mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Environmental Impact Assessment Report And Environmental Management Programme

for Listed Activities Associated with the Proposed Arnot South Coal Mining Project, Situated near Hendrina, Mpumalanga Province

DMRE Reference Number MP 30/5/1/2/2/10292 MR

Environmental Authorisation in Support of the Arnot South Coal Mining Project

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 (ACT NO. 59 OF 2008) (NEM:WA) IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 OF 2002) (MPRDA) (AS AMENDED).

Name of Applicant:	Exxaro Coal Mpumalanga (Proprietary) Limited
Tel no:	+27 (0) 12 307 3000
Fax no:	-
Physical Address:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
File Reference Number SAMRAD:	**MP 30/5/1/2/2/10292 MR**

This document has been prepared by Digby Wells Environmental.

Report Type:	**Draft Environmental Impact Assessment and Environmental Management Plan Report**
Project Name:	**Integrated Environmental Impact Assessment for the Proposed Arnot South Coal Mining Project, Situated near Hendrina, Mpumalanga Province**
Project Code:	**UCD6802**

Name	Responsibility	Signature	Date
Anela Sotashe	Report Compiler		July 2021
Xanthe Taylor	Report Reviewer		August 2021
Barbara Wessels	Senior Reviewer	BWessels	August 2021

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the basic assessment process is to, through a consultative process–

- determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
- identify the alternatives considered, including the activity, location, and technology alternatives;
- describe the need and desirability of the proposed alternatives,
- through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage , and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on the these aspects to determine:
- the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
- the degree to which these impacts—
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be managed, avoided or mitigated;
- through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—
  - identify and motivate a preferred site, activity and technology alternative;
  - identify suitable measures to manage, avoid or mitigate identified impacts; and
  - identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Introduction

Exxaro Coal Mpumalanga (Pty) Ltd (hereafter Exxaro or the Applicant) is applying for environmental authorisation required for the proposed Arnot South Underground Coal Mining Project (hereafter Arnot South Project).

Exxaro held a Prospecting Right (PR) [Reference No. MP 30/5/1/1/2/360 PR] for coal on various farms, near Hendrina in the Mpumalanga Province. The PR, authorised by the Department of Mineral Resources and Energy (DMRE), was renewed in September 2017 and lapsed on 10 September 2020. However, a Mining Right Application (MRA) and Mine Works programme (MWP) were submitted to the DMRE prior the PR expiring, and issued reference number MP 30/5/1/2/2/10292 MR. The MRA for the underground mining was submitted to DMRE on 14 December 2020. The application was acknowledged on 09 March 2021 and reference number MP 30/5/1/2/2/10292 MR was issued. The final Scoping Report (SR) was submitted and was accepted on the same day, the 30 April 2021. The Draft Environmental Impact Assessment/ Environmental Management Programme Report (EIA/EMPr), this report, integrates, amongst others, all the specialist studies' findings, impacts and mitigation measures, for public comment and review.

The proposed Mining Right area covers approximately 16,000 (ha) in extent, however, underground mining will initially only take place over approximately 2,227 ha and the surface infrastructure footprint is 65 ha. Arnot South is the target area for mining and mining-related infrastructure which lies mainly on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. The mineral reserve consists of one economically mineable underground block (No. 2 coal seam), producing approximately 2.4 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal for approximately 17 years. Further drilling will be required to confirm a resource in the southern section of the Mining Right area. The potential future resource of the remaining ROM coal is approximately 32,912,300 tonnes, allowing an additional mining period of approximately 13 years. This application considers the use of underground board-and-pillar mining with continuous miners due to the depth and thickness of the reserve.

Project Applicant

The details of the Project Applicant are included in the table below.

Company name:	Exxaro Coal Mpumalanga (Proprietary) Limited
Contact person:	Mr Tsheko Ratsheko
Physical address:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
Postal code:	0163
Telephone:	+27 (0) 12 307 3000
Email:	Tsheko.Ratsheko@exxaro.com

Project Overview

The purpose of this report is to document the findings of the EIA Process, including:

- Describing the baseline environment of the project area;
- Summarising the specialist findings;
- Presenting the methodology employed to conduct the EIA Process;
- Documenting the findings of the EIA Process;
- Documenting findings of the Public Participation Process (PPP); and
- Making recommendations as appropriate.

The EIA Process was supported by the following specialist studies:

- Soils, Land Use and Land Capability Assessment;
- Fauna and Flora Assessment
- Wetlands Assessment;
- Aquatics Assessment;
- Hydropedological Assessment;
- Surface Water Assessment;
- Groundwater (Baseline Environment);
- Air Quality Assessment;
- Noise Assessment;
- Heritage Assessment;
- Visual Assessment;
- Traffic Assessment;
- Blast and Vibration Assessment; and
- Socio-economic Assessment.

Environmental Assessment Practitioner Contact Details

The contact details for the independent Environmental Assessment Practitioner (EAP) are provided in the table below.

Company Name:	Digby Wells and Associates (South Africa) (Pty) Ltd
Name of Practitioner:	Xan Taylor
Telephone:	+27 11 789 9495
Fax:	011 789 9498
Email:	Xan.Taylor@digbywells.com

Approach and Methodology for the Public Participation Process

A Public Participation Process (PPP) was initiated during the Application Phase. Public participation is an important aspect of the investigation of environmental and social impacts since it allows stakeholders affected by the project an opportunity to voice their opinions and concerns. The process also seeks to ensure that local knowledge, needs and values are well understood and considered in the EIA process. The comments from the stakeholders are included in the Comment and Response Report (CRR) (Attached in Appendix C). The PPP which was undertaken and completed in line with the legislative requirement is discussed in Section 10.

During the Impact Assessment Phase, the following main Public Participation activities will be undertaken:

- Provided feedback on the findings of the specialist studies conducted and mitigation measures proposed by means of consultation with I&APs;
- Releasing the Draft EIA and associated specialist studies being released to the public for comment;
- Consultation with I&APs through focus group meetings; and
- All comments raised during this period will be included in the CRR.

The Draft EIA and Environmental Management Programme (EMPr) will undergo a 30-day public comment and review period from **30 August – 01 October 2021**. The electronic copy of the Draft EIA/EMPr can be downloaded from the Digby Wells website www.digbywells.com (Public Documents), under the data-free service portal.

Project Alternatives

Exxaro undertook prospecting activities on the area of interest and determined the extent of the mining area based on the location of the coal. The location of the Project, and specifically the mining area, is dependent on the location of the identified coal seam (No.2 seam).

All the farms included in the MRA boundary were considered during the undertaking of the various specialist environmental and social impact assessments for the EIA Phase. The findings of the various assessments informed and influenced the technology, layout and location of the mine's infrastructure.

The mine layout is being amended to minimise the impacts to sensitive areas such as wetlands and the Eastern Highveld Grassland by reducing the overall layout to a more condensed area. The design is being updated and will be presented in the Integrated Water and Waste Management Plan report. This impact assessment is based on the preliminary layout.

Environmental Impact Assessment Summary

The EIA/EMP report and associated specialist studies were undertaken and discussed in 12.1 of this report. A quantitative impact rating methodology was applied to determine the significance of the expected impacts pre-mitigation and post-mitigation. Table A below provides a summary of the key impacts expected during various phases of the Project. This report lists and assesses all the potential impacts, together with associated mitigation measures. Most of the below impacts are expected to be of major significance prior to mitigation measures being implemented but are anticipated to be of minor or negligent significance with the application of the recommended mitigation measures. All recommendations from the specialist assessments need to be implemented and the requirements of the EMPr must be strictly adhered to.

Table A: Summary of the Key Impacts Associated with the Proposed Activities

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Construction	Site/vegetation clearance (52.28 ha)	Soil, Land Use, and Land Capability	• Loss of usable soil (high land capability soils); • Soil erosion and sedimentation; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Soil contamination and deterioration; and • Increased runoff from hardened surfaces (soil compaction).	Moderate (negative)	Moderate (negative)
Construction	Construction of diesel storage and explosives magazine	Soil, Land Use, and Land Capability		Moderate (negative)	Minor (negative)
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office.	Soil, Land Use, and Land Capability		Moderate (negative)	Minor (negative)
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long.	Soil, Land Use, and Land Capability		Moderate (negative	Minor (negative)
Construction	Construction of Pollution control dam (PCD) (1.61 ha), Raw water pipeline, Process water, Sewage treatment plant (STP).	Soil, Land Use, and Land Capability		Major (negative)	Moderate (negative)
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Soil, Land Use, and Land Capability		Moderate (negative)	Minor (negative)
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	Fauna and Flora	• Loss of plant communities and sensitive landscapes including, Grassland and Wetland habitats; • Loss of biodiversity and SCC; • Increased erosion; • Potential for AIP proliferation; • Loss of faunal habitat including faunal SCC.	Moderate (negative)	Minor (negative)
Construction	Stockpile of soils, rock dump and discard dump establishment	Fauna and Flora	• Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal; • Natural vegetation will be removed, damaged and fragmented promoting edge effects and AIP proliferation; • Change in habitat and potential change in species composition; and • Increased soil compaction, runoff and erosion into surrounding sensitive landscapes.	Moderate (negative)	Minor (negative)
Construction	Access and haul road construction	Fauna and Flora	• Removal of vegetation and basal layer;	Moderate (negative)	Minor (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
			• Increased proliferation of AIPs; • Increased faunal casualties; and • Increased dust pollution.		
Construction	Construction of infrastructure, and ventilation Shafts	Fauna and Flora	• Increased faunal casualties and vegetation removal; • Increased risk of AIP proliferation and edge effects; and • Changes to the landscape and undulating topographies.	Minor (negative)	Negligible (negative)
Construction	Site/vegetation clearance (52.28 ha)	Wetlands	• Direct loss of 79.76 ha wetlands; • Loss of habitat and biodiversity; • Erosions and sedimentation of adjacent wetlands and water courses; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Water and soil contamination and deterioration; • Increased runoff from hardened surfaces; • Decreased water supply to the wetlands systems; and Change in habitat and potential change in species composition.	Major (negative)	Moderate (negative)
Construction	Construction of diesel storage and explosives magazine	Wetlands		Moderate (negative)	Minor (negative)
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office	Wetlands		Major (negative)	Moderate (negative)
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long	Wetlands		Major (negative)	Minor (negative)
Construction	Construction of Pollution control dam (PCD) (1.6078 ha), Raw water pipeline, Process water, Sewage treatment plant (STP)	Wetlands		Major (negative)	Minor (negative)
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Wetlands		Moderate (negative)	Minor (negative)
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing in proximity to the watercourses.	Minor (negative)	Negligible (negative)
Construction	Removal of vegetation / topsoil for establishment of mining infrastructure such as the haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas.	Hydropedology	Sedimentation and siltation of watercourses through overland flow leading to reduced water quality.	Moderate (Negative)	Negligible (negative)
Construction	Moving vehicles and machinery during construction of infrastructure including haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas. Handling of hydrocarbon residues and spills during construction operations.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	Minor (negative)	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Construction	Removal of vegetation/topsoil for establishment of mining and linear infrastructure. Stockpiling of soils, rock dump and discard dump establishment.	Surface water	Sedimentation and siltation of water resources reducing flow regime within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	Moderate (Negative)	Negligible (negative)
Construction	Handling of hydrocarbons and general waste. Diesel storage and explosives magazine	Surface water	Surface water contamination leading to deteriorated water quality within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	Moderate (negative)	Negligible (negative)
Construction	Construction of infrastructure, and ventilation fans	Surface water	Interception of rainfall, runoff and subsurface flow leading to reduced downstream runoff yield	Moderate (negative)	Minor (Negative)
Construction	Site Clearing, Construction of Infrastructure, Access Road, Stockpiling of Topsoil and Establishment of Rock and Discard Dumps	Air Quality	Reduction in ambient air quality	Negligible (negative)	Negligible (negative)
Construction	Removal of vegetation/topsoil for the establishment of mining and linear infrastructure	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.	Negligible (negative)	Negligible (negative)
Construction	Establishing the box cut	Noise			
Construction	Construction of infrastructure, and ventilation Shafts.	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.		
Construction	Construction of access road and haul roads	Noise			
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Noise			
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	Visual	Removal of all vegetation within the localised infrastructure area alters the aesthetics of the immediate area and creates a contrast between the stripped area and the surrounding vegetation.	Moderate (negative)	Minor (negative)
Construction	Stockpiling of soils, rock dump and discard dump establishment	Visual	• Alteration to the baseline visual environment by creating sharp topographic variation over a relatively moderately undulating terrain. • Includes removal of natural vegetation which creates a sharp contrast.	Moderate (negative)	Moderate (negative)
Construction	All construction activities	Socio-economic	Creation of employment opportunities	Minor - positive	Minor - positive
Construction	• Establishment of infrastructure; • Construction of access and haulage road; • Site/vegetation clearance; • Infrastructure construction; • Diesel storage and explosive magazine ; • Sewage treatment plant ; and	Socio-economic	Creation of Opportunities Within the Supply Chain	Minor - positive	Moderate - positive

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
	• Sewage treatment plant, pollution control dam.				
Construction	All project related activities associated with construction and operation	Socio-economic	Increased Incidences of Livestock Theft	Moderate - negative	Minor - negative
Construction	All project related activities associated with construction and operation	Socio-economic	Impacts Associated with Community Health, Safety and Security	Moderate - negative	Minor - negative
Construction	All Construction Activities	Socio-economic	Loss of Agricultural Land	Moderate - negative	Minor - positive
Construction	All project related activities associated with construction and operations.	Socio-economic	Potential Physical Displacement of Farm Dweller Households	Moderate negative	Minor - negative -
Construction	All project related activities associated with construction and operations.	Socio-economic	Change Sense of Place	Moderate - negative	Minor - negative
Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Soil, Land Use, and Land Capability	Infrastructure area: • Soil quality contamination and deterioration; • Loss of usable soil for agriculture; • Soil erosions and sedimentation; and • Increased runoff and flow from hardened surfaces (soil compaction). Underground mined areas: • Subsidence; • Dewatering; • Groundwater and soil contamination; and • Decreased land capability and agricultural potential	Moderate (negative)	Moderate (negative)
Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Soil, Land Use, and Land Capability		Major (negative)	Moderate (negative)
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Soil, Land Use, and Land Capability		Moderate (negative)	Minor (negative)
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	Soil, Land Use, and Land Capability		Moderate (negative)	Minor (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Operational	Continue with exploration activities	Soil, Land Use, and Land Capability		Moderate (negative)	Minor (negative)
Operational	Underground blasting and operation of the underground workings.	Fauna and Flora	• Increased risk of post-mining land subsidence; • Loss of topsoil; • Impacts on the hydrological systems (water table) impacting the habitat ecology and ecosystem services; and • Potential contamination of underground water with hydrocarbons, polluting sensitive habitats for sensitive faunal and floral species.	Minor (negative)	Minor (negative)
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste.	Fauna and Flora	Contamination of soil, water and surrounding areas / habitats (pan and wetland vegetation) from hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	Moderate (negative)	Negligible(negative)
Operational	Continue with exploration activities	Fauna and Flora	• Continuous disturbances to the fauna and flora by explorative activities;; • Increased vehicle activity; and • Continuous anthropogenic influence stemming from staff, residents and visitors that infiltrate the unexplored natural veld areas will damage and impact on species communities within certain areas. This could disturb unidentified SCC.	Minor (negative)	Negligible (negative)

