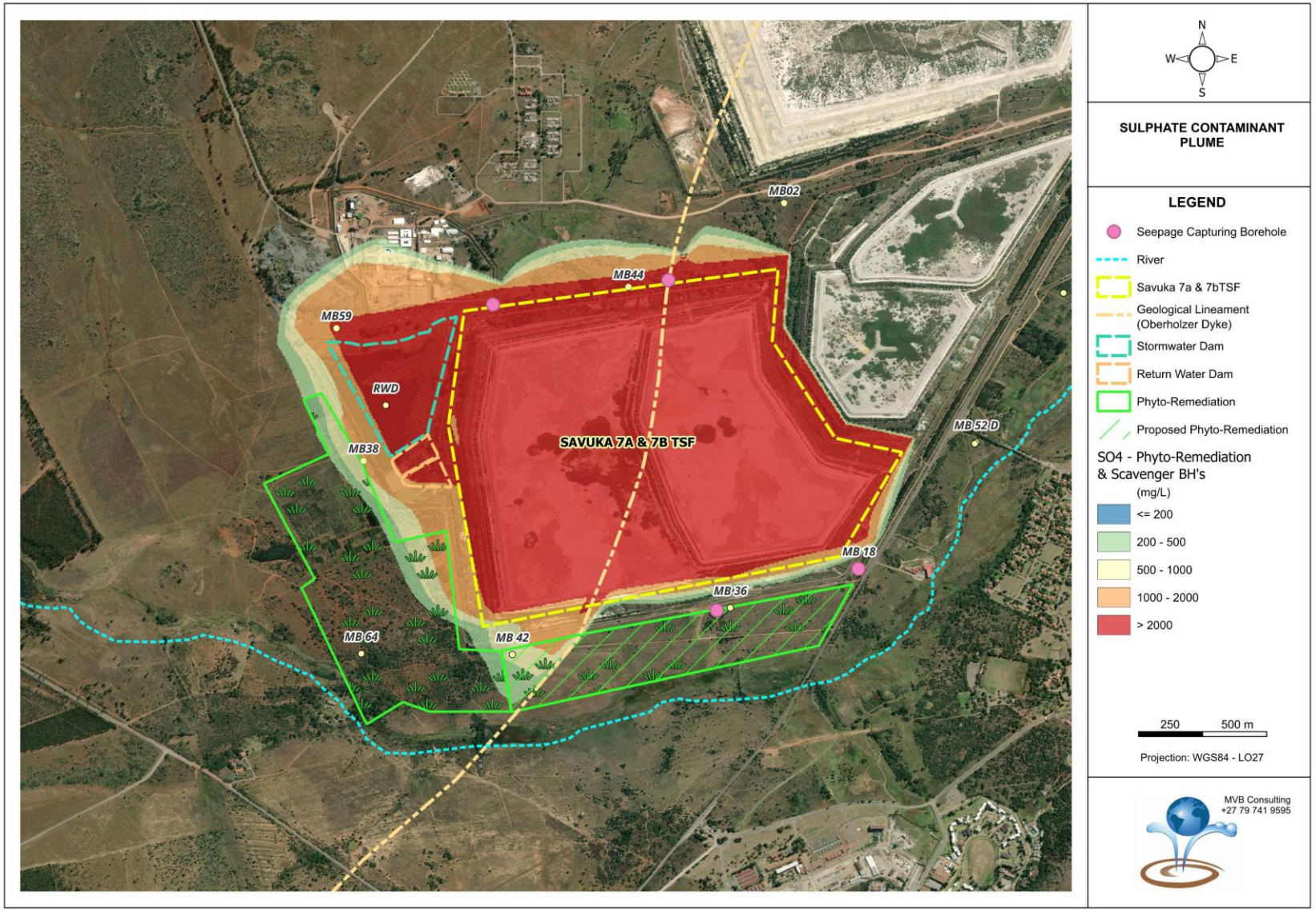

Figure 41: Simulated sulphate plume after 50 years with seepage capturing boreholes supplementing the phyto-remediation

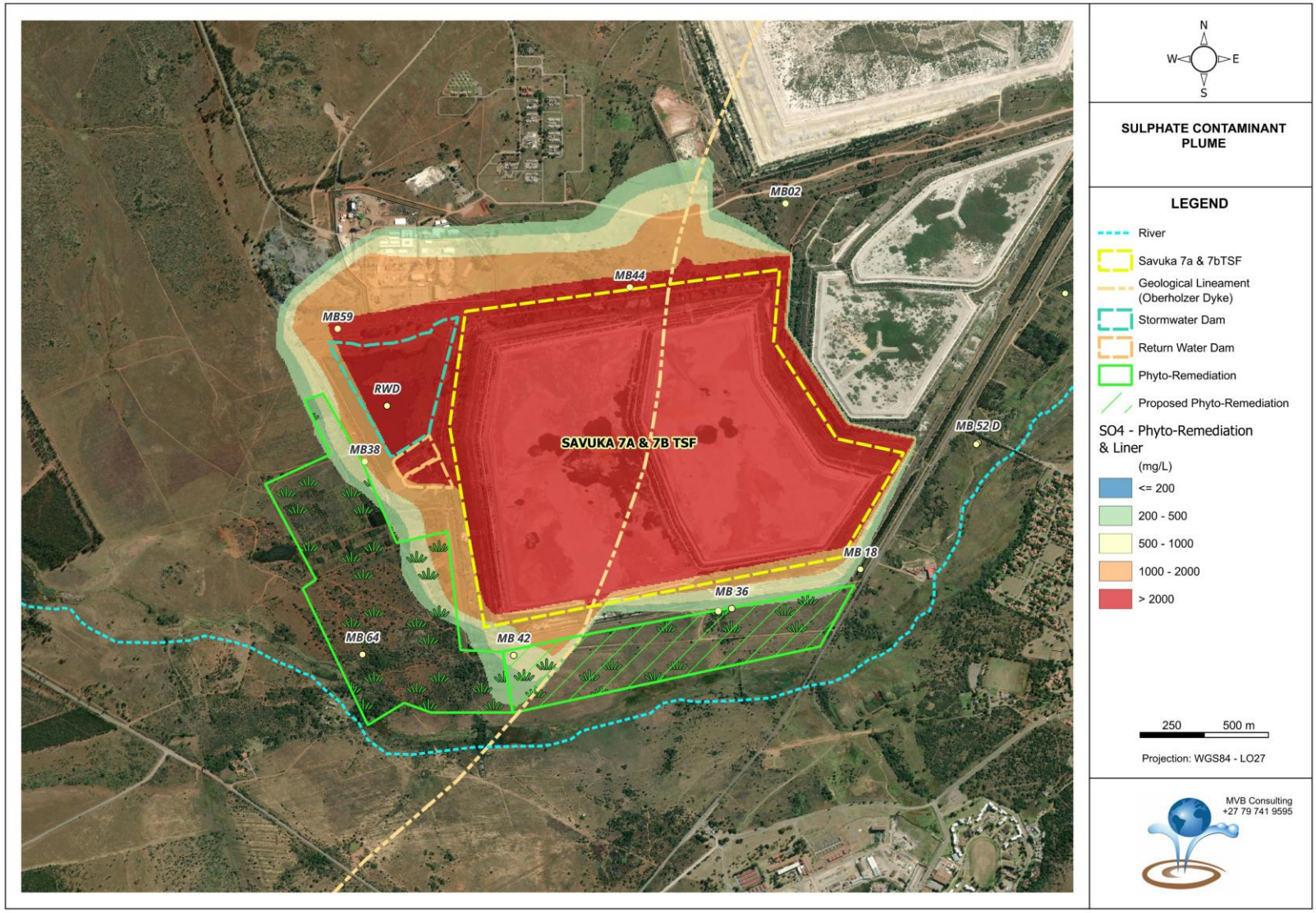

Figure 42: Simulated sulphate plume after 50 years with phyto-remediation fully functional and the RWD lined

The primary risk that this proposed project poses is the seepage of contaminants into the aquifer, and the migration of these contaminants into down-gradient receptors (Wonderfonteinspruit tributary).

The impact of the four scenarios were assessed using the EIMS impact assessment methodology by the specialist.

Mitigation measures for all scenarios:

- For the "do-nothing" option the TSF as well as the RWD remains unlined. The only mitigation is the rehabilitation and decommissioning of the RWD during the closure (decommissioning) phase.
- For the first alternative mitigation, TSF will remain unlined, but a liner in the RWD was considered. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned and rehabilitated whereafter the risk rating improves marginally.
- For the second alternative mitigation scenario, which is the recommended mitigation, the TSF and RWD will remain unlined, but the existing and proposed phyto-remediation will be fully functional. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned and rehabilitated whereafter the risk rating improves marginally. This option has the best rating and is the recommended long-term management option.
- For the third alternative mitigation, the phyto-remediation is supplemented with scavenger boreholes. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned and rehabilitated whereafter the risk rating improves marginally. This option has a slightly lower rating than the previous option, mainly as a result of the higher maintenance costs associated with the borehole maintenance.
- A last option was also considered and modelled should the lining of the RWD supplement the phyto-remediation. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned and rehabilitated whereafter the risk rating improves marginally. This option has a lower rating than the previous two options, mainly as a result of the high installation and maintenance costs associated with lining the RWD.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Groundwater Contamination (particularly sulphates) **(Alternative 3 - mitigation -phyto-remediation) (GW1)**	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Medium	Low	Low
Potential cumulative/ confounding effects	The cumulative impacts of the preferred method of mitigation is rated as low, which means considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.			
Mitigation Measures				
• Phyto-remediation as per identifier 3 above. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned and rehabilitated whereafter the risk rating improves marginally. This option has the best rating and is the recommended long-term management option. • The exiting monitoring network is comprehensive and sufficient to quantify the impact from the RWD and the TSF. The boreholes are generally close to the TSF, referred to as source boreholes. It				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
is important to drill monitoring boreholes further from the contaminant sources to be able to quantify plume migration, as well as close to the property boundary or receptors. These boreholes are referred to as compliance boreholes. Four additional compliance borehole pairs (one shallow and one deep) are recommended as shown in Figure 40. The aim of these boreholes is to monitor the effectiveness of the phyto-remediation. Borehole MB38, which is located inside the phyto-remediation has much better quality than the other monitoring boreholes. Further down-gradient boreholes will confirm that this is because of the phyto-remediation. It is also important to distinguish between the weathered and fractured formations. • The following is recommended in terms of monitoring: o Groundwater levels. o Groundwater quality. o Data should be stored electronically in an acceptable database. o On the completion of every sampling run a monitoring report should be written. Any changes in the groundwater levels and quality should be flagged and explained in the report. o A compliance report can be submitted to DWS once a year, if required. • A comprehensive bi-annual analysis of the dedicated monitoring boreholes. • Groundwater levels should be monitored monthly in the dedicated groundwater monitoring boreholes. • Rainfall should be monitored daily. • Samples should be submitted to a SANAS accredited laboratory. The following recommended parameters to be analysed for include: o pH. o Electrical Conductivity. o Total Dissolved Solids. o Total Alkalinity. o Anions and Cations (Ca, Mg, Na, K, NO_3, NH_4, Cl, SO_4, F, Fe, Mn, Al, Cr).				