Operational	Operating STP (18.32 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Wetlands	• Infrastructure area:
			  • Water and soil quality contamination and deterioration;
			  • Loss of habitat and biodiversity;
			  • Erosion and sedimentation;
			  • Increased runoff and flow from hardened surfaces; and
			  • Change in habitat and potential change in species composition.
			• Underground mined areas:
			  • Subsidence;
			  • Dewatering; and
			Groundwater contamination.
				Major (negative)	Minor (negative)

Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Wetlands		Major (negative)	Major (negative)
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Wetlands		Moderate (negative)	Minor (negative)
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	Wetlands		Moderate (negative)	Negligible (negative)
Operational	Continue with exploration activities	Wetlands		Moderate (negative)	Minor (negative)
Operational	Uncontrolled runoff of stormwater or process water from or through the surface infrastructure.	Aquatics	Water quality deterioration of watercourses receiving unnatural/contaminated runoff.	Minor (negative)	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Operational	Operation of the Box Cut as a means for secure and safe entrance and access to the decline of the underground mine	Hydropedology	Disruption of water flow paths will likely reduce the quantity of water reporting to the Vaalwaterspruit thereby affecting the availability of water for downstream water users	Minor (negative)	There are no mitigation measures to prevent this impact from occurring, but the area to be affected by the box cut and mine shaft is relatively small making this impact of minor negative significance.
Operational	• Overland flow and interflow from the dirty areas or catchments (coal stockpile areas, mine processing plant, workshops, lay down areas etc.). Hydrocarbon residues including oil, grease and fuel spillages from equipment, moving haulage trucks and machinery transported to watercourses.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	Minor (negative)	Negligible (negative)
Operational	Areas containing topsoil stockpiles, overburden, and discard dumps.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	Moderate (Negative)	Negligible (Negative)
Operational	• Handling of hydrocarbons and general waste; and Spillages and leakages from maintenance of haul roads, pipelines, and machinery; and • Use of water for mining operations and production of contaminated effluent/process water.	Surface water	Contamination of water resources and deterioration of water quality.	Moderate (negative)	Negligible (Negative)
Operational	Operation of the Underground Mine, Ventilation Shaft, Use and Maintenance of Haul Road, and Concurrent Rehabilitation	Air Quality	Dust generation and release of gaseous pollutants leading to poor air quality	Minor (negative)	Negligible (negative)
Operational	Ventilation fans and infrastructure area containing stockpile areas	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance	Major (negative)	Minor (negative)
Operational	Underground blasting	Noise	Noise impacts are considered to be negligible therefore was not assessed further.		

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent, and stormwater management infrastructure and stockpile areas.	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.		
Operational	Removal of rock (blasting).	Noise	Noise impacts are considered to be negligible therefore was not assessed further.		
Operational	Establishment and upkeep of Mine related structures along with the box cut	Visual	• Alterations of the natural visual character of the region • Long term vegetation loss Land cover and land use changes.	Moderate (negative)	Minor (negative)
Operational	Establishment and operation of the stockpile and plant region during operations	Visual	Constant topographical changes to the stockpiles, which also have a sharp contrast to the natural landcover in the region;	Minor (negative)	Moderate (negative)
Operational	Lighting of mine infrastructure at night	Visual	• The mine site would contain lighting for security and operational safety purposes. • The artificial lighting could provide a source of distraction to receptors in the region.	Negligible (negative)	Slightly Detrimental
Operational	All project related activities associated with construction and operation.	Socio-economic	Creation of Long-term Employment Opportunities, Skills Development and Work Experience	Minor – positive	Minor - positive
Operational	All project related activities associated with construction and operation.	Socio-economic	Opportunities and Capabilities within the Supply Chain	Minor - positive	Moderate - positive
Operational	All project related activities associated with construction and operation.	Socio-economic	Changes to the Water Quality	Minor - negative	Minor - negative
Operational	All project related activities associated with construction and operation.	Socio-economic	Impacts Associated with Surface Subsidence	Moderate - negative	Minor - negative
Operational	All project related activities associated with construction and operation.	Socio-economic	Occupational Health Risks to Mine Workers	Moderate (negative)	Minor (negative)
Operational	All project related activities associated with construction and operation	Socio-economic	Economic Multiplier	Minor - positive	Moderate - positive
Operational	All project related activities associated with construction and operation.	Socio-economic	Social Development as part of Social and Labour Plan (SLP)	Minor - positive	Moderate - positive
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Ground Vibration	Minor (negative)	Negligible (negative)
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Air blast	Negligible (negative)	Negligible (negative)
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Fly rock	Negligible (negative)	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Decommissioning	Demolition and removal of infrastructure.	Soil, Land Use, and Land Capability	• Soil erosion and sedimentation; • Decreased soil fertility and increased AIPs; • Soil contamination due to decanting and the groundwater contamination plume; • Subsidence; • Dewatering; and • Decreased land capability and agricultural potential.	Moderate (negative)	Minor (negative)
Decommissioning	Post-closure monitoring and rehabilitation.	Soil, Land Use, and Land Capability		Minor (negative)	Negligible (negative)
Decommissioning	Closure of the underground mine.	Soil, Land Use, and Land Capability		Major (negative)	Moderate (negative)
Decommissioning	Demolition and removal of infrastructure.	Fauna and Flora	• Disturbance of soils, and subsequent erosion by wind and water; • Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Unexpected changes in topography and landscape as a result of subsidence.	Minor (negative)	Negligible (negative)
Decommissioning	Post-closure monitoring and rehabilitation	Fauna and Flora	• Minimal negative impacts on the environment; • Activities involve the rehabilitation processes of reprofiling the soils and re-vegetation thereafter; • Impacts include the possibility of erosion and sedimentation; • Proliferation of AIPs; and • Change in the habitat and species composition.	Minor (negative)	Minor (positive)
Decommissioning	Closure of the underground mine.	Fauna and Flora	• Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats. • Change in the land topography and species composition.	Minor (negative)	Negligible (negative) -

Decommissioning	Demolition and removal of infrastructure.	Wetlands	• Impacts to the wetlands and watercourses include:
			  • Erosion and sedimentation;
			  • Increased AIPs;
				Minor (negative)	Negligible (negative)

Decommissioning	Post-closure monitoring and rehabilitation.	Wetlands		Minor(negative)	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Decommissioning	Closure of the underground mine.	Wetlands	• Change in habitat and potential change in species composition; • Soil and water contamination due to decanting and the groundwater contamination plume; • Subsidence; and • Dewatering.	Major (negative)	Moderate (negative)
Decommissioning	Decant and runoff of contaminated water entering aquatic ecosystems.	Aquatics	Water quality deterioration of watercourses in contact with contaminated water resulting in AMD.	Moderate (negative)	Negligible (negative)
Decommissioning	Demolition and removal of infrastructure	Hydropedology	Sedimentation and siltation of watercourses due to increased soil erosion leading to reduced water quality.	Moderate (Negative)	Negligible (negative)
Decommissioning	After decommissioning, dewatering ceases and water accumulates within the mine shaft and the water reacts with the pyrite in the backfilled material, thereby becoming acidified and starts decanting at low lying positions, including the adjacent Vaalwaterspruit.	Hydropedology	Contamination of soil and water resources from potential decant of AMD and movement of contamination plume due to the re-watering of the mine shaft	Major (Negative)	Minor (Negative)
Decommissioning	Demolition and removal of infrastructure.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries.	Moderate (Negative)	Negligible (Negative)
Decommissioning	Spillages and leakages from vehicles and machinery during demolition of infrastructure.	Surface water	Contamination of water resources from AMD and deterioration of water quality.	Moderate (negative)	Negligible (Negative)
Decommissioning	Decant of Acid Mine Drainage (AMD).	Surface water	Water Contamination from Acid Mine Drainage into surface water resources.	Moderate (negative)	Minor (negative)
Decommissioning	Post-closure monitoring and rehabilitation Closure of the underground mine.	Surface water	Restoration of free drainage and runoff yield at least to a certain extent.	**Major Positive**	No mitigation possible.
Decommissioning	Demolition and Removal of Infrastructure and Rehabilitation	Air Quality	Dust generation leading to poor air quality	Minor (negative)	Negligible (negative)
Decommissioning	Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation for the final land rehabilitation	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance. However, the removal of noise generating sources will also lead to a reduction in the noise levels.	Negligible (negative)	Negligible (negative)
Decommissioning	Rehabilitation – rehabilitation mainly consists of spreading and landscaping of the preserved subsoil and topsoil, profiling of the land, and re-vegetation.	Noise	Noise impacts are considered to be negligible therefore will not be assessed further.		

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Decommissioning	Post-closure monitoring and rehabilitation.	Noise			
Decommissioning	Decommissioning	Socio-economic	Economic Boom-Bust after the Operation Phase	Moderate - (negative)	Minor - (negative)

Conclusions and Recommendations

The environmental impacts associated with the proposed Arnot South Project can be mitigated and avoided to a large extent by implanted the recommended mitigation measures. The project is anticipated to positively impact the local and national socio-economic environment and should be approved, provided that the recommendations from the Environmental Assessment Practitioner (EAP) and all regulatory requirements are adhered to. The most significant impacts to the environment relate to wetlands, surface water, aquatics as well as fauna and flora. More detail is provided in the table above. The anticipated groundwater impacts are still under investigation and the significance of these will be confirmed in the Final EIA/EMPr. **The Final EIA/EMPr will be released for a further 30-day comment period for the public to review the report with the inclusion of the Groundwater and Waste Classification assessments.**

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF PLANS

ACRONYMS, ABBREVIATIONS AND DEFINITION

AIPs	Alien Invasive Plant Species
AMD	Acid Mine Drainage
AQIA	Air Quality Impact Assessment
CARA	Conservation of Agricultural Resources
CBAs	Critical Biodiversity Areas
CALLM	Chief Albert Luthuli Local Municipality
CEC	Cation Exchange Capacity
CRR	Comments and Response Report
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
Digby Wells	Digby Wells Environmental
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance And Sensitivity
EMPr	Environmental Management Programme
GSDM	Gert Sibanda District Municipality
Ha	Hectares
HIA	Heritage Impact Assessment
HRAs	Heritage Resources Authorities
I&APS	Interested and Affected Parties
IDP	Integrated Development Plan
IFA	Infrastructure Footprint Area
IHAS	Integrated Habitat Assessment System
IUCN	International Union for the Conservation of Nature
IWUL	Integrated Water Use License
IWULA	Integrated Water Use Licence Application

Km	Kilometres
km^2	Square Kilometres
KV	Kilovolt
kWhr	kilowatt-hour
LED	Local Economic Development
LoM	Life of Mine
m	Metres
m/s	Metres per Second
mamsl	Metres Above Mean Sea Level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mbgl	Metres Below Ground Level
MIRAI	Macroinvertebrate Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 Of 2002)
MR	Mining Right
MRA	Mining Right Application
Mtpa	million tonnes per annum
NCRs	National Noise-Control Regulations
NEMA	National Environmental Management Act, 1998 (Act No. 107 Of 1998)
NEMAQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 Of 2004)
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 Of 2004)
NEM: WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NEM: PAA	National Environmental Management Protected Areas Act, 2003 (Act No. 57 of 2003)
NFEPA	National Freshwater Ecosystem Priority Areas
NGOs	Non-Governmental Organisations
NHRA	National Heritage Resources Act, 1999 (Act No. 25 Of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PCD	Pollution Control Dam

PES	Present Ecological Status
POIs	Points of Interests
RCP	Rehabilitation and Closure Plan
RE	Remaining Extent
ROM	Run of Mine
S&EIR	Scoping and Environmental Impact Reporting
SAAELIP	South African Atmospheric Emission Licensing & Inventory Portal
SAHRA	South African Heritage Resources Agency
SAMRAD	South African Mineral Resources Administration System
SANAS	South African National Accreditation System
SANBI	South African National Biodiversity Index
SANS	South African National Standards
SASS	South African Scoring System
SAWQG	South African Water Quality Guidelines
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SLP	Social and Labour Plan
SOP	Standard Operating Procedure
STLM	Steve Tshwete Local Municipality
STP	Sewage Treatment Plant
SSC	Species of Special Concern
SWMP	Stormwater Management Plan
TIA	Traffic Impact Assessment
TMP	Topsoil Management Plan
TOPS	Threatened or Protected Species
TSP	Total Suspended Particulate
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
Vu	Vulnerable
WML	Waste Management Licence

WTP	Water Treatment Plant
WUL	Water Use Licence
WULA	Water Use Licence Application

Part A: Impact Assessment Report

1 Introduction

Exxaro Coal Mpumalanga (Pty) Ltd (hereafter Exxaro or the Applicant) is applying for environmental authorisation required for the proposed Arnot South Underground Coal Mining Project (hereafter Arnot South Project). Exxaro held a Prospecting Right [Reference No. MP 30/5/1/1/2/360 PR] to mine coal on various farms, near Hendrina in the Mpumalanga Province.

Exxaro held a Prospecting Right (PR) [Reference No. MP 30/5/1/1/2/360 PR] for coal on various farms, near Hendrina in the Mpumalanga Province. The PR, authorised by the Department of Mineral Resources and Energy (DMRE), was renewed in September 2017 and lapsed on 10 September 2020. However, a Mining Right Application (MRA) and Mine Works programme (MWP) were submitted to the DMRE prior the PR expiring, and issued reference number MP 30/5/1/2/2/10292 MR. The Environmental Authorisation (EA) application for the underground mining was submitted to DMRE on 14 December 2020. The application was acknowledged on 09 March 2021 and reference number MP 30/5/1/2/2/10292 MR was issued. The final Scoping Report (SR) was submitted on 12 March 2021 and was accepted on 30 April 2021. The Draft Environmental Impact Assessment/ Environmental Management Programme Report (EIA/EMPr), this report, integrates, amongst others, all the specialist studies' findings, impacts and mitigation measures, for public comment and review.

Due to extensive environmental on-site investigations required for this project, the Applicant applied to extend the submission deadline of the final EIA/EMPr report, and this extension was approved by the DMRE.

The proposed Mining Right area covers approximately 16,000 (ha) in extent, however, underground mining will only take place over 2,227 ha, and the surface infrastructure footprint is 65 ha.

The Mining Right boundary includes the following farms:

- Groblersrecht 175 IS
- Schoonoord 164 IS
- Mooiplaats 165 IS
- Vlakfontein 166 IS
- Tweefontein 203 IS
- Vryplaats 163 LQ
- Vaalwater 173 IS
- Helpmakaar 168 IS
- Weltevreden 174 IS
- Op Goeden Hoop 205 IS
- Nooitgedacht 493 JS
- Klipfontein 495 JS
- Leeuwpan 494 JS

The target area for mining and mining-related infrastructure lies only on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. The farms are located within the jurisdictions of Steve Tshwete Local Municipality (STLM) and Chief Albert Luthuli Local Municipality (CALLM), situated in the Nkangala District Municipality (NDM) and Gert Sibanda District Municipality (GSDM), respectively, in the Mpumalanga Province.

The coal reserve consists of one economically mineable underground block (No. 2 coal seam), producing approximately 2.4 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal for approximately 17 years. Underground mining will be accessed through a boxcut with continuous mining.

Further drilling will be required to confirm the resource in the southern section of the proposed Mining Right area. The potential future resource of the remaining ROM coal is approximately 32,912,300 tonnes, allowing an additional mining period of approximately 13 years. This application considers the use of underground board-and-pillar mining with continuous miners due to the depth and thickness of the reserve.

The proposed development triggers Listed Activities in terms of the Environmental Impact Assessment (EIA) Regulations, 2014 (GN R 982 of 4 December 2014 as amended by GN R326 of 7 April 2017) (EIA Regulations, 2014), as amended promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). Digby Wells Environmental (hereafter Digby Wells) is the appointed Environmental Assessment Practitioner (EAP) to undertake the environmental applications in support of the proposed Project.

Exxaro is applying for the following authorisations and licences, which are required prior to the commencement of mining operations:

- Mining Right Application in terms of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- An Integrated Environmental Authorisation (EA) terms of the NEMA; and a Waste Management Licence (WML) in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA); and
- An Integrated Water Use Licence (IWUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA).

2 Item 3: Project applicant

Exxaro is the applicant and the details of the applicant are presented in Table 2-1.

Table 2-1: Details of the Applicant

Name of Applicant:	Exxaro Coal Mpumalanga (Proprietary) Limited
Registration number (if any):	1999/010289/07
Trading name (if any):	N/A
Responsible person: ***(E.g. CEO, Director, etc.)***	Group Manager: Environment, Mining Licensing and Sustainability
Contact person:	Mr Tsheko Ratsheko
Physical address:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
Postal address:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
Postal code:	0163
Telephone:	+27 (0) 12 307 3000
Email:	Tsheko.Ratsheko@exxaro.com

2.1 Item 3 (a)(i): Details of Environmental Assessment Practitioner

Digby Wells has been appointed to undertake the Environmental Authorisation Application and the Integrated Water Use Licence Application (IWULA) processes, as well as the associated specialist studies and the required Public Participation Process for the proposed Project. The details of the Environmental Assessment Practitioner (EAP) are contained in Table 2-2 below.

Table 2-2: Contact Details of the EAP

Company Name:	Digby Wells and Associates (South Africa) (Pty) Ltd
Name of Practitioner:	Xan Taylor
Telephone:	+27 11 789 9495
Fax:	011 789 9498
Email:	Xan.Taylor@digbywells.com

2.2 Item 3(a)(ii): Expertise of the EAP

This section provides details regarding the EAP's qualifications and experience. The EAP's Curriculum Vitae (CV) and qualifications are attached as Appendix A of this report.

2.2.1 The Qualifications of the EAP

Ms Xan Taylor holds an Honours degree in Environmental Management from University of South Africa.

2.2.2 Summary of the EAP’s Experience

Xan Taylor started working as a Consultant in 2012 and joined Digby Wells in 2015. She has nearly 10 years’ experience. The majority of Xan’s experience pertains to the mining sector applying for applications governed by the NEMA for both the 2010 and 2014 Regulations thereunder, the MPRDA, the NWA, as well as international legislation: including International Finance Corporation Performance Standards and World Bank Guidelines. Her experience comprises managing integrated mining applications: Basic Assessments, Scoping and Environmental Impact Assessments reports, Environmental Management Programmes, international Environmental and Social Impact Assessments, NEMA Regulation 29 and Regulation 31 Amendment reports, Section 102 Amendment reports, exemption applications, Appeal processes, and auditing.

3 Item 3(b): Description of the property

The Arnot South Project is situated approximately 10 km east of the town of Hendrina, 25 km west of Carolina, and 50 km southeast of Middelburg in the Mpumalanga Province of South Africa. The proposed Project is close to two of Eskom’s operating power stations; Hendrina (25 km) and Arnot (5 km).

The N11 national road runs east of the proposed Project area in a north to south direction. The R38 provincial road runs across the southern part of the Project area in a west to east direction. The R33 provincial road runs to the east of the Project area in a north to south direction, and the N4 national road runs north of the Project in a west to east direction.

There are five farm homesteads situated within the planned underground mining area, and a small watercourse runs in a north-eastern direction across the northern half of the mining area. The land is currently mainly used for game farming. Table 3-1 provides a summary of the properties that are included in the Mining Right area (i.e. mining affected farms and those earmarked for future mining). The target area for mining and mining-related activities lie mainly on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. All the necessary mine infrastructure for the Arnot South Project shall be placed on the farm Weltevreden 174 IS, which is on the southern part of the mining layout area.

Refer to Figure 3-1 for the Land Tenure Map (also attached in Appendix B as Plan 1).

Table 3-1: Property Description

<table>
<tr><td rowspan="2">Farm Name:</td><td>Directly affected farms:
<table>
<tr><th>Farm Name</th><th>Farm Portion</th></tr>
<tr><td>Weltevreden 174 IS</td><td>• Remainder of Portion 2;
• Portion 1;
• Portion 4; and
• Remainder.</td></tr>
<tr><td>Mooiplaats 165 IS</td><td>• Remainder of Portion 13;
• Remainder of Portion 14;
• Portion 11;
• Portion 12;
• Portion 13;
• Portion 15; and
• Portion 16.</td></tr>
<tr><td>Vlakfontein 166 IS</td><td>• Portion 2;
• Portion 5;
• Portion 8;
• Portion 9;
• Portion 10;
• Portion 12;
• Remainder of Portion 13; and
• Remainder.</td></tr>
<tr><td>Schoonoord 164 IS</td><td>Portion 19</td></tr>
</table></td></tr>
<tr><td>Farms earmarked for future mining:
<table>
<tr><th>Farm Name</th><th>Farm Portion</th></tr>
<tr><td>Groblersrecht 175 IS</td><td>• Remainder of Portion1;
• Portion 2;
• Portion 3;
• Portion 4;
• Portion 5;
• Portion 6;
• Portion 7;
• Portion 8; and
• Remainder.</td></tr>
<tr><td>Tweefontein 203 IS</td><td>• Portion 4;
• Portion 7;
• Portion 8;
• Portion 13;
• Portion 14;</td></tr>
</table></td></tr>
</table>

		• Portion 18; • Portion 19; • Portion 20; • Portion 21; • Portion 22; • Portion 23; • Portion 24; • Portion 25; • Remainder of Portion 3; • Remainder of Portion 5; • Remainder of Portion 6; • Remainder of Portion 9; • Remainder of Portion 10; • Remainder of Portion 11; and • Remainder of Portion 12.
	Vaalwater 173 IS	• Portion12; • Portion 14; • Portion 21; • Remainder of Portion 2; • Remainder of Portion 10; and • Remainder of Portion 11.
	Nooitgedacht 493 JS	• Portion 4; and • Portion 9.
	Leeuwpan 494 JS	• Remainder; • Portion 7; • Portion 8; • Portion 9; and • Remainder of Portion 4.
	Helpmakaar 168 IS	• Remainder; • Portion5; • Portion 6; • Portion 7; • Portion 8; • Portion 9; • Portion 10; • Portion 11; • Portion 12; • Portion 13; • Remainder of Portion 1; • Remainder of Portion 2; • Remainder of Portion 3; and • Remainder of Portion 4.

	Op Goeden Hoop 205 IS — Remainder of Portion 2 Klipfontein 495 JS — Portion of Remainder of Portion 6
Application Area (Ha):	Mining Right Area: approximately 16,000 ha Underground mining area: 2,227 ha Surface infrastructure footprint: Approximately 65 ha
Magisterial District:	Nkangala District Municipality and Gert Sibanda District Municipality
Distance and direction from nearest town:	50 km southeast of Middelburg

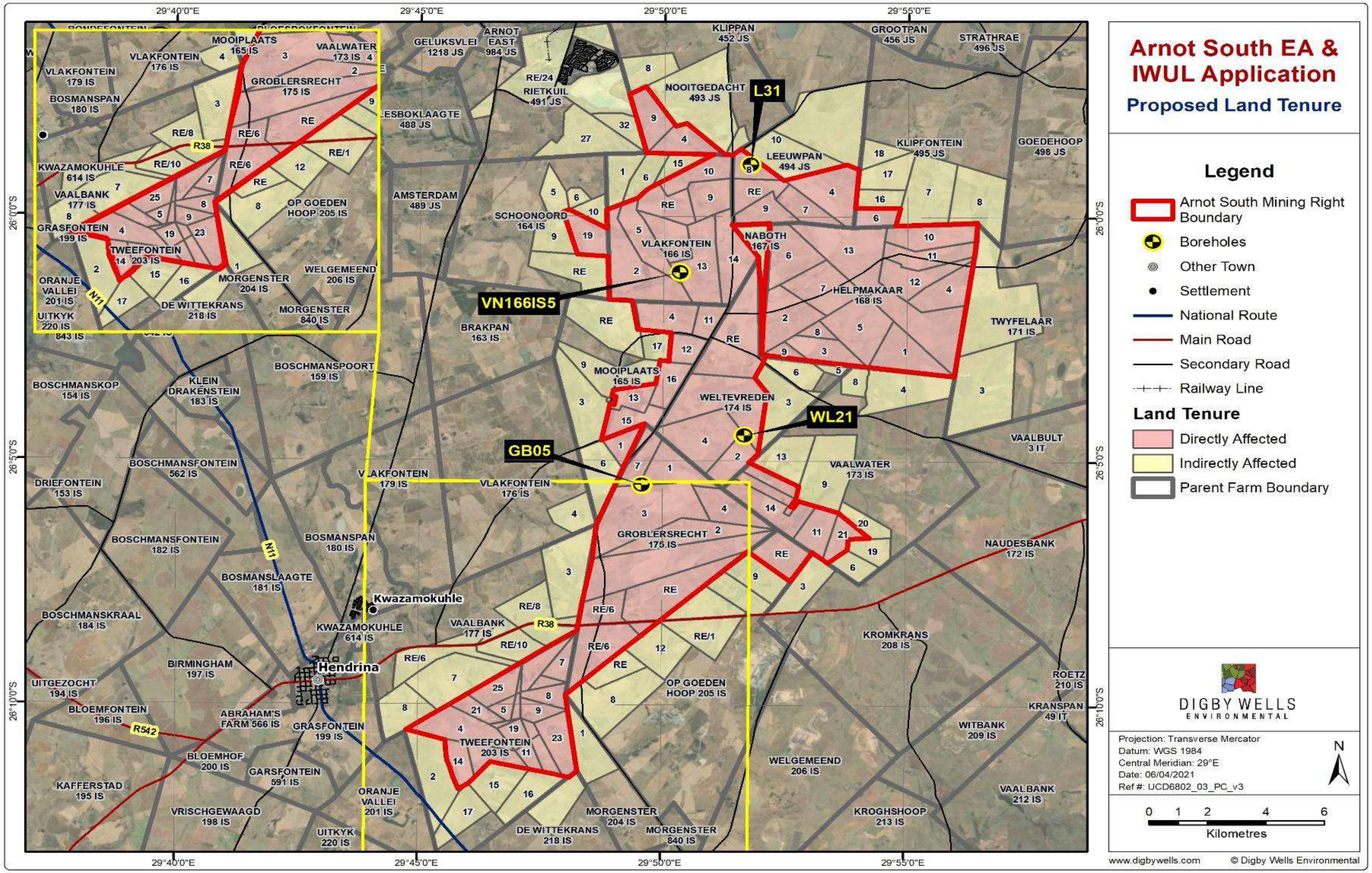


Figure 3-1: Land Tenure Map

4 Item 3(c): Locality map

Figure 4-1 illustrates the regional setting of the Arnot South Project area. The plan is also attached as Plan 2 in Appendix B.

The Project area is situated near the town of Middelburg within two District Municipalities, namely: NDM and GSDM. The area falls within the jurisdiction of STLM and CALLM, located in the Mpumalanga Province. The locality map is depicted in Figure 4-2 (also attached in Appendix B, Plan 3.