8.3.4 SURFACE WATER/ WETLANDS (W)

8.3.4.1 EROSION OF SOILS AND SEDIMENTATION OF SURFACE WATER FEATURES (W1)

The current TSFs are surrounded by toe paddocks reporting to the return water dam (RWD) west of the TSFs. This will limit the potential for eroded soils or sediment to enter the environment. The proposed height increase is expected to make a limited difference in the potential (existing) erosion of soils.

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited impact the height extension will have on the surface water environment (compared to current).

8.3.4.2 POLLUTANTS ENTERING THE SURFACE WATER ENVIRONMENT (W2)

For the most part, potential pollutants are already limited by the design of the project given the containing nature of the existing TSFs.

A stormwater management plan compliant with both TSF-specific regulations and per GN 704 requirements is currently in draft and will be implemented by Harmony.

Uncontrolled release of tailings or contaminated return water is possible and would be considered a residual risk (post-mitigation). A TSF failure while a highly unlikely event has the potential to cause severe pollution of the downstream environment while poor operation/management of the TSFs (and by association the RWD) could see unplanned spill from the RWD.

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited impact the height extension will have on the surface water environment (compared to current).

Important. It should also be noted that the potentially severe impact of a TSF failure is not adequately conveyed by the impact table since the probability is low, resulting in the impact appearing less significant than may be warranted.

8.3.4.3 DECREASE IN RUN-OFF (W3)

The existing TSFs have a containment philosophy in place as enabled by the self-containing TSF basin, toe paddocks and RWD, with overall runoff from the site decreased to near zero (before any treatment and discharge).

The proposed height increase is expected to make a negligible difference in the existing decrease in runoff (relative to an undeveloped site).

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited Impact the height extension will have on the surface water environment (compared to current).

8.3.4.4 FLOOD RISK (W4)

Flood risk is both an impact on the proposed TSFs height extension (flooding originating beyond the TSF) and on the environment (flooding originating from the TSFs) and includes:

- A TSF failure resulting in downstream flooding (flooding originating from the TSF);
- Flooding from the either river system to the north or south of the TSFs (flooding originating beyond the TSFs); and
- Surface water run-on towards the TSFs (flooding originating beyond the TSFs).

This risk is expected to be present during the construction, operational, decommissioning and rehab/closure phases (flooding originating beyond the TSFs) and during the operational, decommissioning and rehab/closure phases (flooding originating from the TSFs). The proposed increase in TSFs height has no influence on existing flood risk to the TSFs, however, flood risk from the TSFs may be increased due to increased TSF volume. A quantified assessment of flooding would need to consider the actual fluvial flood risk to the TSFs (from the adjacent river systems).

The consequence of flooding is potentially severe, however, flooding originating beyond the TSFs is expected to have been mitigated (to at least a degree) through the toe paddocks and associated bunding that hydraulically separates the TSFs from the adjacent environment.

TSF failure (while highly unlikely to occur), has both flooding and pollutant implications.

Pre-mitigation and post-mitigation scoring are equivalent due to the existing operation of the TSFs and the limited impact the height extension will have on the surface water environment (compared to current).

Important. It should be noted that the potentially severe impact of flood risk is not adequately conveyed by the impact table below since the probability of extreme flooding is low, resulting in the impact appearing less significant than may be warranted.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Erosion of Soils and Sedimentation of surface water features (W1)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Pollutants entering the surface water environment (W2)	Operation, Decommissioning, Rehabilitation	Low	Low	Low

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
	and Closure and Post-closure			
Decrease in run-off (W3)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Flood Risk (W4)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Potential cumulative/ confounding effects	For the erosion of soils and contamination (W1 and W2), the cumulative impact was rated as high: considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change. For decrease in run-off and flood risk (W3&W4), the cumulative impact was rated Low: considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.			

Mitigation Measures

Erosion of Soils and Sedimentation of surface water features (W1)

The below mitigation is expected to already be part of the existing TSFs management and also applies to the proposed height extension.

- Ensure the existing stormwater management plan is sufficient (per GN704 and TSF-specific requirements).
- Monitor the TSFs to ensure areas of potential erosion are identified and managed appropriately.
- Rehabilitation should include topsoil replacement, re-vegetation and maintenance/aftercare for disturbed areas insofar as it should be developed for disturbed areas.
- Concurrent rehabilitation of the TSFs should ideally occur during the life of the TSFs. This would likely include cladding of TSFs side slopes and subsequent revegetation with final TSFs rehabilitation resulting in fully vegetated site.
- Additional guidance on erosion control is available in: Landcom Soils and Construction, Volume 1, 4th edition from 2004 (otherwise known as the Blue Book).

Pollutants entering the surface water environment (W2)

The below mitigation is expected to already be part of the existing TSFs management and also applies to the proposed height extension.

- Ensure the existing stormwater management plan is sufficient (per GN704 and TSF-specific requirements).
- Develop the TSFs using sound engineering to limit the likelihood of a failure.
- Maintain and operate the TSFs/RWD to limit the potential for overfilling of the RWD that leads to a spill.
- Monitor the TSFs to identify any potential failures/slumps.
- Keep activity within the managed dirty water footprint where possible.
- Store hydrocarbons off-site where possible, or otherwise implement hydrocarbon storage with adequate bunding.
- Handle hydrocarbons carefully to limit spillage.
- Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited.
- Use drip trays for stationary vehicles or otherwise park over areas suited to their storage (e.g. with an oil interceptor)
- Designate a single location for refuelling and maintenance where possible.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance

- Keep a spill kit on site to deal with any hydrocarbon leaks.
- Remove soil from the site which has been contaminated by hydrocarbon spillage.
- Undertake surface water monitoring to enable change detection related to contaminants originating from the site.

Decrease in run-off (W3)

The below mitigation is expected to already be part of the existing TSFs management and also applies to the proposed height extension.

- Limiting the time and area over which machinery operates will limit the compaction of soils on the site.
- Divert clean water run-on away from the site.

Flood Risk (W4)

The below mitigation is expected to already be part of the existing TSFs management.

- Ensure the existing stormwater management plan is sufficient (per GN704 and TSF-specific requirements).
- Ensure that flood protection of the TSFs is sufficient to manage flood risk from both adjacent river systems (north and south) and
- stormwater run-on.
- Develop the TSFs using sound engineering to limit the likelihood of a failure.
- Monitor the TSFs to identify any potential failures/slumps.

Monitoring

- Potential contaminants of concern that need to be monitored are expected to have already been identified based on the historical quarterly surface water quality monitoring that has been undertaken. The understanding of the mine's processes and the associated contaminants that might be released in the event of a failure in an aspect of the TSF's (e.g. toe paddock rupture or RWD overflow) is likewise expected to be clearly understood with monitoring reflecting this.
- Quarterly monitoring reports should be produced to differentiate seasonal variations and general trends due to the mining activities, with a comparison of water samples to standards and guidelines set by the Department of Water and Sanitation (DWS) and an analysis of parameters over time so that trends can be established.
- The recommended monitoring points are also provided in the specialist report and should be included in the EMPr.

8.3.5 NOISE (N)

8.3.5.1 NUISANCE AND IMPACT ON SENSE OF PLACE DUE TO NOISE (N1)

The area surrounding the project area consists predominately of mining development and other industrial activities. Other dominant land uses in the project area include the local access roads, dirt roads, tar national road and existing pipeline and powerline servitudes. The proposed properties are expected to be generally flat, with a few steep TSFs in adjacent properties. The area is predominantly characterised by TSFs and other infrastructure related to the mining activities from the Harmony Savuka Mine and other Harmony mining activities in the area. There are some residential areas including schools and community facilities further away from the TSFs. However, the increase in height of the TSF and extension of mining will not have an impact on the noise baseline conditions of the area. Deposition of tailings and other activities associated with the operation of the TSFs is are fairly noiseless, especially from ground level.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Nuisance and impact on sense of place due to noise (N1)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Potential cumulative/ confounding effects	Due to the activity being an existing activity and only extending the duration of the impact is relevant, the impact will not cause to cumulative effects of noise in the surrounding area and is, therefore, rated as low.			
Mitigation Measures				
• Existing mitigation measures as per the EMPr for the operational, decommissioning, closure and post-closure phases to continue being implemented.				

8.3.6 VISUAL/ LANDSCAPE (V)

8.3.6.1 VISUAL IMPACT AND IMPACT ON SENSE OF PLACE (V1)

- Landscape Impact

The Savuka 7a and 7b TSFs s and development are on an existing TSF; no new support infrastructure is required. This activity would cause an insignificant change to the existing landscape, with a negligible loss of the elements, features, and aesthetic and perceptual aspects contributing to the baseline landscape's character. However, the activity may generate dust, mainly in the winter months. The landscape impact (i.e., the change to the fabric and character of the landscape caused by the project's physical presence) is rated negligible.