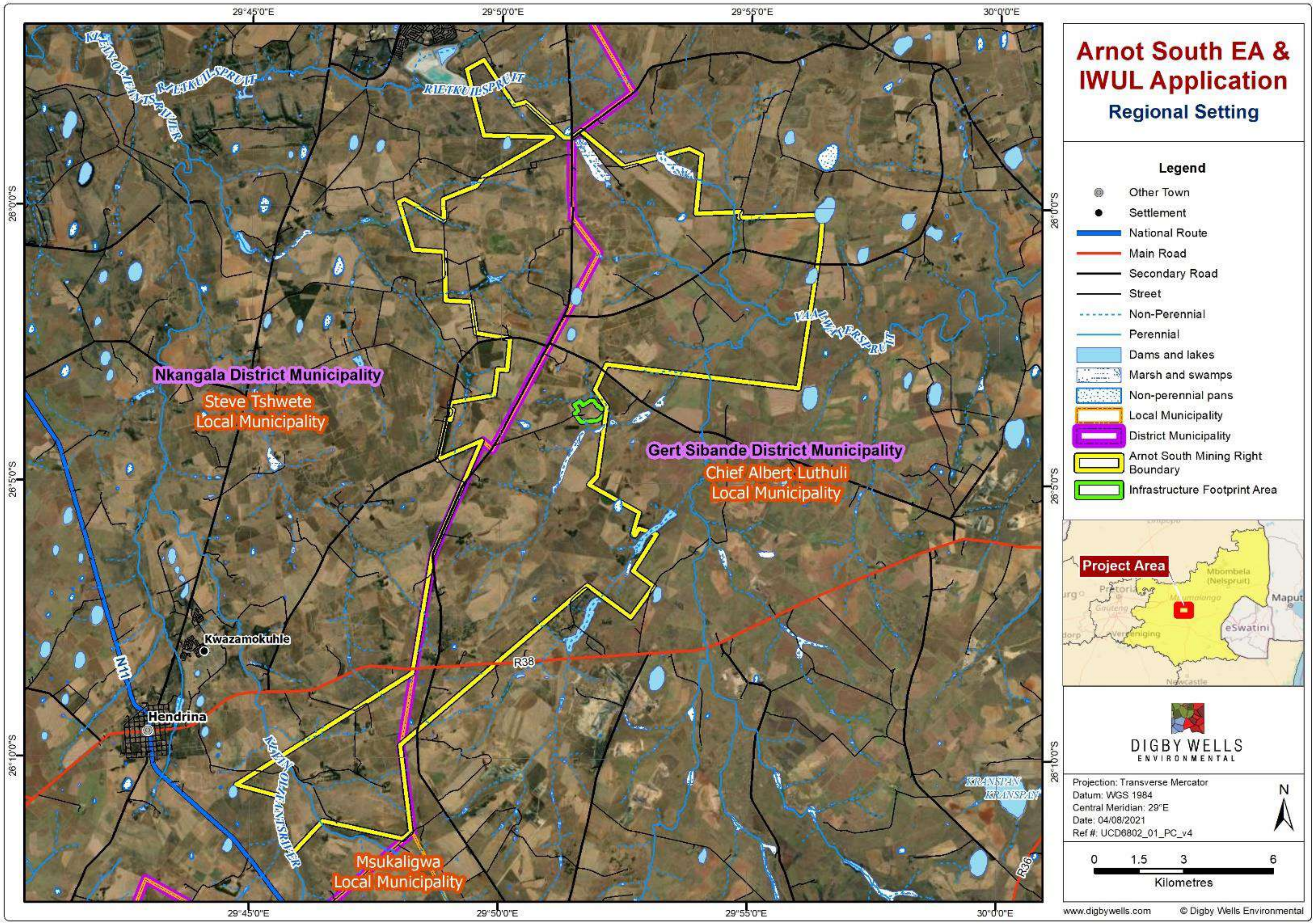


Figure 4-1: Regional Setting

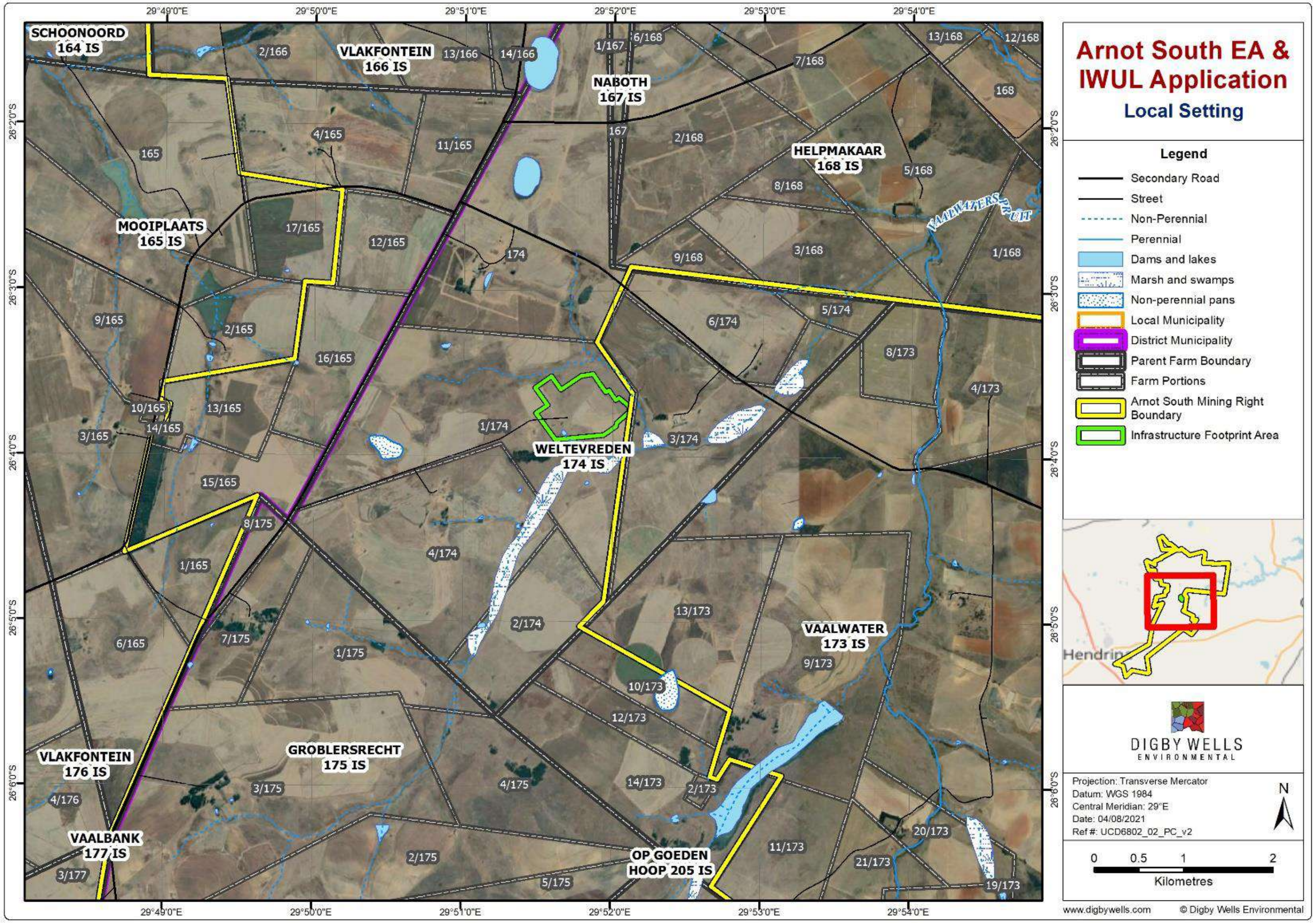


Figure 4-2: Local Setting

5 Item 3(d): Description of the scope of the proposed overall activity

The proposed infrastructure layout plan, as shown in Figure 5-1 below, are included in Appendix Bas Plan 4.

For the purpose of the report, the following terms apply:

- **Mining Right area** defines the farms included in the MRA boundary as indicated in Section 3 above;
- **Project area** defines farm portions directly affected by mining and mining-related infrastructure (i.e. Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS); and
- **Study area** will be determined by each specialist and the zone of influence in terms of potential impact the Project area will have, relevant to the individual specialist fields.

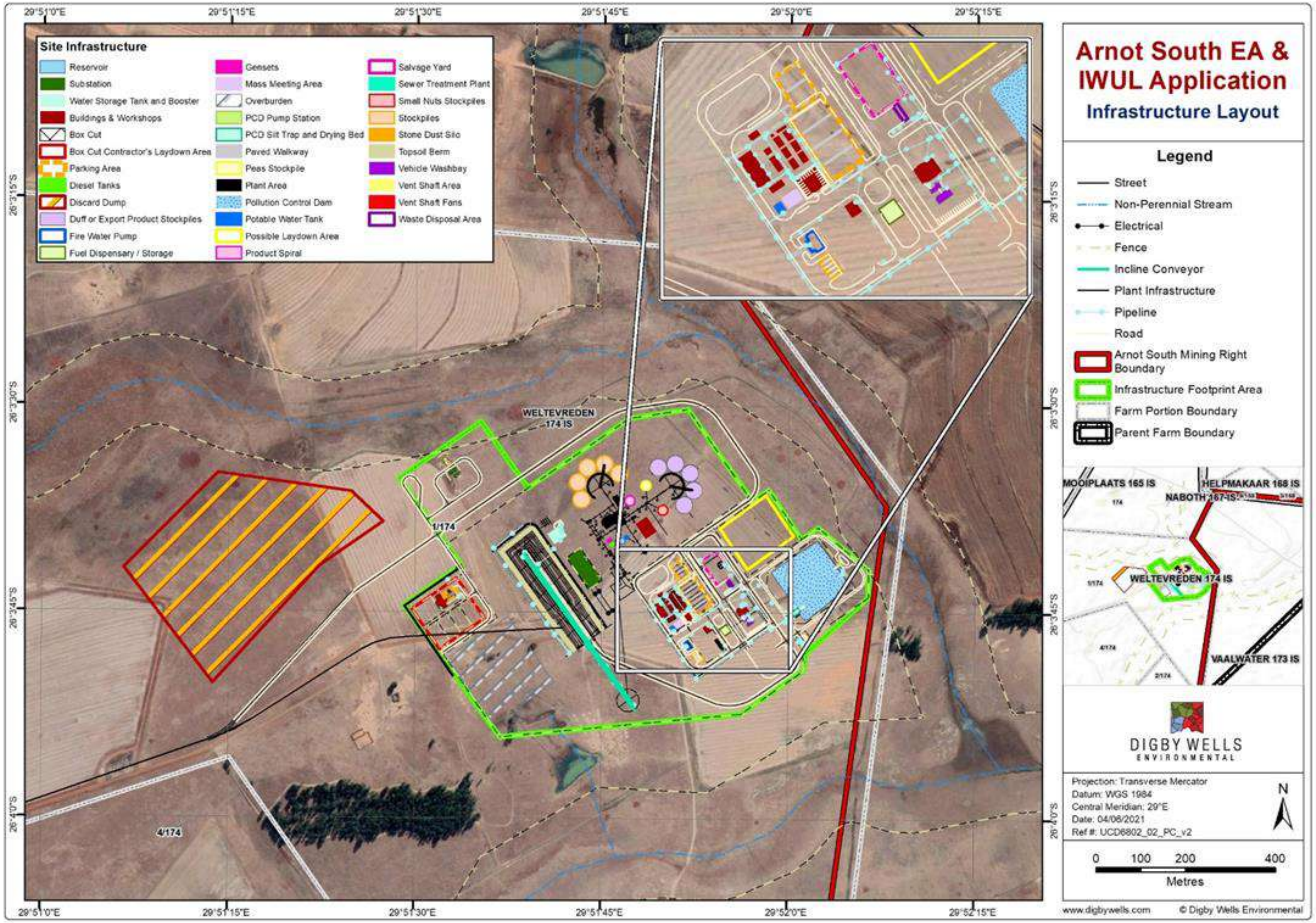


Figure 5-1: Infrastructure layout

5.1 Item 3(d)(i): Listed and specified activities

Together with the EIA Regulations, 2014 (as amended), the Minister published Regulations in terms of Sections 24 and 24D of the NEMA for Activities that require Environmental Authorisation prior to their commencement.

Activities identified in Listing Notice 1 (GN R 983) require that a Basic Assessment Process be followed when applying for an EA. Activities identified in Listing Notice 2 (GN R 984) require a Scoping and EIA Process to be undertaken.

As indicated in Table 5-1 below, Regulations GN R.983, GN R.984 and GN R.921 will be triggered, and therefore a Scoping and EIA process had to be undertaken, and approval received prior to the activities being commended with.

Table 5-1: Listed and Specified Activities

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Establishment of infrastructure Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office	Infrastructure footprint - 65 ha	*Not Listed*	-	-
Listing Notice 1				
Construction of access and haulage road *The development of a road-* *(i) for which an environmental* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road-* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	19 113 m	X-24 *(ii)*	GN R983, under NEMA	-
Pollution control dam *The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50,000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.*	1.6078 ha	X- 13	GN R 983 under NEMA	-

Name of Activity	Areal extent of the activity		Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Raw water pipeline *The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or (b) where such development will occur within an urban area.*	Pipeline Bowser Pipeline Bulk Water Pipeline Drainage Pipeline Fire Water Pipeline New Pipeline Potable Water Pipeline Process Water Pipeline Return Water Pipeline Sewer	44 m 44 m 2 m 1 894 m 5 m 1618 m 878 m 890 m 855m	X-9 (i) and /or (ii)	GN R983 under NEMA	-
Process water *The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or*			X-10 (i) and or (ii)	GN R 983 under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
(b) where such development will occur within an urban area.				
Operating sewage treatment plant *The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or* *(b) where such development will occur within an urban area.*	18.3168 m	X-10	GN R 983	GN R 921 under NEM: WA Category B 4 (10)
Power line construction *The development of facilities or infrastructure for the transmission and distribution of electricity-* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or* *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more*	22kV line, 2.3 km long	X- 11	GN R983, under NEMA	-
Listing Notice 2				

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Site/vegetation clearance *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan*	65 ha	X-15	GN 984, under NEMA	-
Mining of coal by underground mining *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including-* *(a) associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource; or* *(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing.*	5 050.83 ha	X- 17	GN R 984 under NEMA	-
Infrastructure construction *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including-* *(a) associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource; or* *(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;*	51 501 m (linear infrastructure)	X- 17	GN R 984, under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.				
Diesel storage and explosive magazine *The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*	Approximately 1 ha	X- 4	GN R 984 under NEMA	
Water Use Licence *The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent*	Inclusive of all water management infrastructure on site.	X- 6	GN R 984 under NEMA	GN R 921 under NEM: WA Category B 4 (11)
Sewage treatment plant *The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15 000 cubic metres or more.*	Less than 1 ha (0.00836 ha)	X-25	GN R 984 under NEMA	
Waste Activities				
Sewage treatment plant, pollution control dam *The construction of a facility for a waste management activity listed in Category B of this Schedule*	Sewage treatment plant - 0.00836 ha Pollution control dam 1.6078 ha	Category B 4 (10)	GN R 921 under NEM: WA	Yes

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Rock removal (blasting) and stockpiling (rock dumps, soils, ROM, and discard dump) *The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).*	Discard dump 2 946 ha Overburden stockpile 13 716 ha	Category B 4 (7), (10) & (11)	GN R 921 under NEM: WA	Yes

5.2 Description of the activities to be undertaken

The below sections describe the proposed activities associated with the Project.

5.2.1 Mineral Deposit and Resource Reserve

The Arnot South Project is located on the eastern margin of the Witbank Coalfield, and is comprised of sediments of the coal bearing Ecca Group of the Karoo Basin (Arnot South MWP, 2020). The Witbank Coalfield falls within the Vryheid Formation of the Ecca Group and comprises of five coal seams that are referred to as No.1 to No. 5 coal seam from bottom to top and these are contained within a succession of some 70 m to 75 m in thickness. The No. 2 coal seam is the most economically exploitable coal seam of the Coalfield and contains hard, dull to lustrous coal with several bright coal bands and occasional stone partings.

The basement floor and local surface topography determine the depth to the top of the No. 2 coal seam and reaches an average depth of around 45 m in the lease area. Minimum depth in the sub-outcrops is around 10 m to 20 m, and maximum depths are around 110 m to the south. Figure 5-2 below, extracted from Arnot South MWP (2020), shows the depth distribution of the coal seam. Based on this, Digby Wells has determined high-risk areas which are too shallow for underground mining, which correlate with the shallowest sections of the seam. The extent of the high-risk areas amounts to approximately 5,202 ha. The thickness of the No. 2 coal seam at Arnot South varies from 0.5 m to 5.0 m, averaging 1.65 m and is generally thickest in the central portion of the basement low/channel.

The quantity of coal to be extracted from the proposed underground mine is approximately 2.4 Mtpa of ROM coal product for 17 years. Further drilling will be required to confirm a resource to the south of the mining area. The potential future resource of the remaining ROM coal is approximately 32,912,300 tonnes, allowing an additional mining period of approximately 13 years. The coal product will be sold to various markets (i.e. Eskom which must still be negotiated, and Richards Bay Coal Terminal).

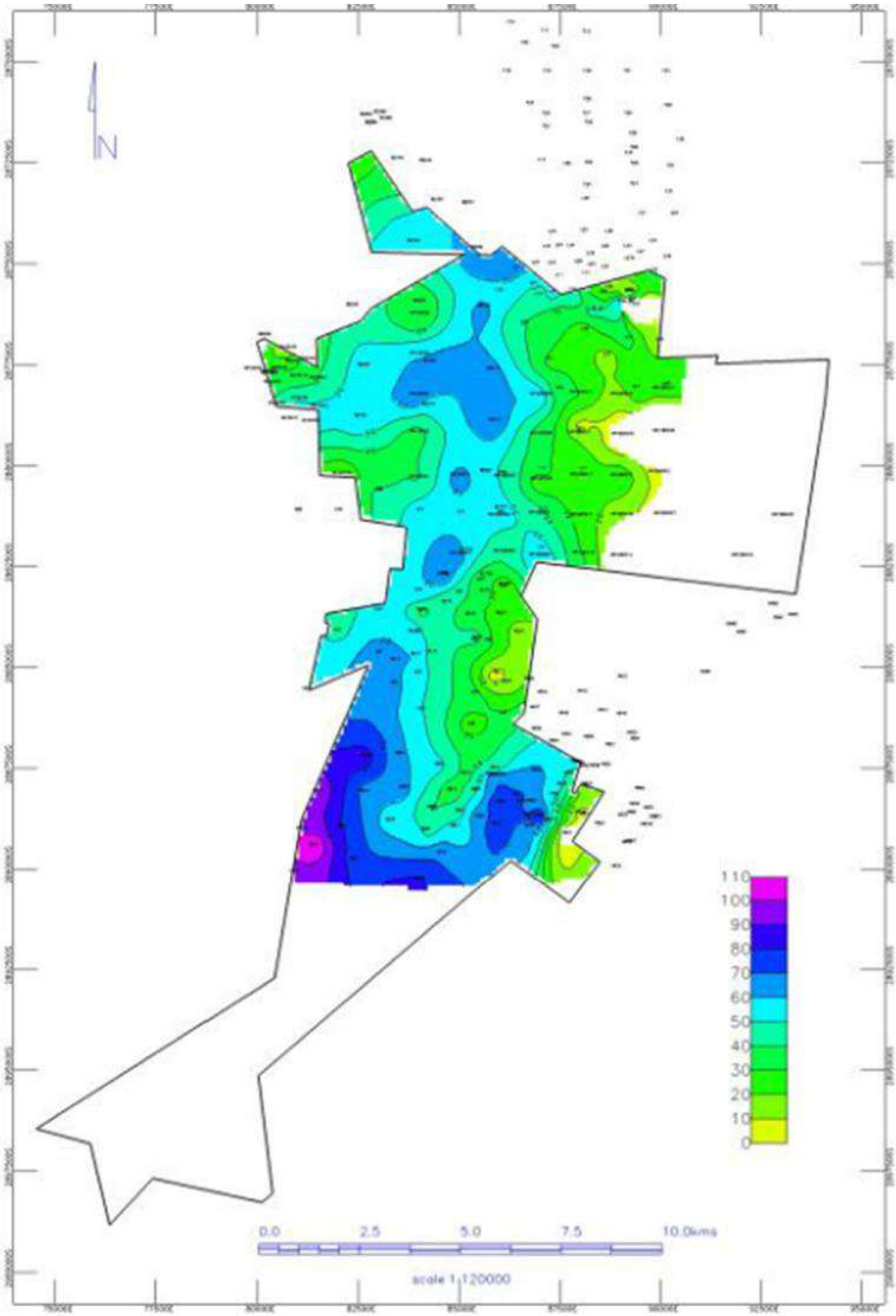


Figure 5-2: Seam Elevation (Source: Arnot South MWP, 2020)

5.2.2 Mining Method

Due to the depth and thickness of the No. 2 coal seam, the Arnot South resource area will be mined by underground mining methods. Underground bord and pillar mining utilising continuous miners and shuttle cars is considered as the optimal mining method for the mining of the initial reserve. The mining of the initial reserve on which the mining is planned consists of one economically mineable underground block (No. 2 coal seam). Mining shall commence on the south-eastern end of the block from where the underground mining shall develop northwest. The No. 2 coal seam shall be accessed via a boxcut located at the south-eastern end of the planned mining layout. An eight-degree ramp, 8.0 m wide, shall give access into the box cut and to the underground entrance portals. The inclination of the ramp shall allow rubber-wheeled equipment to travel up and down the ramp unassisted. The basis of the selected position of the boxcut is on the most practical underground mining layout with the least conveyor belt transfer points.

The main underground trunk conveyor belt will run in a north-western direction to the north-western end of the mining layout. Continuous miners will be deployed to cut and load the ROM coal into shuttle cars. Shuttle cars shall be utilised to deliver the ROM coal to a system of conveyor belts to deliver the coal to the surface by a shaft conveyor belt. The ROM coal will be fed into a primary and secondary crusher before being stacked on a coal product stockpile and then transported to the respective markets. The ROM coal shall be processed through a double-stage dense medium washing plant to produce export and Eskom products.

5.2.3 Production and Scheduling

The Arnot South Project will deploy five continuous miner production sections. The main development panel will develop in a north-western direction, and as it advances, secondary production panels will start from the main panel to the left and right on both sides of the main panel.

The planned production rate of the main development production section is 45,000 tonnes per month (tpm). At that production rate, the main panel advance shall be 150 m per month. The production rate shall allow one secondary production panel to become available for mining on each side of the main panel after each month of main panel development. The planned production build-up includes introducing five continuous miner production sections in four months with steady-state production of 200,000 tpm reached in month seven. As indicated above, the initial underground mine has an estimated life of 17 years, producing 2.4 Mtpa of ROM coal. It is anticipated that production shall be consistent right up to end of the current 17-year mine planning.

During the 17 years of planned mining, the Applicant shall conduct additional drilling towards the south of the current underground mining layout. The results of this drilling shall be applied to plan the life extension of Arnot South that shall include additional underground mining of the No. 2 seam. The total estimated LoM is 17 years (including the assumed resource (No. 2 and No. 4 coal seams) earmarked for mining towards the southern section within Mining Right.

5.2.4 Infrastructure Associated with the Mine

The main infrastructure (Refer to Figure 5-1 above) associated with the proposed Arnot South Project includes, but is not limited to:

- Adit/ Boxcut;
- Medical facility;
- Temporary guardhouse;
- Site access (fencing & gates);
- Laydown area;
- Substation;
- Weighbridges;
- ROM stockpiles;
- Vent shaft;
- Discard facility;
- Topsoil stockpiles;
- Overburden stockpiles;
- Fuel dispensary/storage;
- Conveyors;
- Offices;
- Stores;
- Brake-test ramp;
- Stormwater management infrastructure;
- Workshop;
- Vehicle wash bay;
- Laundry facility;
- Pollution Control Dam (PCD);
- Washing plant;
- Potable water tank;
- Water storage tank and booster;
- Ventilation shafts (including fans);
- Sewage Treatment Plant;
- Change-house;
- Salvage yard;
- Coal Handling and Processing Plant (CHPP);
- Powerline/s;
- Pipelines;
- Parking area;
- Water Treatment Plant (WTP);
- 3.0 km access road; and
- Road infrastructure (district road 15 km upgrade).

5.2.4.1 Access Roads

Access to the Arnot South Project shall be by an existing gravel road that runs from the paved road that links the N4 highway to Hendrina town. The distance along the existing gravel road is 13 km with a short new 3.0 km road that shall be constructed from the existing gravel road.

5.2.4.2 Contractors Camp and Laydown Areas

Administrative buildings, workshops and contractor laydown areas will be constructed within the Mining Right boundary. The workshop areas will include bunded storage facilities for waste, fuel, lubricants and other hazardous substances. The bunded storage facilities will be constructed in accordance with the applicable South African National Standards (SANS) codes.

5.2.5 Power Supply

Based on the position of the proposed mine, there is suitable Eskom infrastructure in the immediate vicinity to the site. A high-level review to establish where existing infrastructure lies, indicates that the neighbouring Arnot Mine should be the closest point from where power can be sourced for the Arnot South Project. The reticulation concept for the site would comprise the following:

- A continuous connected supply from the national grid, generated, and controlled by Eskom at a ‘notified maximum demand’ level; and
- Onsite automated standby power supply generators that would be sufficient to maintain the operation of critical machines, emergency plant operations, and essential lighting and security requirements of the mine site.

Eskom supply distribution at Arnot South shall consist of a switching yard that shall be constructed at the site and comprise of the following:

- A 132/88-kilovolts (kV) supply line connected to the national network, terminated in a distribution yard constructed on the Exxaro property;
- One by 12 megavolt amperes (MVA) 132/88 kV to 11 kV transformer shall connect to the 132/88 kV yard distribution network at the site; and
- The 11 kV terminals from the transformer shall connect to an 11 kV distribution network via the site main intake substation that shall supply power to the site.

The Applicant shall construct an intake the substation adjacent to the Eskom yard that will house the incoming supply and distribution switchgear supplying the various major plant sections. This substation will also house the power supply maximum demand and kilowatt-hour (kWhr) metering, surge protection instrumentation, and Power Factor Correction (PFC) equipment.

An earlier power supply point for the early development operations will be required. The Applicant will require the erection of a containerised substation to satisfy the supply and distribution requirements of the Project. The equipment installed would be repositioned into the main incomer substation when constructed.

5.2.6 Water Supply

5.2.6.1 Staff Water Requirements

The calculation for water requirements for use by the mine staff indicates 200 litres (ℓ) per person per day. The water supply capacity, therefore, equates to 42.6 kilolitres (kℓ) per day. Boreholes will be established to supply water for staff requirements. A small WTP will be built at the Mine to produce potable water from the borehole water.

5.2.6.2 Industrial Water Requirements

All underground water entering the workings from the roof or floor strata will be pumped to underground dams constructed for this purpose. This water shall be used for dust control underground, and any excess shall be pumped to the PCD on the surface from where it shall be used as make-up water for the CHPP. An additional source of bulk water supply shall be from the now-closed, neighbouring Arnot Colliery underground workings. The coal washing plant water consumption, required as make-up water, has been estimated to be between 1,000 m^3 to 1,200 m^3 per day. The plant will be equipped with a filter press and thickener to clarify the plant water for re-use. Effluent from the plant will be pumped to the process water tank for re-use.

5.2.6.3 Surface Run-off Water

Run-off water collected from disturbed areas will be routed to the PCD located near the CHPP, utilising a series of diversion berms. The collected water will be used for the mining and treatment processes. All water generated by the mining activities shall be stored in a high-density polyethene-lined (HDPE) PCD and re-used in the washing plant as well as for dust control purposes on the haul roads.

5.2.6.4 Mine Closure

The prediction is that the underground workings shall start decanting post-closure and allowance has been made in the capital expenditure and operating cost of a WTP. The WTP will treat any water that decants from the underground mining areas before release into a natural watercourse. The location of the WTP has not been determined at this point, as current considerations indicate that water treatment shall only be required towards the end of the LoM.

5.2.7 Waste management

General and hazardous waste will be generated as a result of the Arnot South Project. The waste will be handled, separated, stored and disposed of accordingly. The following waste types are anticipated to be generated at the operation:

- General waste:
  - Domestic Waste;
  - Paper;

  - Plastic;
  - Cardboard;
  - Tins; and
  - Glass.
- Hazardous Waste:
  - Hydrocarbon waste such as oily rags as a result from the hydrocarbon stored onsite;
  - Chemical waste from the chemicals that may be utilised for cleaning purposes;
  - Light bulbs (i.e. containing mercury); and
  - Coal refuse and mine water.
- Mine waste will be disposed at a registered landfill site, once the authorisations have been granted.

It is anticipated that all general waste will either be recycled or disposed of at the local municipality landfill site, which will be negotiated once the relevant environmental and mining authorisations are in place. Hazardous waste will be removed offsite by a hazardous waste contractor. A safe disposal certificate for the removal of hazardous waste will be retained as proof of safe disposal. The applicant is seeking to authorise the environmental applications once the Project is determined to be feasible, negotiations will be undertaken with the relevant parties.

5.2.8 Employment and Recruitment

The Arnot South Project shall be a contractor-operated mine. The planned workforce will consist of 168 permanent employees and contractor employees during the construction and operational phases.

5.2.9 Project Activities

Table 5-2 provides a summary of activities associated with the proposed Arnot South Project that were further assessed as part of the EIA process.