- Magnitude of Impact

In addition to the minor landscape impact, it is anticipated that visual impacts will result from the Savuka 7a and 7b TSFs in all Project phases, i.e. operational and closure. Activities associated with the Project may be visible to varying degrees and from varying distances around the project site. During the operation phase, which could last up to 4 years, the TSFs' visibility will result from the rising dam walls, ultimately reaching a height of a maximum of 70m above natural ground level. Typical visual issues associated with TSF projects are:

  - Who will be able to see the new development?
  - What will it look like, and will it contrast with the receiving environment?
  - Will the development affect sensitive views in the area, and if so, how?
  - What will the development impact be during the day and at night?
  - What will the cumulative impact be, if any?

- Public Concerns

In addition to these general issues, the public may voice a concern about the cumulative visual impact of the facility, albeit within the vicinity of existing mining operations. Their concerns may be:

  - The mine operations could cause an aesthetic altering of the landscape;
  - The effect of security lights that could be visible from great distances, especially from the southwest (Deelkraal) of the connector road west of the facilities.

However, minimal lighting is proposed at the TSFs, and the status quo could be maintained.

- Sensitive Viewers and Locations

Receptor locations where people would most likely be susceptible to adverse changes in the landscape caused by the physical presence of the Project might be:

  - Deelkraal residential area (all other residential areas are associated with the mines, and receptor sensitivity would be low);
  - The farmstead south-west of the TSFs; and
  - Travellers along the connector road west of the TSFs.

People living in and passing through these locations will experience a minor change and negligible loss of the baseline landscape aesthetic due to the scale and extent of the proposed Savuka 7a and 7b TSFs height extensions. However, due to the high visual absorption capacity (VAC) of the existing landscape when viewed from these locations and the fact that deposition will occur on an existing footprint, potentially sensitive receptors would view the new facilities within the context of existing mining infrastructure that would effectively not change. These changes would occur over the life of the mine and beyond as the TSFs would remain as residual structures in the landscape and represent the worst-case scenario for the project.

- Visibility

As described above, visual sensitivities could arise from receptors living in and visiting the study area and observing changes to the aesthetic baseline. The rising walls of the Savuka 7a and 7b TSFs would mostly be 'absorbed' into the visual scene from these areas, rendering the proposed Savuka TSFs moderately visible from sections of the connector road and the southeastern extremities (on the side slopes of the hills) of the Deelkraal residential areas. The Savuka 7a and 7b TSFs extensions would also be visible in the northwest and southeast of the proposed extension sites. However, these areas are mainly occupied by mining activities and plantations.

The Savuka 7a and 7b TSFs Height Extension project will contextually fit with the baseline landscape patterns no matter from which angle they are viewed, although they would add to the cumulative negative effect of mining operations in the study area. The visibility of the activities is considered low.

- Effects of Night-lighting

The impact of lights at night is a sensitive issue associated with mines. The impact of night lighting is consistently raised by I&APs, specifically when they can be seen from tourist and/or residential sites and when the impact would continue for the mine's life. However, existing light pollution generated by mining and urban areas would negate any real effect they may have. However, stringent management measures should be implemented to limit light spillage beyond the TSFs' site boundaries and minimise cumulative light pollution.

- Visual Exposure

Visual exposure is determined by qualifying an object's visibility, with a distance rating to indicate the degree of intrusion and visual acuity. As the distance between the viewer and the object increases, the visual perception of the object reduces exponentially as changes in form, line, colour, and texture in the landscape become less perceptible with increasing distance.

- Visual Intrusion

Visual intrusion deals with contextualism, i.e. how well does a Project activity fit with or disrupt/ enhance the ecological and cultural aesthetic of the landscape as a whole? The simulations illustrate the effect that Project activities will have on views experienced from various sensitive viewing points indicative of typical views towards the proposed TSF facilities. When visible, the TSFs would appear in the middle ground (800m to 3,0km from the viewer) of views from the west and south of the facility and in the background (beyond 3,0km) of views from the far west. Views from the south would mostly be screened by topography. Foreground views are limited to existing mining areas.

The simulation also illustrates the TSFs from 1,8km away (middle ground view) when viewed from the connector road. The TSFs would be visible from this perspective as their side walls rise. The extension activities would

always be viewed within a scene that includes existing mining infrastructure, and the potential for negative visual intrusion is reduced substantially.

- Determining magnitude

Four main factors are considered in determining the magnitude, and the waste material facilities will be residual activities and remain post-mining operations (albeit in a rehabilitated state).

  - Visual Intrusion: The nature of intrusion or contrast (physical characteristics) of a Project component on the visual quality of the surrounding environment and its compatibility/discord with the landscape and surrounding land use within the context of the landscape's VAC.
  - Visibility: The areas from which Project components will be visible.
  - Visual exposure: Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion.
  - Sensitivity: Sensitivity of visual receptors to the proposed development.

A numerical or weighting system is avoided when synthesising the criteria. Attempting to attach a precise numerical value to qualitative resources is rarely successful and should not be used as a substitute for reasoned professional judgment (LI-IEMA 2013). Given these factors, the magnitude of the visual impact is summarised in Table 24 and rated:

  - Moderate and High - no receptors
  - Low For sensitive viewing areas northwest and west of the Project activities
  - Negligible for receptors north and northwest of Project activities and beyond 3,0km from the closest project activity.

Table 24: Magnitude of Visual Impact

High	**Moderate**	**Low**	**Negligible**
None	None	For receptors west (connector road) and southwest (Deelkraal residential area) of the TSFs and less than 3,0km from the closest edge of the TSF (i.e. middle-ground of a view)	For receptors, southwest of the site at more excellent than 3,0km from the closest edge of the TSF (i.e. background of a view)
Major loss of or alteration to the baseline's key elements/features/characteristics near the site. i.e., a pre-development landscape or view and/or introduction of elements considered uncharacteristic when set within the attributes of the receiving landscape. High visual impacts would result.	Partial loss of or alteration to the baseline's key elements/features/characteristics. i.e., a pre-development landscape or view and/or introduction of elements that may be prominent but not necessarily problematic when set within the attributes of the receiving landscape. Moderate visual impacts would result.	Minor loss of or alteration to the baseline's key elements/features/characteristics. i.e., a pre-development landscape or view and/or the introduction of elements that may not be problematic when set within the attributes of the receiving landscape. Low visual impacts would result.	Negligible loss or alteration to the baseline's key elements/features/characteristics. i.e., a pre-development landscape or view and/or the introduction of elements that are not problematic within the surrounding landscape - approximating the 'no change' situation. Negligible scenic quality impacts would result.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Visual Impact and Impact on Sense of Place (V1)	Operation	Low	Low	Low
Visual Impact and Impact on Sense of Place (V1)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Potential cumulative/ confounding effects	Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate from it) or actions that occurred in the past, present, or are likely to happen in the foreseeable future. They may also affect how the landscape is experienced, and cumulative effects may be positive or negative. They may be considered part of the mitigation measures where they comprise a range of benefits. Cumulative effects can also arise from the intervisibility of a range of developments and the combined effects of individual components of the proposed development occurring in different locations or over time. The separate effects of such individual components or developments may not be significant. However, they may create an unacceptable degree of adverse impact on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, vegetative cover or other visual obstruction, elevation, and distance, as this affects visual acuity, which is also influenced by weather and light conditions (LI-IEMA, (2013)). A Savuka 7a and 7b TSFs Height Extension project would add to existing mining land-use activities prominent in the subregion. The Savuka 7a and 7b TSFs have existed for decades. The proposed Project is to increase the height of these existing TSFs. Therefore, the cumulative effect of the Project, which is also adjacent to existing mine activities, would be LOW. I.e. Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.			
Mitigation Measures				
In considering mitigating measures, three rules are considered - the measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance), and acceptable (within the framework of the existing landscape and land use policies for the area). To address these, the following principles have been established: • Mitigation measures should be designed to suit the locality's existing landscape character and needs. They should respect and build upon landscape distinctiveness. • It should be recognised that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective. ***Planning and Site Development*** • Apply dust suppression methods to limit the dust generated during the establishment phase. • Before operation, ensure the post-closure rehabilitation plan is geared toward acceptable topographic and ecological conditions. ***Landscaping and Ecological Approach*** • Where new vegetation is proposed to be introduced to the site (on the rising side slopes), an ecological approach to rehabilitation should be adopted. For example, communities of indigenous				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
plants (primarily grasses) will enhance biodiversity, a desirable outcome for the area. This approach can significantly reduce long-term costs as less maintenance would be required over conventional landscaping methods, and the introduced landscape would be more sustainable. ***Good housekeeping*** • "Housekeeping" procedures should be developed for the project to ensure that the Project site and adjacent lands are kept clean of debris and that dust generation is limited. ***Lighting*** Light pollution is primarily the result of bad lighting design, which allows artificial light to shine outward and upward into the sky, where it is not wanted, instead of focusing the light downward, where it is needed. Ill designed lighting washes out the night sky's darkness and radically alters the light levels in rural areas where light sources shine as 'beacons' against the dark sky and are generally not wanted. Simple changes in lighting design and installation yield immediate changes in the amount of light spilt into the atmosphere. The following are measures to minimise light pollution beyond the perimeter of the Project sites that must be considered in the lighting design of the Project: • Should light fixtures be installed, ensure precisely directed illumination to reduce light "spillage" beyond the site's immediate surroundings. • Avoid high pole-top security lighting along the periphery of the site and use only lights that are activated upon illegal entry. • Minimise the number of light fixtures to the bare minimum, including security lighting. **Monitoring:** • During the operational phase, the mine's environmental officer should monitor or report on adherence to the proposed management measures monthly. • During the closure and rehabilitation phase, the mine's environmental officer should monitor or report on adherence to the proposed management measures quarterly.				

8.3.7 ECOSYSTEMS/ HABITATS (EH)

- *Current Impacts to Freshwater Biodiversity*

The list below refers to the present-day local impacts observed within the assessed wetland areas:

- Historical alterations to the natural hydrological regime due to the presence of access roads through wetlands;
- Alterations to hydrology and geomorphology through the development of dams within wetlands and the local catchment;
- Loss of vegetation and wetland area through infrastructure infringement;
- Impaired water quality from mining runoff;
- Impeding flow within watercourse from informal and formal road crossings;
- Proliferation of alien invasive vegetation; and
- Erosion of watercourse from altered hydrology and geomorphology.

- *Anticipated Impacts*

It should be noted that the TSF has already been established and is currently in use, and the height of the facility is now being increased. Therefore, the majority of the impact has already occurred. The project entails continuing with deposition using the cyclone method for another 2 to 3 years which is an added impact of low significance.

The construction phase for the project was not considered for the assessment as no construction would be undertaken while a decommissioning phase for the project was also not considered given the expected longevity of the infrastructure. Unlike the DWS Risk Assessment, which is activity specific, this impact assessment provides a cumulative assessment of significance per impact. As such, the pre- and post-mitigation impact ratings present

within the “Low” class. The proposed activities being assessed in this impact assessment refer to TSF height extension/operation of TSF.

8.3.7.1 SILTATION OF WATER RESOURCES (EH1)

The extension of the TSF increases the risk of fine tailings material being mobilized via surface runoff, wind erosion, and stormwater discharge. If erosion control measures are inadequate, these sediments can enter nearby wetlands, altering substrate composition and smothering aquatic vegetation.

8.3.7.2 EROSION OF WATER RESOURCES (EH2)

Altered drainage patterns associated with increasing the height of the TSF can accelerate erosion along nearby watercourses.

8.3.7.3 ALTERING OF HYDROLOGICAL REGIME (EH3)

The additional height of the TSF may alter natural surface and subsurface flow paths, leading to increased runoff, reduced infiltration, and localized water table changes. This can disrupt wetland recharge and modify seasonal water availability, impacting wetland-dependent species.

8.3.7.4 PROLIFERATION OF ALIEN VEGETATION (EH4)

Disturbance from altered water flow can create favourable conditions for invasive species to establish. Poor rehabilitation practices may further encourage the spread of aggressive alien vegetation within wetland buffer zones.

8.3.7.5 IMPAIRED WATER QUALITY (EH5)

The extension of the TSF increases the potential for contaminants such as heavy metals, sulphates, and fine sediments to leach into surface and groundwater. Stormwater runoff from tailings areas, accidental spills, and seepage from storage facilities can introduce harmful substances into adjacent wetland habitats.

8.3.7.6 WETLAND DISTURBANCE AND DECREASE IN FUNCTIONALITY (EH6)

Due to all the other impacts described, the wetland will be disturbed and its functionality decreased.

8.3.7.7 PHYTOREMEDIATION FOR GROUNDWATER POLLUTION (EH7)

According to the Geohydrological Impact Assessment (van Biljon, 2025), applying Phytoremediation to counter groundwater pollution, will result in lowering the water table. Certain plant species used in phytoremediation, particularly those with high transpiration rates, can significantly draw down the water table as they uptake large volumes of water to support their growth and contaminant uptake processes. However, channelled valley-bottom wetlands are characterised by their location on valley floors, the presence of a river channel running through them, and the absence of characteristic floodplain features. Therefore, these wetlands are typically influenced by water inputs from the river channel and adjacent valley-side slopes, which contribute to their hydrological and ecological dynamics (Ollis *et al*., 2013).

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Siltation of water resources (EH1)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Erosion of water resources (EH2)	Operation, Decommissioning, Rehabilitation and	Low	Low	Low

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
	Closure and Post-closure			
Altering of Hydrological Regime (EH3)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Proliferation of Alien Vegetation (EH4)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Impaired Water Quality (EH5)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Wetland disturbance and decrease in functionality (EH6)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Phytoremediation for Groundwater Pollution (EH7)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Potential cumulative/ confounding effects	The quantitative impact of the proposed project in isolation on freshwater biodiversity is anticipated to be "Low" due to the proposed activities that will avoid wetland features and their buffers wherever possible and given that mitigation measures will be in place during the operational phase where impacts will be more likely to occur. The cumulative impact of the proposed project on freshwater biodiversity is anticipated to be "Low" given the nature of the activities and expected low magnitude of impact once the height of the TSF is established. Therefore, a slight and short-term deterioration to the wetland's integrity and functionality conditions are expected but will likely remain within the recommended ecological category as a result of the proposed development activities. An irreplaceable loss of freshwater biodiversity is not anticipated.			
Mitigation Measures				
Siltation of water resources (EH1) • Update and implement the stormwater management plan. • Implement and maintain silt traps and sediment basins at strategic stormwater discharge points. • Establish and maintain vegetated buffer zones (using indigenous grass species) between the TSF and nearby wetlands, within 15 m from the TSF. • Regularly inspect and clear sediment traps and drains to ensure continued functionality. • Apply dust suppression measures (e.g., water spraying or biodegradable binders) on or vegetate exposed tailings to reduce wind-blown silt deposition where required.				

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance

Erosion of water resources (EH2)

- Install energy dissipation structures at stormwater outflows to reduce flow velocity, where required.
- Stabilize slopes and embankments where required.
- Implement a controlled release of stormwater through designed drainage channels to prevent concentrated flows from reaching wetland areas.
- Conduct regular inspections of stormwater management infrastructure and repair erosion-prone areas immediately.
- No machinery or vehicles should be allowed to parked in any wetlands. All activities to be restricted to authorized areas only.

Altering of Hydrological Regime (EH3)

- Implement stormwater management, to be informed by the hydrological report.
- Use permeable berms or check dams in water diversion channels to slow down and evenly distribute water flow.
- Monitor groundwater levels.

Proliferation of Alien Vegetation (EH4)

- Remove alien vegetation manually or mechanically rather than using herbicides, to avoid contamination risks. This should be conducted annually.
- Implement a maintenance program to ensure that previously cleared areas do not become re-infested with alien vegetation.

Impaired Water Quality (EH5)

- Conduct routine water quality monitoring at key points downstream of the TSF to detect contamination early.
- Conduct groundwater quality monitoring.

Wetland disturbance and decrease in functionality (EH6)

- Establish a 15 m wetland buffer zone with clear demarcation to prevent accidental encroachment. This can include signage.
- Restrict heavy vehicle access to designated and authorized roads.
- Implement a long-term wetland monitoring program to track ecological changes and implement adaptive management strategies.

Phytoremediation for Groundwater Pollution (EH7)

- Use indigenous plant species that are well-adapted to local conditions. This helps maintain the ecological balance and supports local biodiversity.
- Monitor water levels by means of the current groundwater monitoring programme to detect any significant changes in the water table. The geohydrologist is to advise on the suitability of the programme, and to recommend any changes.
- The geohydrologist is to also advise on 'allowable' changes to the groundwater levels, and to prescribe remedial actions if levels are exceeded.
- Manage the density of phytoremediation plants to prevent excessive water uptake and potential lowering of the water table. This can be achieved by spacing plants appropriately and using mixed planting strategies.

Further recommendations

- Strict adherence to the wetland buffers should be practiced, unless for activities that have been authorised;
- Update and implement a stormwater management plan for the operational phase of the development. The plan must address the movement of water on site and include measures to reduce erosion and sedimentation of the watercourses. Furthermore, the plan must ensure that only clean water is released into the environment;

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
• Ensure that waste generated on site during the operational phase is appropriately contained, categorised and disposed of; and • Review and update the surface, groundwater and also aquatic biomonitoring programmes for the operation. In the event no monitoring programmes are available, these must be informed by the relevant specialists. It is recommended that an annual wetland monitoring programme be considered for the necessary authorisation, for this project.				

8.3.8 SOCIAL (S)

8.3.8.1 SAFETY ASPECTS RELATED TO STABILITY (S1)

Although the likelihood is low there is always a risk that a TSF may fail, with dire consequences to people and the environment. Farmers and communities living in the zone of influence of a TSF should be included in the emergency preparedness planning in case of such an event. With the height extension and change in deposition method to allow for a faster rate of deposition, certain mitigation measures is required to ensure that there is no risk of TSF failure, or that the risk does not increase.

Important. It should be noted that the potentially severe impact of a dam wall break on safety is not adequately conveyed by the impact table below since the probability is low, resulting in the impact appearing less significant than may be warranted.

8.3.8.2 IMPACT ON LIVELIHOODS (S2)

A livelihood refers to the way of life of a person or household and how they make a living, in particular, how they secure the basic necessities of life, e.g., their food, water, shelter and clothing, and live in the community (Vanclay et al., 2015).

Although the likelihood is low there is always a risk that a TSF may fail, with dire consequences to people and the environment. Farmers and communities living in the zone of influence of a TSF should be included in the emergency preparedness planning in case of such an event. With the height extension and change in deposition method to allow for a faster rate of deposition, certain mitigation measures is required to ensure that there is no risk of TSF failure, or that the risk does not increase.

Important. It should be noted that the potentially severe impact of a dam wall break on livelihoods is not adequately conveyed by the impact table below since the probability is low, resulting in the impact appearing less significant than may be warranted.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Safety aspects related to stability (S1)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Impact on livelihoods (S2)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	Low	Low	Low
Potential cumulative/ confounding effects	Not applicable.			

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Mitigation Measures				
• All measures in the EMPr, conditions of the Environmental Authorisation and updated Water Use License should be implemented; • The applicant must apply for a water use license amendment; • Updated designs should be drafted by registered and suitably qualified engineers and submitted and approved by relevant authorities; • The relevant standards and legislation related to the management and design of the TSFs described in this report should be adhered to at all times; and • The emergency response and management plan must be available at all times and staff and visitors should receive training and or awareness of this with relevant signs erected where required.				