Table 5-2: Proposed Project Activities

Phase	Activity
Construction	Removal of vegetation / topsoil for establishment of mining and linear infrastructure
	Establishing the box cut
	Diesel storage and explosives magazine
	Construction of infrastructure, and ventilation shafts
	Construction of access road and haul roads
	Stockpiling of soils, rock dump and discard dump establishment.
Operational	Ventilation fans and infrastructure area, including stockpile areas and the discard dump
	Underground blasting and operation of the underground workings
	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas
	Removal of rock (blasting)
	Operating the washing plant
	Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste
	Operating sewage treatment plant and water treatment plant
	Stockpiling and dumping (rock dumps, soils, ROM, discard dump) establishment and operation
	Maintenance activities – throughout the operational phase, maintenance will need to be undertaken to ensure that all infrastructure in operating optimally and does not pose a threat to human or environmental health. Maintenance will include haul roads, pipelines, processing plant, machinery, water and stormwater management infrastructure, and stockpile areas.
	Continue with exploration activities
Decommissioning	Demolition and removal of infrastructure
	Post-closure monitoring and rehabilitation
	Closure of the underground mine

6 Item 3(e): Policy and legislative context

From an environmental and social perspective, the proposed Arnot South Project is required to comply with all the obligations in terms of the provisions of the NEMA and MPRDA. The additional legislative guidelines directing the Project are outlined in further detail in Table 6-1 below.

Table 6-1: Policy and Legislative Context

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>**The Constitution of the Republic of South Africa, 1996**</u> Under Section 24 of the Constitution of the Republic of South Africa, 1996 (the Constitution) it is clearly stated that: *Everyone has the right to* *(a) 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.*	Digby Wells is undertaking an EIA process to identify and determine the potential impacts associated with the Arnot South Project. Mitigation measures recommended will aim to ensure that the potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.
<u>**National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (as amended in 2017)**</u> The Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The EIA Regulation, 2014 was published under GN R 982 on 4 December 2014 (EIA Regulations) and came into operation on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R 983 (Listing Notice No. 1), GN 984 (Listing Notice No. 2) and GN R 985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the NEMA, as amended. The EIA Regulations have been made applicable to prospecting and mining activities.	Activities associated with the proposed underground mine are identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental authorisation prior to being undertaken. The Environmental Authorisation Application was submitted to the DMRE on 14 December 2020. The Scoping report was accepted on 30 April 2021. An application for a request for extension to submit the final EIA report was sent to the case officer via email on 4 June 2021 and a hard copy was submitted on 09 June 2021. This EIA/EMPr is be informed by the requirements of the NEMA and Regulations thereunder.
<u>**Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002)**</u> The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts.	The Applicant has applied for a Mining Right to mine coal on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. Farm portions have been listed under Section 3. The EIA process is undertaken to meet the requirements of the MPRDA read with the EIA Regulations, 2014 (as amended). Financial Provisioning and Closure Costs are included herein, and the report is appended hereto as Appendix S.
<u>**National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)**</u> On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C. These activities include inter alia the following: <u>Category A</u> describes waste management activities requiring a Basic Assessment process to be carried out in accordance with the EIA Regulations supporting an application for a waste management licence; <u>Category B</u> describes waste management activities requiring an Environmental Impact Assessment process to be conducted in accordance with the EIA Regulations supporting a waste management licence application; and <u>Category C</u> describes waste management activities that do not require a WML but these activities will have to comply with the prescribed requirements and standards as prescribed by the Minister, which includes the Norms and Standards for Storage of Waste, 2013. These activities include the storage of general waste at a facility with a capacity to store in excess of 100 m^3 and storage of hazardous waste in excess of 80 m^3. The Waste Classification and Management Regulations published under GN R 634 of November 2013 require that all wastes be classified according to SANS10234 and managed according to its classification.	A Waste Management License (WML) has been applied for due to the nature of mining activities.
<u>**National Water Act, 1998 (Act No. 36 of 1998) (NWA)**</u> The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and	An IWULA and an associated Integrated Water and Waste Management Plan (IWWMP) are required in terms of Section 21 of the NWA for the Arnot South Project. The IWULA and

Applicable legislation and guidelines used to compile the report	Reference where applied
authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA. GN R 704 was published in June 1999 and aims to regulate the use of water for mining and related activities for the protection of water resources and states the following: • Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution; • Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution; • Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, and • Regulation 7 details the requirements necessary for the protection of water resources.	IWWMP will be compiled and submitted to the DWS as the decision-making authority.
<u>DWS[1] Best Practice Guideline – G1: Storm Water Management Plan (SWMP)</u> These are guidelines provided by the DWS for the development of a SWMP. The following will be undertaken to develop the conceptual SWMP: • Delineate the clean and dirty area contributing to runoff (based on the final layout plans) and site-specific hydrological assessments to determine volumes that require to be handled. The SWMP should ensure that temporary drainage installations should be designed, constructed, and maintained for recurrence periods of at least a 25-year, 24-hour event, while permanent drainage installations should be designed for a 50-year, 24-hour recurrence period; and • Site specific assessments to establish the appropriate mitigation measures and surface water monitoring programme.	All water management infrastructure will be designed for a 1:100 year, 24 hour rainfall event.
<u>DWS Best Practice Guideline – G4: Impact Prediction</u> The impacts of mine activities on the groundwater environment must be assessed as part of the MRA, as well as for the IWULA. The baseline conditions must be assessed to define the current aquifer systems, groundwater use and groundwater conditions before mine commencement and to determine the extent of possible future impacts on the groundwater resources.	An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision-making authority. The EIA as part of the MRA assessed potential impacts on groundwater resources as a result of the Project.
<u>National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA)</u> The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: • Alien and Invasive Species Lists, 2014 published (GN R.599 in GG 37886 of 1 August 2014); • National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; and • National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN R.1002, 9 December 2011).	A Fauna and Flora Impact Assessment has been undertaken and appended hereto as Appendix E.
<u>National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)</u> The prevailing legislation in the Republic of South Africa with regards to the Air Quality field is the National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA). According to the Act, the DEA, the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS). These standards provide the goals for air quality management plans and also provide the benchmark by which the effectiveness of these management plans is measured. The NEM: AQA provides for the identification of priority pollutants and the setting of ambient standards with respect to these pollutants.	An Air Quality Impact Assessment has been summarised in this EIA/EMPr and is appended hereto as Appendix K
<u>National Dust Control Regulation 2013</u> The Minister of Water and Environmental Affairs, released on the 01 November 2013 the National Dust Control Regulation, in terms of Section 53, read with Section 32 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA). In the published National Dust Control Regulations, terms like target, action and alert thresholds were omitted. Another notable observation was the reduction of the permissible frequency of	An Air Quality Impact Assessment has been summarised in this EIA/EMPr and is appended hereto as Appendix K

[1] Previously the Department of Water Affairs (DWA)

Applicable legislation and guidelines used to compile the report	Reference where applied
exceedance from three to two incidences within a year. The standard actually adopted a more stringent approach than previously and would require dedicated mitigation plans now that it is in force.	
National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989) The National Noise-Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCRs) form part of the Environmental Conservation Act and these Regulations apply to external noise. The NCRs differentiates between Disturbing Noise levels (which is objective and scientifically measurable which are generally compared to existing ambient noise level) and Noise Nuisance (which is a subjective measure and is defined as noise that "*disturbs or impairs or may disturb or impair the convenience or peace of any person*"). Local Authorities use Controlled Areas to identify areas with high noise levels. Restrictions have been set out for development that occurs in these Controlled Areas. These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication. As such, a Noise Impact Assessment in accordance with the NCRs must be undertaken for submission to determine the potential disturbing and nuisance noise levels associated with a particular development.	A Noise Impact Assessment has been summarised in this EIA/EMPr and the report is appended hereto as Appendix L.
The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Provincial Heritage Resources Authority of Gauteng (PHRA-G), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000).	For the Scoping Phase, a Notice of Intent to Develop (NID) was submitted to SAHRA. A Heritage Impact Assessment has been undertaken and included as Appendix M.
GN R 1147 (Financial Provisioning Regulations), 2015 The Financial Provisioning Regulations prescribe methods for determining the quantum of financial provision for rehabilitation and mechanisms for providing for it. Section 41 (1) of the MPRDA has been repealed and Section 24P of the NEMA, as amended, which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision must guarantee the availability of sufficient funds.	The Financial Provisioning Regulations are applicable to rehabilitation and closure plans as they prescribe the minimum content of an annual rehabilitation plan and the minimum content of a final rehabilitation, decommissioning and mine closure plan. The Closure and Rehabilitation Report is attached as Appendix S and summarised in this EIA/EMPr.
GN R 527 (MPRDA Regulations), 2004 Regulation 527 (GN R. 527) specifies that the EMP must include environmental objectives and specific goals for mine closure. The applicant for a mining right must make prescribed financial provision for the rehabilitation or management of negative environmental impacts, which must be reviewed annually. R527 provides specific principles for mine closure including safety and health, residual and latent environmental impacts etc.	The EMPr is provided in Part B, Sections 5 and 6 of this report.

7 Item 3(f): Need and desirability of the proposed activities

Globally, coal plays a vital role in electricity generation. South Africa's energy is predominately coal fuelled. About 77% of the country's primary energy needs are provided by coal (Eskom, 2018). Renewable and alternative energy sources cannot yet meet the demands of the country's electricity needs. Coal mining is therefore crucial and until alternative energy generation options can be implemented on a sufficiently large scale, South Africa remains mainly dependent on coal mining.

Without a steady and secure supply of coal, it is unlikely that Eskom will be able to meet the energy demands of the country. As a result, coal mining is of paramount importance to South Africa for continued electricity generation in order to meet the energy demands of the country in the short, medium and long term. In addition to supplying the local economy, approximately 28% of South Africa's production is exported. The Witbank Coalfield is one of the most significant sources of South Africa's mined coal.

The Arnot South Project falls within the Witbank Coalfield. Based on preliminary studies there is potential for a 17-year LOM, delivering an average of 2.4 Mtpa ROM coal at steady state production. Based on the qualities of the products planned from the Arnot South Project, it is anticipated that the primary product (API4) shall be sold to Richards Bay Coal Terminal (RBCT) whereas the secondary product (thermal coal) shall be produced for the Eskom market. The mine will potentially contribute to the reduction of the domestic shortfall of coal, helping Eskom to ensure a sustainable supply of power which the South African economy depends on.

The positive aspects of the proposed Arnot South Project include the benefits of additional income generation in the area. The proposed Project will result in the development of the mine within the Project area and thus ensure that the mining activities create economic benefits to support the local and national economic and social needs. Thus, the proposed Project will result in employment opportunities (although not many).

7.1 Questions to be engaged with when considering need and desirability

The Guideline on the assessment of Need and Desirability (Department of Environmental Affairs (DEA), 2017) includes a number of questions, the answers to which should be considered in the EIA Process. Table 7-1 presents the needs and desirability analysis undertaken for the Arnot South Project.

Table 7-1: Need and Desirability

Theme	No.	Question	Response
Securing ecological sustainable development and use of natural resources"	1	How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?	The proposed Project is within an ecologically sensitive area. During the EIA Phase, the impacts to each environmental aspect were assessed according to the Digby Wells impact assessment methodology. Section 12.1 provides details on the impacts and risks identified for the Project..
	1.1	How were the following ecological integrity considerations taken into account?	
	1.1.1	Threatened Ecosystems	The Project is located within the endangered Eastern Highveld Grassland vegetation type, with vulnerable, near threatened and protected floral species potentially occurring on site. A total of 15 362 species potentially found in the Project area are listed in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. This includes Endangered, Near Threatened, and Vulnerable species. These have been listed in sections 11.5.1 and 11.5.2. A Fauna and Flora Assessment was conducted and is included in Appendix E.
	1.1.2	Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.	A Wetland Impact Assessment was conducted and is include as Appendix F. A rapid site survey was undertaken and used to refine the wetland delineation and to determine the PES, ES, and the EIS. Fifteen (15) wetland HGM systems were identified, some comprising several HGM units. The delineated wetlands were mostly defined as **permanent** and **seasonal** wetlands due to their setting in the landscape and clear SWI (mottles and gleying). As a result of this investigation, it was

Theme	No.	Question	Response
			found that the infrastructure footprint is within 500m of a wetland, and the recommendation of the Wetland Specialist is to relocate the infrastructure outside of the zone of regulation. The design is being updated and will be presented in the Integrated Water and Waste Management Plan report.
	1.1.3	Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)	The CVBs within the Study Area (HGM Systems 1, 2, 5, 6, 7, 8 and 9) are narrow, deeply eroded and somewhat well vegetated. The Project area consists of areas that are classified as CBA Irreplaceable in the northern and southern regions of the Mining Right area, which are the most important biodiversity areas in the Province and cannot afford to suffer further loss of habitat or ecological functioning, as their remaining extent is already below biodiversity targets, see Appendix F.
	1.1.4	Conservation targets	The Arnot South Project area falls within the Eastern Highveld Grassland (Gm12) vegetation type (Mucina & Rutherford, 2006). For the most part, mitigation measures have been suggested which will reduce the adverse effects identified during this EIA Phase. However, the Project will have adverse effects on the identified avifauna species.
	1.1.5	Ecological drivers of the ecosystem	
	1.1.6	Environmental Management Framework	
	1.1.7	Spatial Development Framework (SDF)	The NDM Integrated Development Plan (IDP), containing the SDF, was referenced for the compilation of this EIA Report.
	1.1.8	Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.)	A desktop survey of wetlands was carried out for the Scoping Phase which referenced National Freshwater Ecosystem Priority Areas (NFEPA) wetlands. No RAMSAR sites are present in the vicinity of the Project area.