8.3.9 ECONOMIC (E)

8.3.9.1 EMPLOYMENT OPPORTUNITIES CONTINUE FOR ANOTHER FEW YEARS AND THE ASSOCIATED ECONOMIC BENEFITS FOR THE LOCAL AREA (E1)

The project will ensure job security for currently employed people, as they will be able to continue with their current jobs. This impact would be experienced on a wider level since it will allow them to meet the needs of their family members. Wages that employees receive will continue their spending power in the study area. This will be especially beneficial to retail and other service providers. The job continuation will be a significant positive impact during the operational phase.

Apart from the direct economic impacts of the proposed project, there will also be secondary economic opportunities that can potentially benefit local service providers. The positive impact of the mine on the local economy will continue for the life of the mine. The SLP also commits to secondary economic development in the area, and if it is implemented as planned should be a significant contribution.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Employment opportunities continue for another few years and the associated economic benefits for the local area (E1)	Operation, Decommissioning, Rehabilitation and Closure and Post-closure	High	High	High
Potential cumulative/ confounding effects	Not applicable.			
Mitigation Measures				
• The proposed project be approved and mining to continue to ensure the positive impact will realise.				

9 SUMMARY OF SPECIALIST REPORTS

Various specialists that were appointed to undertake the specialist assessments for the application area.

- Air Quality Impact Assessment – Airshed Planning Professionals.
- Hydropedological Statement – The Biodiversity Company.

- Groundwater Assessment – MVB Consulting.
- Hydrological Assessment – Mike Bollaert.
- Wetland Delineation and Assessment – The Biodiversity Company.
- Visual Impact Assessment – Graham Young Landscape Architect.
- Closure Costing (EIMS & Minelock Environmental Engineers).
- Health Risk and Radiological Impact Assessment – Airshed Planning Professionals and Aquisim Consulting.

Table 25 presents a summary of the findings and recommendations as identified in the specialist studies undertaken to inform the BAR.

The following specialist studies were undertaken:

- Air Quality Impact Assessment – Airshed Planning Professionals.
- Hydropedological Statement – The Biodiversity Company.
- Groundwater Assessment – MVB Consulting.
- Hydrological Assessment – Mike Bollaert.
- Wetland Delineation and Assessment – The Biodiversity Company.
- Visual Impact Assessment – Graham Young Landscape Architect.
- Closure Costing (EIMS & Minelock Environmental Engineers).
- Health Risk and Radiological Impact Assessment – Airshed Planning Professionals and Aquisim Consulting.

Table 25: Summary of Specialist Findings

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
Air Quality Impact Assessment	**Main Findings:** An air quality study was conducted for the current (Savuka and Mponeng operations) and future (increase height of Savuka 7a & 7b TSFs) activities. The main objective of this study was to determine the significance the increased heights of the two TSFs will have on the air quality and resulting impacts on nearby receptors. This section summarises the main findings of the receiving environment and impact assessment. The main findings of the receiving environment assessment are: • AQSRs near the Savuka operations include Southdene (north of Savuka 5 TSF), Elandsridge (southeast of 7b TSF and southwest of 5 TSF), Harmony Hostel (southeast of 7b TSF) and Harmony Hospital (south of the Savuka Plant). • The main sources associated with the Savuka and Mponeng operations likely to contribute to baseline PM emissions include mining and reclaiming	Section 8.3

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	operations, processing operations, vehicle entrained dust from roads, vehicle exhaust and windblown dust from exposed areas on existing TSFs. • Other sources of PM within the area include other companies mining, transport and processing activities, farm activities, occasional biomass burning, household fuel burning in the residential areas, vehicle entrained dust from public roads and vehicle exhaust. • The wid field is dominated by winds from the northerly sector with the strongest winds (>6 m/s) mostly from the north-northeasterly sector. The predominant northerly wind field remains similar throughout the seasons. • Dust fallout results from the 10 DMUs at Savuka for the period January 2023 to October 2024 show compliance with the NDCR at both the residential and non-residential sites. The main findings of the impact assessment for current and future operations are as follows: • Simulated PM2.5 concentrations comply with the NAAQS at all AQSRs, both for current and future operations. • Simulated PM10 concentrations comply with the NAAQS at all AQSRs, both for current and future operations. • Simulated dustfall rates were above the NDCR limits for residential areas at one AQSR (Elandsridge) both during current and future operations, with a 3.5 km area of exceedance of the agricultural limit (400 mg/m²-day). Measured dustfall rates are however below the NDCR limit for residential areas at all AQSRs, including Elandsridge for the past three years, implying a possible overprediction of simulated dustfall rates. • The environmental risk due to unmitigated future operations is classified as **Medium.** With mitigation (80% CE through grassing of TSF side slopes and wet slurry deposition) the risk is classified as **Low**. **Recommendations:** With the potential impacts from windblown dust from the active TSFs, especially the increased Savuka 7a & 7b TSFs, the following recommendations are proposed: • Dustfall monitoring ensuring dustfall rate in compliance with the NDCR limits; and	

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	• Mitigation measures aimed at reducing wind erosion from the active TSFs, i.e. the grassing of TSF side slopes. **Conclusion:** In conclusion, it is the specialist opinion that the project may be authorized provided that the recommended air quality management measures are implemented.	
Hydropedological Statement	**Conclusion:** The existing TSFs, particularly compartments 7A and 7B, currently contribute minimally to catchment hydrology through limited lateral seepage and episodic surface runoff during rainfall events, which are largely managed via engineered containment systems. These contributions are constrained by the dominant hydropedological setting, which is characterised by vertical recharge patterns through well-drained soils such as Glenrosa and Hutton. The proposed height extension of these TSFs is not anticipated to significantly alter this status Catchment-scale modelling confirms that the overall impact on water regime stores is negligible, with potential losses accounting for < 2% of the total catchment water budget. Importantly, the footprint expansion avoids responsive saturated zones, and the hydropedological flow regime, particularly vertical infiltration, remains largely intact. Consequently, the TSF height extension will not materially affect the subsurface or surface water contributions to adjacent watercourses, provided that current seepage and stormwater controls are maintained. Therefore, it is the specialist's opinion that the proposed Savuka TSF height extension project and associated infrastructure will not result in a significant loss of total streamflow and groundwater recharge water regime stores. It is therefore recommended that the proposed activities proceed as have been planned and no further hydropedology assessments are necessary	
Groundwater Assessment	**Main Findings:** The following risks are generally associated with this project: • The primary risk that this proposed project poses is the seepage of contaminants into the aquifer, and the migration of these contaminants into down-gradient receptors (Wonderfonteinspruit tributary). The following mitigation measures were included in the assessment: • Option 1: For the "do-nothing" option (Identifier 1 in the table below) the TSF as well as the RWD remains unlined. The only mitigation is the rehabilitation and decommissioning of the RWD during the closure (decommissioning) phase.	Section 8

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	• Option 2: In this option the TSF will remain unlined, but a liner in the RWD was considered. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned and rehabilitated whereafter the risk rating improves marginally. • Option 3: In this option the TSF and RWD will remain unlined, but the existing and proposed Phyto-remediation will be fully functional. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned and rehabilitated whereafter the risk rating improves marginally. This option has the best rating and is the recommended long-term management option. • Option 4: In this option the phyto-remediation is supplemented with scavenger boreholes. This option will change the risk from High Negative to Low Negative during the operational phase. After closure the RWD will be decommissioned a slightly lower rating than the previous option, mainly as a result of the higher maintenance costs associated with the borehole maintenance. **Recommendation:** It is evident from the assessment that the phyto-remediation is effective, and it is recommended that it be expanded as proposed. The installation of a liner and / or scavenger boreholes may improve the rehabilitation of the groundwater, but it is considered unnecessary as the phyto-remediation is effective on its own. The drilling of additional boreholes down-gradient from the phyto-remediation is nevertheless recommended to confirm and quantify the clean-up of the groundwater.	
Hydrological Assessment	**Site Sensitivities** There are parts of the TSFs that are within sensitive areas. This primarily includes the influence of the northern and southern river systems adjacent to the TSFs, since the 1:100 RI flood event (medium sensitivity) falls out of the site. **Identified Impacts** Flooding and pollutants entering the surface water environment are the two primary impacts whether or not indicated by the impact assessment. Both impacts are poorly represented in the impact assessment due to their probability of occurrence (improbable). In the case of flooding, there is flooding originating beyond the TSFs (from the northern and southern river systems and surface water run-on) and flooding originating from the TSFs (due to a TSF failure). The latter	Section 8

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	presents the largest risk to this study (that of flood risk and pollutants entering the surface water environment). A secondary pollutant risk is poor management of the TSFs (and by association the RWD) resulting in a spill. **Surface Water Monitoring** Regular surface water quality monitoring is required to enable change detection, concerning the potential contamination of surface water by any pipeline leaks. Surface water monitoring points are expected to be present given the existing Savuka 7A and 7B TSFs, plus the surrounding work associated wit the greater operation. For the sake of this study, indicative sampling points are provided for the Savuka 7A and 7B TSFs alone. Sampling points are laid out to either capture flows towards the TSFs or flows away from the TSFs (pre and post-pollutant potential respectively). **Authorisation** The proposed Savuka 7a & 7b TSFs height extensions can be authorised with regard to the hydrological (surface water) environment inclusive of the recommended mitigation measures provided by the specialist. A review of Mponeng's surface water monitoring plan will also be required to ensure that the TSFs are adequately considered (as it relates to monitoring positions).	
Wetland Delineation and Assessment	**Site specific wetland features** Four (4) Hydrogeomorphic (HGM) units were identified within the encompassing 500 m Savuka TSF PAOI. These were classified as; one (1) channelled valley-bottom (seriously modified), two (2) unchanneled valley-bottoms (one seriously and one largely modified) and one (1) artificial wetland. Several earth dams were identified within the PAOI, most of which were instream features. Several dams were identified within the PAOI, most of which were off-channel features. Furthermore, the one HGM unit has been identified as an artificial depression. In addition, two non-perennial drainage features were identified where one has connectivity to the larger perennial river such as the Mooiriver. **Risk and Impact Statement** A risk assessment was conducted for the proposed project. The post-mitigation risks for the project presented within the "Low" significance categories. Additionally, a second impact assessment was undertaken for the project and the pre- and post-mitigation impact ratings present within the "Low" class. The cumulative impact of the proposed project on freshwater biodiversity is anticipated to be "Low" given the nature of the activities and expected low magnitude of impact once the height of the TSF is established. Therefore, a negligible	Section 8

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	deterioration to the wetland's integrity and functionality conditions are expected, for the duration of the operational phase of the project. However, the recommended ecological category of the systems is expected to be unaffected. An irreplaceable loss of freshwater biodiversity is not anticipated. **Specialist Opinion** No fatal flaws were identified for the project. It is the opinion of the specialists that the project may be favourably considered for approval, and the Competent Authority must consider the prescribed mitigation measures and recommendations for the authorisation.	
Visual Impact Assessment	The existing visual condition of the landscape that may be affected by the proposed Project has been described. The study area's scenic quality has been rated low to high within the context of the subregion. The project footprint is in a landscape type with a low scenic quality. Sensitive receptors, viewing areas and landscape types have been identified and mapped, indicating a potentially low sensitivity to the project. However, the results of the public participation process must confirm this assumption. Impacts on views are the highest when receptors are identified as sensitive to change in the landscape, and their views are focused on and dominated by these changes. The results of the public participation process were not known at the time of writing this report, and generic sensitivities were ascribed to indicate that visual issues would be of low concern to the I&APs. The Project continue with an activity that is currently occurring in the subregion and cause a low cumulative alteration to the baseline's key features and characteristics during the operational phase. The pre-development landscape and views will not be significantly affected by this activity, characteristic of the mining subregion when set within the attributes of the receiving landscape. The Project would primarily affect receptors travelling through the study area on the connector road west of the project site and people living in the Deelkraal residential area. The effect (worst case scenario) on the visual environment during all phases of the project is assessed to be of LOW significance that would occur over the short term (maximum of 5 years). A LOW negative impact is when the impact does not have a direct influence on the decision to develop in the area. The impact is reversible in all phases, although it could incur time and cost during the operational phase.	Sections 8.3.6

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	Implementing mitigation measures could reduce the predicted impact, and the effect would remain of low significance. Monitoring and mitigation are recommended in both phases to ensure that the potential negative impact remains low. The cumulative effect of the Project is rated LOW. **Visual impact statement** GYLA believes that the visual impacts associated with the proposed Savuka 7a and 7b TSFs Height Extension Project, given the worst-case scenario, are of low significance due to the nature, scale, and duration of project activities within the context of the receiving environment. The impacts associated with the various phases of the Project can be mitigated slightly, and these measures should be implemented and effectively managed. The Savuka 7a and 7b TSFs Height Extension project is deemed acceptable from a visual perspective.	
Health Risk and Radiological Impact Assessment	**General** The purpose of the radiological public safety and impact assessment was defined as to demonstrate that members of the public living near the Project will not be exposed to levels of ionizing radiation above the regulatory compliance criteria for public protection and to assess the associated radiological impact as input into the ESHIA process. A systematic approach was followed that included the definition of the regulatory framework and technical basis of the assessment, a system description, the systematic definition of public exposure conditions, the consequence analysis of the exposure conditions and the radiological impact assessment. The section is structured as follows. Section 9.2 presents some general conclusions as derived from the radiological impact assessment results, while Section 9.3 presents recommendations for the improvement of the radiological public safety and impact assessment. **Conclusions** Following a systematic Source-Pathway-Receptor analysis approach, two public exposure conditions were derived to be representative of the area, namely a Residential Area Exposure Condition and a Commercial Agricultural Exposure Condition. The atmospheric pathway was explicitly included in the definition of the exposure conditions, whereas the surface water and groundwater pathways were treated through sensitivity and uncertainty analysis. It was argued that the public exposure condition is broadly representative of the human behavioural conditions near the Project. In addition,	Section 8

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	other potential exposure conditions that may exist will result in lower levels of radiation exposure. Given the pre-operational status of the Project, the radiological assessment is prospective based on available information and reports generated as part of the ESHIA process. The results and conclusion are presented here, therefore, for the conditions and parameter values assumed for the assessment. These may change for future iterations as and when site-specific data and information become available and are used. The following was concluded from the total effective dose assessment results: • The most significant contribution from the atmospheric pathway is from the inhalation of airborne radon gas. This is due to the presence of Ra-226 in the source material. • The contribution from the groundwater pathway was evaluated with the Project TSFs as the main contributing source. It was illustrated that the potential radiological impact is only visible in thousands of years at maximum total effective doses of less than 100 µSv.year-1, which means that it cannot be considered as a contributing pathway for the Commercial Agricultural Exposure Condition during the operational phase of the Project; • The results for the two public exposure conditions were presented as dose isopleths for the different age groups, with more detailed exposure route-specific results at the receptor locations conservatively selected to be close to the infrastructure of the Project. The results show that notwithstanding the proximity of the receptor locations to the surface infrastructure, the doses are still less than the dose constraint for all age groups, with a maximum contribution of less than 250 µSv.year-1 from the atmospheric pathway. • It can, therefore, be concluded with a reasonable level of assurance that members of the public who can associate themselves with one of the exposure conditions will not be subject to a total effective dose of more than the public dose constraint of 250 µSv.year-1. These total effective dose assessment results were used to derive the radiological impact rating during the different phases of the Project. Table 9.1 summarises the radiological impact significant rating for the operational phase of the Savuka 7A and 7B TSF, while Table 9.2 summarises the	

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	radiological impact significant rating for the post-closure phase of the proposed Savuka 7A and 7B TSF. **Recommendations:** The radiological impact assessment made use of assumptions for conditions and parameter values required for the dose assessment, which is not ideal. To improve the radiological public safety and impact assessment, Recommendations were made for the baseline site characterisation programme and the radiological monitoring programme. Based on the outcome of the preliminary baseline site characterisation and the outcome of the radiological public impact and safety assessment, the following is recommended as an extension of the baseline site characterisation programme of the Project: • Perform gamma radiation and dose rate surveys on a grid basis of all potentially affected areas; • Perform an airborne radon gas survey in the Project area using RGMs on a campaign basis; • Collect surface water, groundwater and sediment samples on an upstream and downstream basis that is representative of the Project area for full-spectrum radio analysis of the U-238, U-235 and Th-232 decay chains; and • Collect soil samples at selected locations that coincide with selected locations that represent potentially hot-spot areas identified during the gamma radiation survey for full-spectrum radio analysis of the U-238, U-235 and Th-232 decay chains. The proposed radiological monitoring programme for the Project includes recommendations for the monitoring of surface water, groundwater, sediment, environmental radon, as well as dust fallout, including the frequency and type of analysis. Most monitoring points proposed to be part of the monitoring programme coincide with the monitoring programme for the environmental pathways (e.g., soils surface water and groundwater). Considering the surface infrastructure that will be developed for the Project, the following was noted: • The surface water monitoring locations should coincide with the existing surface water monitoring points currently included in the public RPP. The principle to be applied is that the monitoring locations should be upstream and downstream of the Project area in potentially affected surface water streams, as well as upstream and downstream of potential discharge points.	

Specialist study undertaken	Recommendations and Conclusion of Specialist Report	Reference to the applicable section of the Report where Specialist recommendations have been included.
	• The sediment monitoring locations should coincide with the surface water monitoring points, applying the same principles. • The groundwater monitoring points should coincide with the existing groundwater monitoring points. The principle to be applied is that the monitoring locations should be upstream and downstream of the Project area, as well as upstream and downstream of specific surface facilities. The exact location will be determined by the availability of water-bearing boreholes in the specific area. • The dust fallout monitoring locations should coincide with the monitoring points (dust buckets) proposed in Airshed (2025). • The environmental radon monitoring locations do not have to coincide with specific locations. The principle to apply is that it should be widespread over the mining rights area, in the dominant wind direction where receptors are located, complemented with monitoring locations in what can be considered as background. The exact location is often influenced by whether a secured location is available to improve the recovery rate of the RGMs.	

10 ENVIRONMENTAL IMPACT STATEMENT

10.1 SUMMARY OF KEY FINDINGS

A summary of the key findings of the environmental impact assessment as undertaken in this BAR is outlined below:

- The majority of the impacts had a low rating prior to mitigation, which were then decreased, but still falls within the low- negative category in the post-mitigation and final significance rating scenario.
- The proposed approved height extension of the Savuka 7a& 7b TSFs has the potential to impact negatively on the surrounding environment. However, the impact assessment conducted by the EAP and specialists concluded that the foreseeable impacts can be mitigated to acceptable levels through the implementation of the proposed mitigation measures.
- Air Quality will only increase slightly and will still fall within all the acceptable levels.
- Radiology impacts can be mitigated to acceptable levels.
- Hydrypedology will only be negligibly negatively affected.
- Groundwater pollution will significantly improve with the implementation of phyto-remediation as recommended by the specialist.
- Parts of the TSFs occur within sensitive surface water areas. This primarily includes the influence of the northern and southern river systems adjacent to the TSFs, since the 1:100 RI flood event (medium sensitivity) falls out of the site. The specialist concluded that the activity can be authorised with regard to the hydrological (surface water) environment inclusive of the recommended mitigation measures presented in the report. A review of Mponeng's surface water monitoring plan will be required to ensure that the TSFs are adequately considered (as it relates to monitoring positions).
- The Wetland assessment identified four (4) wetland systems within the 500 m regulated area of the proposed project area of influence. One system is artificial and was not scored. The three natural systems scored an overall PES score ranging from D – "Largely Modified", to E – "Seriously Modified", due to the modifications arising from anthropogenic influences and surrounding mining activities. The ecosystem service score was determined to be "Moderately High" for one and "Intermediate" for the other two HGM's identified. The wetlands average EIS scores were in the "B – High" EIS class. A post-mitigation buffer of 15 m was assigned to the systems.
- The already low noise levels created by the operation of the TSFs, will not increase by the height extension.
- The VIA identified some sensitive visual receptors to the southeast of the TSFs, however, it was concluded that the added impact of the 5 to 10 m height extension is negligible.
- It should be noted that the potentially severe impact of a dam wall break on safety and livelihoods is not adequately conveyed by the impact assessment (final significance low), since the probability is low, but the severity if very high, resulting in the impact appearing less significant than may be warranted.
- Consultation with the community and landowners will be conducted in order to capture any comments or concerns regarding the proposed activities and to ensure the community and landowners are kept informed and allowed to raise issues. The concerns raised will be included in the final BAR.