Theme	No.	Question	Response
			An Aquatic Assessment is appended in this EIA report. The landscape comprises of channelled valley bottom, depression and bench flat wetlands. No RAMSAR sites are present in the vicinity of the Project area. Coal mining does not align with the Paris Agreement in terms of reducing CO_2 emissions, due to the ultimate emissions the coal-fired plants will produce.
	1.2	How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	The mineral reserve consists of one economically mineable underground section (No. 2 coal seam). Due to the depth and thickness of the No. 2 coal seam, the Arnot South resource area shall be mined by underground mining methods. Underground Subsidence may result in water levels rising due to flooding of the underground mine void, potentially contaminating shallower aquifers. In addition, subsidence may also promote surface decant in lower areas through induced fracturing. Also, the Project area will need to be assessed due to potential impacts such as habitat loss, habitat fragmentation, alien invasive plants proliferation and loss of faunal and floral species of conservation concern. Digby Wells' impact assessment methodology has been undertaken to identify, determine and assess the potential impacts during the EIA Phase, refer to Section 12.1.
	1.3	How will this development pollute and/or degrade the biophysical environment? 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 (including offsetting) 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 firstly 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?	General and hazardous waste will be generated as a result of the Arnot South Project. The waste will be handled, separated, stored and disposed of accordingly. It is anticipated that all general waste will either be recycled or disposed of at the local municipality landfill site. Hazardous waste

Theme	No.	Question	Response
			will be removed offsite by a hazardous waste contractor. A safe disposal certificate for the removal of hazardous waste will be retained as proof of safe disposal.
	1.5	How will this development 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 (including offsetting) the impacts? What measures were explored to enhance positive impacts?	All heritage resources identified within the Project area are of negligible cultural significance. The Cultural Heritage sites in the Project area were investigated during this EIA Phase and are presented in Appendix M. A Heritage Impact Assessment was undertaken during the EIA Phase to identify and assess any potential impacts on existing cultural heritage and graves within the Project area. However, two (2) heritage resources (i.e **Wf-01- and Wf-01-2)** were identified in the Project area.. **Both these** structures are assumed to be older than 60 years and must be assumed to have General Protection under Section 34 of the NHRA. It was noted that the environment was also disturbed through anthropogenic and animal activities. The Heritage baseline is further discussed in Section11.13.
	1.6	How will this development 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	Coal extraction for use in electricity generation is a non-renewable energy resource, however, South Africa is dependent on coal and until the energy supply and demand can feasibly be replaced with renewable energy, non-renewable energy sources will be required. Mitigation measures aimed at avoiding, reducing and / or managing the negative impacts are found in this report. The extent of positive impacts associated with this Project are conveyed in Section 12.1 and associated specialist studies which have been appended.

Theme	No.	Question	Response
		remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	
	1.7	How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact 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?	The EIA Phase has confirmed the presence of wetlands. The extent of potential impacts and potential mitigation is outlined in Section 12.1. No mining will occur within the delineated pans. This is to advise on the impact of moisture displacement the proposed activities may have on the sustainability of infrastructure development and the environment. It must be noted that avoidance of this impact would result in the No-Go alternative being implemented, as the coal seam is too shallow to motivate underground mining.
	1.7.1	Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)	Historically, Eskom has struggled to secure coal from South African mining operations due to international prices of coal yielding more profit for mines. South Africa will be a coal-dependent country for the foreseeable future. While the mining and use of coal has its disadvantages for the environment, it is an important part of South Africa's development. The socio-economic impacts of coal mining include employment and increasing the country's economic value through the support of various industries..
	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 (i.e. what are the opportunity costs of using these resources this the proposed development alternative?)	

Theme	No.	Question	Response
	1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	A sensitivity map was generated in the pre-application phase which identified all the natural sensitivities identified thus far. The Project increases dependency on resources (i.e. non-renewable resources).
	1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts?	The risks still being investigated include an external water source since the Project is located in a water scarce catchment. Risk management procedures implemented include the identified avifauna species. Also, mitigation measures contained in this report reduce environmental risks. However, it should be noted that mining has irreversible environmental impacts that cannot be avoided. Environmental legislation and frameworks were applied while compiling reports for the EIA Phase. These were important as they helped consider the limits of the ecosystems and contained current knowledge about the consequences of decisions and actions.
	1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Part A, Section 21 outlines the gaps, uncertainties and assumptions which were presented in each of the special studies undertaken.
	1.8.2	What is the level of risk associated with the limits of current knowledge?	
	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?	
	1.9	How will the ecological impacts, resulting from this development impact on people's environmental right in terms following:	

Theme	No.	Question	Response
	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?	As with all coal mining, there will be a general deterioration of the environment. Specifications on the negative impacts and their mitigation measures are found in the Section 15 below. For the detailed methodology used to determine the significance of the identified impacts, refer to Part A, Section 13
	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.)?	
	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?	
	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?	Alternatives in terms of infrastructure placement were investigated in the pre-application phase, through the identification of sensitive areas on site. Sensitive areas on site were avoided as far as possible.
	1.13	Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale,	Cumulative impacts were investigated and presented under Section 12.2.

Theme	No.	Question	Response
		scope and nature of the project in relation to its location and existing and other planned developments in the area?	
Promoting justifiable economic and social development"	2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	
	2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,	The socio-economic baseline took the NDM and GSDM IDPs for the period 2019-2020 into consideration. The IDPs present issues and requests raised by residents in each local municipal district of the Municipalities.
	2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	The spatial and economic development projects will be implemented through the Municipal IDP. The proposed Project will promote and support the sustainability of existing business, as well as assist in increasing local beneficiation and shared economic growth for the confirmed 17 years LoM.
	2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	
	2.1.4	Municipal Economic Development Strategy ("LED Strategy").	
	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?	The proposed Project will result in limited job opportunities. The positive impact from the Project will be recognised through implementing the Community Development Projects.
	2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries. The Applicant is committed towards contributing to the socio-economic activities of the immediate community and the region. Arnot South Coal Mine commits to the requirements of the Skills

Theme	No.	Question	Response
			Development Act. In addition, the company will ensure that the contractors have fully developed skills plans and all colliery employees receive training and development in accordance with these plans.
	2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	The Company will implement the SLP Community Development projects and initiatives which are based on the requirements identified by surrounding communities through the SLP consultation process.
	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?	Arnot South Coal Mine will offer portable skills to employees throughout the LoM, to ensure that they have skills other than those required by the mine, to lessen the negative impact and foster continued livelihood.
	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 mine will be a contractor-run-operation. The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries.
	2.5.2	reduce the need for transport of people and goods	Coal product will be trucked to various markets. The Applicant will also provide employee transport to and from the mine thereby mitigating increased traffic for individual road users.
	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 public transport),	
	2.5.4	compliment other uses in the area,	A Traffic Impact Assessment was undertaken to establish potential congestion on surrounding roads and provide mitigation measures

Theme	No.	Question	Response
			to manage the impact. A **'Full'** access extending from an access road which intersects the **D383**, about 3.0km to the west of where the main infrastructure is proposed, will be the proposed access for the mine development.
	2.5.5	be in line with the planning for the area,	The current proposed LoM is 17 years and the Closure and Rehabilitation Report will consider end-land use in line with the LED Strategy.
	2.5.6	for urban related development, make use of underutilised land available with the urban edge,	Not applicable. The proposed Arnot South Project area is outside an urban area.
	2.5.7	optimise the use of existing resources and infrastructure,	No infrastructure is available on site which can be utilised as part of the mining operation; however, the proposed infrastructure on site will all be removed during decommissioning and will therefore not create unwanted infrastructure either.
	2.5.8	opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	No bulk infrastructure will form part of this development.
	2.5.9	discourage "urban sprawl" and contribute to compaction/densification,	The project area and surrounds are fairly rural and cannot therefore influence urban sprawl.
	2.5.10	contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	The Community Development projects associated with the SLP will prioritise Historically Disadvantaged South Africans as beneficiaries.
	2.5.11	encourage environmentally sustainable land development practices and processes,	Mining is inherently unsustainable and a destructive activity involving the taking of a non-renewable resource. The successful

Theme	No.	Question	Response
			rehabilitation of the area will contribute to mitigating the impacts caused by mining.
	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.),	The location of the proposed Project is dependent on the location of the identified mineral resource (coal reserve).
	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 project will allow the mine to continue contributing to the local, regional and national Gross Domestic Product (GDPs), and also to the local communities through potential employment of workers and local contractors, as well as other influences and community upliftment programmes that are undertaken by the mine through their SLP.
	2.5.14	impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	In total, 948 heritage resources were identified within the regional, local and site-specific study areas. The predominant tangible heritage resources recorded in the area under consideration demonstrate affiliations with the historical period, including the historical built environment and burial grounds and graves. Two (2) heritage resources were identified within the Project area, refer to Appendix M, the report is also included as Appendix M.
	2.5.15	in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The Arnot South Project shall be a contractor-operated mine. The planned workforce will consist 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries. The proposed project will ensure employment, as well as programmes implemented from the mine's SLP.

Theme	No.	Question	Response
	2.6	How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	Socio-economic impacts undertaken during the EIA and included in Appendix Q
	2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Gaps in knowledge, uncertainties and assumptions have been determined during the EIA Phase and presented in the EIA Report, see Section 21
	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?	
	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?	
	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?	The aim of the SLP is to initiate projects which develop the surrounding communities which may be impacted by a proposed mining project. The mine itself will have a LoM of 17 years and therefore will present long-term sustainable employment. The Community Development projects associated with the SLP will prioritise Historically Disadvantaged South Africans as beneficiaries.
	2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	
	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 socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	

Theme	No.	Question	Response
	2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	
	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?	
	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?	
	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?	
	2.13	What measures were taken to:	
	2.13.1	ensure the participation of all interested and affected parties,	During the pre-application and Scoping Phase, an I&AP database was developed to identify and verify the directly and indirectly affected landowners or land occupiers as well as the potentially affected surrounding communities. This was updated and used throughout the EIA process as well.

Theme	No.	Question	Response
	2.13.2	provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Digby Wells will maintain and update the I&AP database to ensure communication with all registered I&APs. Site notices have been erected in various locations around the site and in the nearest communities to announce the Project, SMS notifications will be utilised to provide progress reports to I&APs as well as Digby Wells contact information for further consultation. Due to COVID-19 Regulations, Focus Group meetings will be held in both the Scoping and EIA Phases to engage with any I&AP who wishes to attend, and the Project will be presented at these meetings as well as the findings of the impact assessments. COVID-19 measures during face-to-face meetings will be taken into consideration.
	2.13.3	ensure participation by vulnerable and disadvantaged persons,	Section10 of this Report, describes the Scoping and EIA public participation process and activities that were undertaken during the Scoping Phase and EIA Phase for the proposed Project. Focus Group meetings are planned to be held in the scoping and EIA phases of the Project. Efforts will be made at the meetings to be held to ensure that all participants can participate in a language they are able to understand.
	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,	The consultation process seeks to inform affected communities of the positive and negative impacts associated with the proposed Project and provide opportunity for any stakeholder to raise concerns which will be responded to both on record in the reports and through direct written response (where possible). Furthermore,

Theme	No.	Question	Response
			the Applicant will create community forums with guidance form the Municipality.
	2.13.5	ensure openness and transparency, and access to information in terms of the process,	Digby Wells is bound by legislation and regulations to share information pertaining to the Project, to be transparent and impartial.
	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, and	All stakeholder needs will be accommodated as far as is reasonable.
	2.13.7	ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein was be promoted?	The EAP cannot force participation from specific demographics. Cultural norms will be respected and adhered to; however, no demographic can be excluded from public consultation and therefore all registered stakeholders and meeting attendees will be considered intrinsic to the public consultation process and outcomes. COVID-19 measures during face-to-face meetings will be taken into consideration.
	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)?	
	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	The Applicant must produce a Health and Safety policy and best practice on site, compliant with the Mine Health and Safety Act, 1996 (Act No. 29 of 1996). Workers must be educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Also, adequate measures need to be taken to ensure that the appropriate personal protective equipment is issued to

Theme	No.	Question	Response
			workers based on the areas that they work 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 Arnot South Project will be a contractor-run operation, meaning most of the staffing will be employed by the mining and engineering contractors. The planned workforce will consist 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries.
	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),	The Arnot South Project shall be a contractor-operated mine. The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries.
	2.16.3	the distance from where labourers will have to travel,	The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries.
	2.16.4	the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	
	2.16.5	the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	The main land uses of the farmland include cultivation, cattle grazing, infrastructure.
	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, and	The Scoping and EIA process requires governmental departments to communicate regarding any application. In addition, all relevant

Theme	No.	Question	Response
			Departments and key stakeholders have been notified about the project by the EAP and registered as Interested and Affected Parties who will continue to be notified and engaged with regarding the project throughout the EIA process..
	2.17.2	that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	Not Applicable.
	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?	As part of the EIA Process, Financial Liability for the Applicant was calculated to determine the cost of decommissioning and rehabilitating the mine site to an end-land use which is sustainable and in the best interest of both the surrounding communities and the environment. The purpose of the EIA is to propose mitigation measures to reduce or avoid the impacts as a result of the mine proceeding.
	2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	
	2.20	What measures were taken to ensure that he 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?	
	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?	The layout of the proposed mining infrastructure was informed by sensitivity mapping of the farms directly impacted by the mining activities.

Theme	No.	Question	Response
	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?	Cumulative impacts were investigated and presented under Section 12.2.

8 Item 3(g): Motivation for the Overall Preferred site, Activities and Technology Alternatives

The location of the Project has been decided by the location of the identified coal resource. The preferred mining method is underground mining to avoid sensitive areas on the surface as far as possible.

The layout of the surface infrastructure was considered in the specialist studies which advised proposed changes to the layout to avoid or minimise certain impacts. From the specialist assessments that were undertaken during the EIA Phase, it was advised that the infrastructure be moved outside of the 500 m zone of regulation, of the wetland. The mine layout is being amended to minimise the impacts to sensitive areas such as wetlands by reducing the overall layout to a more condensed area. The design is being updated and will be presented in the Integrated Water and Waste Management Plan report. This impact assessment is based on the preliminary layout.

9 Item 3(h): Full Description of the Process followed to Reach the Proposed Preferred Alternatives within the Site

This section describes the alternatives investigated during the preliminary phase of the Project.

9.1 Item 3(h)(i): Details of all alternatives considered

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives help identify the most appropriate method of developing the project, taking into account location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives and the no-go alternative. Alternatives also help identify the activity with the least environmental impact.

A project alternative is defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004).

In an EIA process, project alternatives serve to determine the most effective way of meeting the objectives of that project. This is generally done through either enhancing the benefits of an activity and/or mitigating the negative impacts and risks of an activity.

According to the Department of Environmental Affairs (DEA) Criteria for Determining Alternatives in EIA Guideline (2004), there are various types or categories of alternatives, including:

- Location alternative – alternative project sites in the same geographic area;
- Process/design alternative – alternative process/design/equipment;
- Activity alternative – consideration of different means to achieve the same project objective;
- Routing alternative – consideration of different routes for linear infrastructure;

- Site layout alternative – consideration of the different options to place project infrastructure; and
- No-go alternative – the proposed project/activity does not proceed, implying that the current situation or status quo remains.

Four types of alternatives were considered for the Project, namely location, mining method, technology and the No-Go alternative. These are discussed in the sections below.

9.1.1 Location of the Project

The location of the Project is dependent on the location of the identified coal resource (No.2 seam). Exxaro undertook prospecting activities on the area of interest and determined the extent of the mine based on the location of the coal. Farms included in the Mining Right boundary and impacted by mining activities were investigated during the EIA Phase of the Project.