10.2 FINAL LAYOUT MAP

The final layout map showing the location of the activity against the identified as part of the Basic Assessment Process, Specialist Studies the Provincial Biodiversity Plans (refer to Figure 43 [1]below). The proposed TSF height extension project is located along a disturbed and modified area. The identified sensitivities include the flood line and the three (3) delineated hydrogeomorphic (HGM) units within a 500 m regulated area. These comprise a Channelled Valley Bottom (CVB) and two Unchannelled Valley Bottom (UVB) wetlands. Sensitive air quality and visual impact receptors have also been identified as sensitive.

[1] Note that the Department of Water and Sanitation requested that the Savuka TSF 5a and 5b be included in the assessment for the existing c) and i) water uses. For this, only the wetland study was required to be updated and included these sections in the sensitivity map, and not the hydrological study sensitivity.

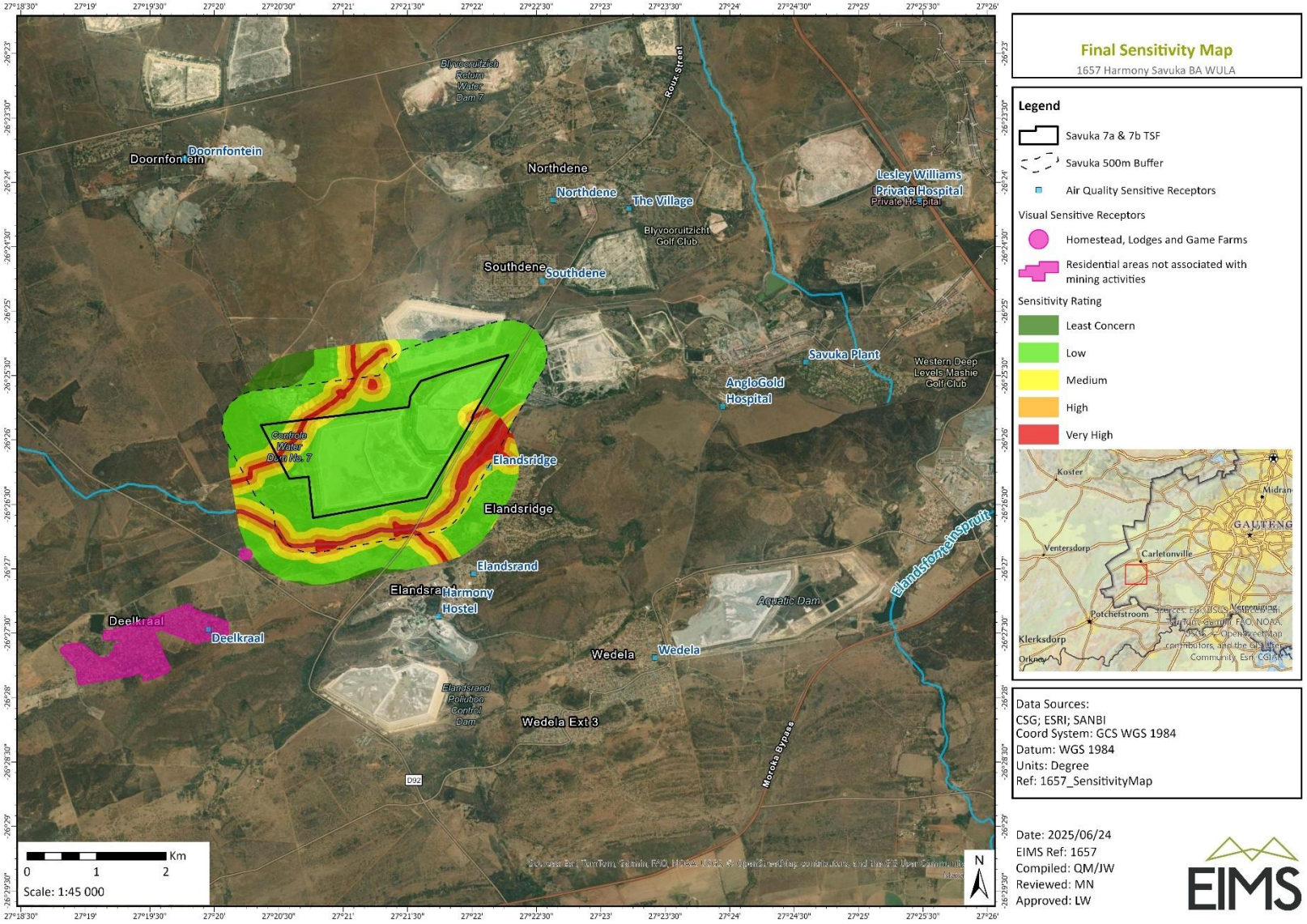

Figure 43: Consolidated sensitivity layout map

10.3 SUMMARY OF POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS

The proposed height extension of Savuka 7A and 7B TSFs will have one important positive impact (need and desirability) i.e. extending employment opportunities at the mine and in turn have a positive impact on the continued economy of the area. Several negative direct and indirect impacts have also been identified, that may result from the height extension of the TSFs, such as reduced air quality, ground and surface water impacts, sensitive habitat impacts, visual and noise and resultant impact on sense of place, as well as health impacts from radioactive material and gases being released into the atmosphere and groundwater. These impacts ranges from short to long term and were all rated as low post mitigation.

The implementation of the proposed mitigation measures will ensure that the negative implications and risks of the project are reduced to a low level. Appropriate mechanisms for avoidance and mitigation of these negative impacts are included in the EMPr. The potential negative impacts are described in Section 8.3.

11 PROPOSED IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES

The management objectives are to minimise the socio-economic and bio-physical impacts of the proposed activity in terms of the perceptions and expectations of I&APs. The outcome to be achieved is to lessen the impact through the following measures:

- Adhere to an open and transparent communication procedure with stakeholders at all times;
- Ensure that accurate information regarding the TSF operations and the resultant lack of requirements for site access and labour is communicated to I&APs;
- Ensure that information is communicated in a manner which is understandable and accessible to I&APs;
- Prevent the unnecessary destruction of, and fragmentation, of the vegetation community;
- Prevent the loss of the faunal community (including potentially occurring species of conservation concern) associated with the vegetation communities;
- Limiting the activity to the defined servitude area and only impacting those areas where it is unavoidable to do so otherwise;
- Enhance project benefits and minimise negative impacts through consultation with stakeholders;
- To limit interference with existing land uses as far as possible during installation of the pipeline;
- Ensure an approach that will provide the necessary confidence in terms of environmental compliance;
- Prevent the further loss and fragmentation of vegetation communities and the CBA areas in the vicinity of the project areas;
- Conserve sensitive receptors linked with wetland habitats to ensure that the functional integrity of all delineated systems is ensured;
- As far as possible, reduce the negative fragmentation effects of the linear development and enable safe movement of faunal species;
- Avoid damage to road infrastructure;
- Mitigate the impact on the wetlands;
- Prevent water quality contamination;
- Mitigate the impact on hydromorphic soils and compaction; and
- Maintain safety to surrounding communities.

12 ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

The following conditions are recommended for inclusion in the Environmental Authorisation:

- All mitigation measures included in the Basic Assessment Report, EMPr and associated specialist studies report must be adhered to;
- The existing Dust Management Plan for the Mponeng operations should be reviewed and follow an iterative process, including: implementation, monitoring, reporting, reviewing and adjustment to the necessary steps. It is recommended that the current dust fall monitoring network be maintained and the monthly dust fall results used as indicators to tract the effectiveness of the applied mitigation measures. Dust fall collection should follow the ASTM method as per the NDCRs.
- In terms of groundwater monitoring a comprehensive bi-annual analysis of the dedicated monitoring boreholes should be undertaken. Groundwater levels should be monitored monthly in the dedicated groundwater monitoring boreholes and rainfall should be monitored daily.
- It is recommended that the proposed phyto-remediation is implemented as soon as possible to assist with removing contaminants in the soil and groundwater.
- Harmony should ensure that monitoring of erosion and compaction on site during operations continues. Currently Harmony employs Intasol for managing the TSFs and this monitoring forms part of their responsibilities in terms of the contract.
- The existing updated AIP management plan (2025) must be implemented to prevent the further spread and proliferation of AIP species to the surrounding areas, especially the wetland habitats. Permits need to be obtained where required, should alien plants be kept for stability of the TSF.
- Limit the extent of natural wetlands that will be lost or deteriorated by the proposed activities as far as possible. Make sure that all the other HGM units and their buffers are avoided as far as possible to limit the impacts on them.
- Ensure that the TSF are re-vegetated as soon as possible to prevent runoff through rain. Active slopes cannot be vegetated for safety reasons. Once a step in has been done vegetation can safely be done. All vegetation can only be done as per safe instruction from the legally appointed Intasol and EoR.
- Safe operating systems and procedures are to be implemented during operation of the facility. (This is currently part of Intasol's responsibility as the Appointed Engineer (EoR), however, it is ultimately the responsibility of Harmony to ensure the engineer is registered and the contract is valid).
- Implement and maintain a GN 704 compliant stormwater management plan to manage run-on towards the TSF.
- Continue to develop the TSF using sound engineering to limit the likelihood of a failure. Maintain and operate the TSF to limit the potential for failure. Monitor the TSF to identify any potential failures/slumps. (This is currently part of Intasol's responsibility as the Appointed Engineer (EoR), however, it is ultimately the responsibility of Harmony to ensure the engineer is registered and the contract is valid).
- Undertake surface water monitoring to enable change detection related to contaminants originating from the site.
- Maintain and operate the TSF/RWD to limit the potential for overfilling of the RWD that leads to a spill.
- Implement proposed radiological monitoring programme for the project which includes recommendations for the monitoring of surface water, groundwater, sediment, environmental radon, well as dust fallout, including the frequency and type of analysis.
- Concurrent rehabilitation of the TSF side slopes must continue.

- The mine must implement a community-friendly external grievance mechanism in conjunction with farmers and communities.
- Stakeholder Engagement will continue throughout the construction and installation of the pipeline to ensure the community and landowners are kept informed and allowed to raise issues. These issues will then be addressed through a grievance mechanism; and
- The applicant should adhere to the conditions of the EA, EMPr and the Specialist reports for this project.

13 DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

Certain assumptions, limitations, and uncertainties are associated with the BAR. This report is based on information that is currently available and, as a result, the following limitations and assumptions are applicable:

- The project scope and descriptions are based on project information provided by the client;
- The information presented in this report is based on the information available at the time of compilation of the report;
- It is assumed that all data and information supplied by the Specialist, Applicant or any of their staff or consultants is complete, valid, and true; and
- The description of the baseline environment has been obtained from specialist studies.

Furthermore, certain assumptions, limitations, and uncertainties are associated with the BAR according to the appointed specialist studies and these are detailed for each aspect below.

- Air Quality Impact Assessment – Airshed Planning Professionals.
    - Use was made of simulated Weather Research and Forecasting Model data for a point at the Savuka site, and this is regarded as representative of the project area.
    - The quantification of sources of emission was restricted to the project activities and operations within the study domain only. Although other background sources were identified, such sources were not quantified.
    - Information required for the calculation of emissions from dust sources for the project operations was supplied by EIMS with the baseline activities taken from a previous study conducted for West Wits operations. The assumption was made that this information was accurate and correct.
    - Routine emissions from the operations were estimated and modelled.
    - In assessing the mitigated impact, it was assumed that the slopes of the TSF was vegetated, and a control efficiency of 80% as measured by Blight (1989) was achieved.
- Groundwater Assessment - Hydrology Impact Assessment – MVB Consulting.

In conducting the numerical groundwater modelling, the following assumptions and limitations apply:

- The following conditions typically need to be described in a model:
    - Geological and geohydrological features.
    - Boundary conditions of the study area (based on the geology and geohydrology).
    - Initial groundwater levels of the study area.
    - The processes governing groundwater flow.
    - Assumptions for the selection of the most appropriate numerical code.

- Field data is essential in solving the conditions listed above and developing the numerical model into a site-specific groundwater model. Specific assumptions related to the available field data include:
    - The top of the aquifer is represented by the generated groundwater heads.
    - The available geological / geohydrological information was used to describe the different aquifers. The available information on the geology and field tests is considered as correct.
    - Many aquifer parameters have not been determined in the field and therefore have to be estimated.
- In order to develop a model of an aquifer system, certain assumptions have to be made. The following assumptions were made:
    - No abstraction boreholes were included in the initial model.
    - The boundary conditions assigned to the model are considered correct.
    - The impacts of other activities (e.g. agriculture) have not been considered.
- It is important to note that a numerical groundwater model is a representation of the real system. It is therefore at most an approximation, and the level of accuracy depends on the quality of the data that is available. This implies that there are always errors associated with groundwater models due to uncertainty in the data and the capability of numerical methods to describe natural physical processes.

- Hydrological Assessment – Mike Bollaert.
    - In identifying site sensitivities, where furrows appear to manage larger areas or are otherwise extensions of non-perennial rivers, they are assumed to fall within the conceptual definition of a watercourse insofar as having the potential to cause flooding and route pollutants downstream;
    - No site visits were conducted.
- Wetland Delineation and Assessment – The Biodiversity Company.
    - It has been assumed that the spatial files provided to the specialist is accurate; Apart from the “features” as indicated in Figure 1-2 of the wetland report, no other relevant spatial information in terms of the structure design was provided in relation to the proposed development at the time of survey and report preparation;
    - The delineations presented herein were derived from previous assessments undertaken for the area and, are considered to be representative and sufficient for the purpose of this assessment;
    - The seasonality of the above-mentioned surveys is not considered to be a limiting factor of the assessment, for which the results are conclusive in the opinion of the specialist;
    - Only natural features were considered for the ecological components of this assessment; and
    - The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by a maximum of five meters to either side.
- Visual Impact Assessment – Graham Young Landscape Architect.
    - The description of project components have been derived from information the Environmental Assessment Practitioner supplied.
- Closure Costing (Minelock Environmental Engineers).

- All information was provided by EIMS and the Applicant;
- No site visits were conducted;
- In cases where no information was available, estimates/assumptions were made based on experience.

- Health Risk and Radiological Impact Assessment – Airshed Planning Professionals and Aquisim Consulting.
  - The specialist made use of assumptions for conditions and parameter values required for the dose assessment, which is not ideal. To improve the radiological public safety and impact assessment, recommendations were made for the baseline site characterisation programme and the radiological monitoring programme.
  - Section 2 of the report, presents in detail, the overview of the assessment context that defines the high-level assumptions and constraints imposed on the assessment.

14 REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

The section below gives a reasoned opinion on why the activity should be authorised as well as conditions that should be included in the authorisation.

14.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORISED OR NOT

The impacts on the environment can be mitigated through open communication with the community, landowners, and implementation of the proposed EMPr mitigation measures. It is therefore the opinion of the EAP and appointed specialist that the proposed activity should be authorised as long as the proposed mitigation measures are implemented. This will ensure continued employment of the existing workforce.

14.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

The following conditions are recommended for inclusion in the Environmental Authorisation:

- All mitigation measures included in the Basic Assessment Report, EMPr and associated specialist studies report must be adhered to;
- The existing Dust Management Plan for the Mponeng operations should be reviewed and follow an iterative process, including: implementation, monitoring, reporting, reviewing and adjustment to the necessary steps. It is recommended that the current dust fall monitoring network be maintained and the monthly dust fall results used as indicators to tract the effectiveness of the applied mitigation measures. Dust fall collection should follow the ASTM method as per the NDCRs.
- In terms of groundwater monitoring a comprehensive bi-annual analysis of the dedicated monitoring boreholes should be undertaken. Groundwater levels should be monitored monthly in the dedicated groundwater monitoring boreholes and rainfall should be monitored daily.
- It is recommended that the proposed phyto-remediation is implemented as soon as possible to assist with removing contaminants in the soil and groundwater.
- Harmony should ensure that monitoring of erosion and compaction on site during operations continues. Currently Harmony employs Intasol for managing the TSFs and this monitoring forms part of their responsibilities in terms of the contract.
- The existing updated AIP management plan (2025) must be implemented to prevent the further spread and proliferation of AIP species to the surrounding areas, especially the wetland habitats. Permits need to be obtained where required, should alien plants be kept for stability of the TSF.

- Limit the extent of natural wetlands that will be lost or deteriorated by the proposed activities as far as possible. Make sure that all the other HGM units and their buffers are avoided as far as possible to limit the impacts on them.
- Ensure that the TSF are re-vegetated as soon as possible to prevent runoff through rain. Active slopes cannot be vegetated for safety reasons. Once a step in has been done vegetation can safely be done. All vegetation can only be done as per safe instruction from the legally appointed Intasol and EoR.
- Safe operating systems and procedures are to be implemented during operation of the facility. (This is currently part of Intasol's responsibility as the Appointed Engineer (EoR), however, it is ultimately the responsibility of Harmony to ensure the engineer is registered and the contract is valid).
- Implement and maintain a GN 704 compliant stormwater management plan to manage run-on towards the TSF.
- Continue to develop the TSF using sound engineering to limit the likelihood of a failure. Maintain and operate the TSF to limit the potential for failure. Monitor the TSF to identify any potential failures/slumps. (This is currently part of Intasol's responsibility as the Appointed Engineer (EoR), however, it is ultimately the responsibility of Harmony to ensure the engineer is registered and the contract is valid).
- Undertake surface water monitoring to enable change detection related to contaminants originating from the site.
- Maintain and operate the TSF/RWD to limit the potential for overfilling of the RWD that leads to a spill.
- Implement proposed radiological monitoring programme for the project which includes recommendations for the monitoring of surface water, groundwater, sediment, environmental radon, well as dust fallout, including the frequency and type of analysis.
- Concurrent rehabilitation of the TSF side slopes must continue.
- The mine must implement a community-friendly external grievance mechanism in conjunction with farmers and communities.
- Stakeholder Engagement will continue throughout the construction and installation of the pipeline to ensure the community and landowners are kept informed and allowed to raise issues. These issues will then be addressed through a grievance mechanism; and
- The applicant should adhere to the conditions of the EA, EMPr and the Specialist reports for this project.

15 PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

The Environmental Authorisation is required for a minimum of five (5) years.

16 UNDERTAKING

I, **Monica Niehof**, declare –

- The correctness of the information provided in the reports;
- The inclusion of comments and inputs from stakeholders and I&APs;
- The inclusion of inputs and recommendations from the specialist reports where relevant; and
- That the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein.

Signature of the environmental assessment practitioner:

Name of company:

Environmental Impact Management Services (Pty) Ltd

Date: 17/06/2025

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