As a result of this investigation, it was found that the infrastructure footprint is within 500m of a wetland, and the recommendation of the Wetland Specialist is to relocate the infrastructure outside of the zone of regulation. The design is being updated and will be presented in the Integrated Water and Waste Management Plan report.

9.1.2 Mining Method Alternatives

The proposed alternatives for coal extraction considered underground versus opencast mining. Due to the depth of the No. 2 coal seam to be mined, the method of coal extraction will be by means of an underground mine using continuous miners. The Arnot South Project shall, therefore, be an underground mine operated by a selected underground mining contractor. The following factors influenced the decision:

- The planned annual product sales;
- Potential markets;
- The shape of the resource block;
- The depth, thickness, and distribution of the coal seams;
- Producing from a single access adit while producing consistent products for the selected markets;
- Operating and maintaining five continuous miner's production sections while ensuring consistent production fleet utilisation and consistent operating costs; and
- Ensuring the highest Net Present Value (NPV) for the Project (Arnot South MWP, 2020).

There are potential additional areas where the No. 2 coal seam is mineable by underground continuous miners or drill and blast mining methods and areas where the No. 4 upper and lower coal seams are mineable by opencast mining methods. However, the preferred mining method for these two additional reserves will be confirmed following the completion of drilling activities.

9.1.3 Technology Alternatives

The proposed mine will be an underground mine and bord-and-pillar mining with continuous miners and shuttle cars will be used.

There are two main types of washing processing technology which could be used for coal beneficiation, namely: dry processing and wet washing. The preferred technology for the Arnot South Project is wet washing. The coal shall be beneficiated through a double-stage dense medium washing plant to produce export and Eskom products. The washing plant feed conveyor shall feed a 3.0 m by 6.0 m single deck horizontal desliming screen where the 50 mm by zero mm shall be wet screened on a 1.0 mm deck.

9.1.4 The “No-Go” Alternative

The No-go alternative is the option of not mining coal in the area. This option also means that all potential negative impacts associated with the proposed mine and its associated infrastructure would not occur. However, the potential benefits associated with the Project would also not occur. According to the Nkangala District Environmental Management Framework, the area within which the proposed Project falls has been earmarked for mining and power generation development as these two sectors currently drive the economic value of production in the Project area.

If the Project were not to proceed, the additional economic activity, skills development and available jobs would not be created, the coal reserve would remain unutilised and the economic activities would continue as at present, with little economic growth developing in the region. There is a proven coal reserve in the Witbank Coalfield for this project, and if the Project does not proceed the socio-economic opportunities for the communities will not be realised.

10 Item 3(i): Details of the Public Participation Process followed

The public participation process was developed to ensure compliance with environmental regulatory requirements and to provide I&APs with an opportunity to evaluate the proposed Project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent.

During the Scoping Phase, the following core stakeholder engagement activities were undertaken:

- Stakeholders (including Government Departments, landowners, land occupiers, communities, Non-Governmental Organisations, agricultural organisations, Parastatals and businesses) have and will continue to be identified and captured in a stakeholder database;

- A Background Information Document (BID) and letter was distributed to the identified I&APs together with the placement of adverts and site notices around the Project area;
- The environmental Scoping Report and associated documentation was made available for public comment for a period of 30 days, from 22 January 2021 to 24 February 2021;
- Due to the COVID-19 national lock down, the Draft Scoping Report was released electronically and could be accessed on the Digby Wells website and via our data-free service portal;
- It should be noted that consultations were only undertaken with a select of the identified stakeholders. To date, Exxaro is in the process of arranging engagement meetings with the directly and indirectly affected landowners as a form of introductory meetings. The aim of these meetings will be to have conversations around the potentially impacted farms and land access for Digby Wells to be able to undertake the PPP and complete the specialist's studies during the Impact Assessment Phase. It should, however; be noted that a Focus Group Meeting (FGM) was held with a select affected parties particularly with the Ward Councillors from the surrounding community of Kwazamokuhle; and
- Suggestions and concerns received during the public comment period have been recorded and responded to in Table 10-3 below, and included in the Public Participation Report attached in Appendix C.

10.1.1 Consultation with Stakeholders during Scoping Phase

A notification letter and Short Message Service (SMS) were utilised to distribute invitations to the I&APs. Telephonic discussions were also undertaken throughout the Scoping Phase to inform I&APs about upcoming FGMs, as well as to obtain comments. These three methods were employed to ensure that the stakeholders were well informed and given the opportunity to attend the meetings, affording them an opportunity to raise comments related to the Project.

As part of planning for face-to-face stakeholder consultations, Digby Wells submitted a Stakeholder Engagement Plan (SEP) as per the Disaster Management Act: Regulations Relating to COVID-19 (GN R 650 of 30 July 2020) of the Department of Environment, Forestry and Fisheries. It should be noted that the SEP was approved by the DMRE prior to the commencement of the public participation activities. The purpose of the stakeholder meetings was to disseminate detailed Project information to the I&APs. During the engagement the various stages of the Scoping process, and the public participation process were explained, as well as the related legislated timeframes. Having various stakeholder meetings (i.e. focus group meetings) was important in order to address the differing needs and concerns of the I&APs, for example employment, social development and land acquisition. FGMs for the EIA Phase are planned to be held between **30 August – 01 October 2021**. This will, however, be confirmed with stakeholders.

10.1.2 Public Participation Activities

Table 10-1 provides a summary of the public participation activities undertaken during the Scoping Phase together with the relevant reference proof.

Table 10-1: Public Participation Scoping Phase Activities

Activity	Details
Identification of stakeholders	Stakeholder database which represents various sectors of society, including directly affected and adjacent landowners, in and around the proposed Project area.
Distribution of BID announcement letter	A BID with registration and comment form was emailed to stakeholders on 22 January 2021. An SMS was also sent to stakeholders on 22 January 2021 announcing the availability of the Draft Scoping Report.
Placing of newspaper advertisement	A newspaper advertisement was placed in the Middelburg Observer and Witbank News.
Putting up of site notices	Site notices were put up at the proposed Project site on 21 January 2021. A site notice placement report and map were developed to indicate the locations of site notices in and around the Project area.
Announcement of Draft Scoping Report	Announcement of availability of the Draft Scoping Report was emailed to stakeholders on 22 January 2021. The Draft Scoping Report was released electronically and made available to stakeholders on the Digby Wells website (www.digbywells.com under Public Documents) and could be accessed via our data-free service. Note: ***Due to COVID-19 Regulations, no documents were placed at public areas.*** Stakeholders were sent a data-free link where they can access the reports. http://view.datafree.co/PublicDocuments/.
Consultation with Stakeholders	Digby Wells interacted with the following stakeholders I&APs during the announcement of the project who requested to be added on the database as Interested and Affected Persons: • Gugu Maphahlaza • Dan Mokhine • Sponono Madimabe • Busisiwe Sibanyoni • Anna Mofokeng • Doctor Skhosana • Victor Roberts • Mirriam Motswene

Activity	Details
	The following Ward Councillors who fall under Steve Tshwete Local Municipality from Ward 1 & 3 respectively were consulted: • Lindiwe Mahlangu; and • Doctor Skhosana. The councillors stated above reserved their comments and informed the project team that during the Environmental Impact Assessment Phase they will fully engage and raise comments accordingly.
Obtaining comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders were captured in the Comment and Response Report (CRR). The CRR is appended to this report (refer to Appendix C).
Announcement of Final Scoping Report	This report will be made available on www.digbywells.com (under Public Documents).

10.1.3 Consultation with Stakeholders during the EIA Phase

During the Impact Assessment Phase, the following main Public Participation activities will be undertaken:

- Provided feedback on the findings of the specialist studies conducted and mitigation measures proposed by means of consultation with I&APs;
- Releasing the Draft EIA and associated specialist studies being released to the public for comment;
- Consultation with I&APs through focus group meetings; and
- All comments raided during this period will be included in the CRR.

Table 10-2 provides more detail regarding the Stakeholder Engagement activities undertaken thus far, together with referencing materials.

Table 10-2: EIA Phase Public Participation Process Activities

Activity	Details
Update of stakeholder database	The stakeholder database was updated.
Announcement of draft EIA Report	Announcement of availability of the draft EIA Report was emailed to stakeholders on 30 August 2021. The draft EIA Report was released electronically and made available to stakeholders on the Digby Wells website (www.digbywells.com under Public Documents) and could be accessed via our data-free service. Note: ***Due to COVID-19 Regulations, no documents were placed at public areas.*** Stakeholders were sent a data-free link where they can access the reports. http://view.datafree.co/PublicDocuments/.

Activity	Details
Obtaining comments from stakeholders	The stakeholders were provided with an opportunity to comment on the Draft EIA Report. Comments, issues of concern and suggestions received from stakeholders have been captured in the final CRR.
Announcement of daft EIA Report	This report has been made available on www.digbywells.com (under Public Documents)

10.2 Summary of issues raised by I&APs

CRR has been compiled capturing all stakeholder comments obtained during the Scoping Phase public comment period. The CRR is contained in Table 10-3 below.

Table 10-3: Comments and Responses Received During Scoping Phase

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
Project Specific Issues						
What will the distance of the project's area be from the community?	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	The proposed project is located 10km east of the town of Hendrina and approximately 5km east of the Kwazamokuhle Community.
What information does the mine have about the size, personal circumstances and income of the communities?	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	The Social Impact Assessment researched sources such as Stats SA to gather information on the local communities, municipalities and province. The information requested forms the baseline on this study and can be found Section 11.17 and in Appendix Q
Who will be adversely affected by potential environmental and social impacts in the project's area of influence? How will they control dust?	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	Currently, the landowners operating farms within the surface footprint area (where the mining infrastructure is to be located). Digby Wells advises these farms be bought by the Applicant, however, these negotiations will only proceed if the Applicant finds the project to be financially viable and all the relevant authorisations are in place.

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
What will trucking affect traffic on local roads?						Dust will be controlled through dust suppression and limited vegetation clearance. The Traffic Impact Assessment was undertaken during the EIA Phase and included in this report as Appendix O. Should the preferred method of transport be only trucking, this will have an impact on the surrounding road network. The Applicant proposes to transport product via rail, but this option must be explored in further detail and will be applied for in a separate application.
At which stage of project development will parties be most affected (e.g. prospecting, extraction, decommissioning, and rehabilitation at all stages)?	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	Each project phase is associated with different impacts. Please refer to Section 15, Table 15-1 for a summary of all the impacts per environmental aspect, in each phase. Some of the most significant impacts include the following: • Reduction of ambient air quality; • Noise emissions from equipment/ machinery;

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
						• Impacts associated with community health, safety and security; • Loss of agricultural land; • Potential physical displacement of farm dweller households; • Change sense of place; and • Contamination of soil, water and surrounding areas / habitats.
How will the project be done in a manner that prevents the pollution of water resources?	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	Clean a dirty water must be separated on site and mine-affected water will be stored and reused in the dirty mining areas, or treated before being released into the natural environment. The Applicant is required to follow the mitigations as stipulated in the EMP which is contained in Part B of this report. Refer to Table 5-1 of Part B. Further to this, an environmental monitoring programme has been developed (also presented in Part B, Section 8) which the mine must

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
						implement to track and rectify any incidents of pollution.
Proposed Project Mine Plan and Infrastructure						
Exxaro must ensure that during their mine planning; the communities are informed of the potential benefits that will be generated from the proposed project. Hendrina town is very impoverished yet there are mining operations in the area. Furthermore, the issue of graves on farm properties must be considered if any identified during the mine planning.	Cllr	Lindiwe Mahlangu (Ward 3)	Kwazamokuhle Community	28 January 2021	Focus Group Meeting Hendrina Municipality Offices	Thank you for your comments. The comment on community benefits has been forwarded to Exxaro for consideration in their mine planning. Furthermore, Digby Wells will conduct a Heritage Impact study that will identify and assess any potential impacts on existing cultural heritage and graves if any within the project area. The findings of the study will be presented during the Impact Assessment Phase. A Heritage Impact Assessment was undertaken during the EIA Phase to identify and assess any potential impacts on existing cultural heritage and graves within the Project area. However, two (2) heritage resources (i.e **Wf-01- and Wf-01-2)** were identified in the Project area.. **Both these** structures are assumed to be older than 60 years and must be assumed to have General Protection

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
						under Section 34 of the NHRA. It was noted that the environment was also disturbed through anthropogenic and animal activities. The Heritage baseline is further discussed in Section11.13, and Appendix M of this report.
How many times a day does the mine plan on blasting and how will this impact the community? What will the noise levels be? Will roads, cropping and grazing land be diminished? Will this have a negative impact on infrastructure and services?	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	This mine will be underground mining only, so the blast impact will be limited to the underground mine workings. The Blasting and Vibration Report (Appendix P) describes how the mine must undertake blasting to prevent or minimise negative impacts from mining. Any loss of crops must be compensated by the mine, and this will be limited to the directly affected farms. The Applicant plans to use rail transport for export coal, and additional coal trucks may affect the tarred roads in the area.
How will the benefit the local communities? When can communities have access to the plan?	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	Thank you for your comments. Digby Wells has developed the proposed Infrastructure Mine Plans as planned by

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
When can communities make comments on the plan?						Exxaro for the proposed project. These plans are contained in Appendix B. The communities will benefit from the Social and Labour Plan projects, once those have been approved.
Public Participation						
Indicated that they have received the information documentation of the proposed Arnot South Mining project which will impact their farm areas. Emphasised that it is essential to meet with Exxaro and Digby Wells as soon as possible. Indicated Mr van der Merwe's availability for the first week of February 2021. Requested that the meeting be held at their premises at Farm Vlakfontein, Hendrina.	Mr	JH van der Merwe Landowner	Sarel van der Merwe Boerdery (Pty) Ltd.	25 January 2021 and 18 February 2021	Email Correspondence	Extensive consultation has been undertaken with the van der Merwe's as directly affected landowners. Digby Wells and Exxaro were in contact with the van der Merwe family to discuss land access and the option of drilling boreholes on the van der Merwe farms. Any further consultation will be conducted during the EIA public comment period, as registered I&APs.
	Ms	Desirié Giebler Personal Assistant				

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
Requested that the Steve Tshwete Local Municipality be registered on the project and be kept informed of any public meetings	Cllr	Lindiwe Mahlangu (Ward 3) and Doctor Skhosana (Ward 1)	Kwazamokuhle Community	28 January 2021	Focus Group Meeting Hendrina Municipality Offices	Thank you for your interest in the proposed project. Digby Wells has registered the Municipality on the stakeholder database.
Emphasised that the community must be kept informed. As such, requested to be part of the landowner Focus Group Meetings as the farms falls under her jurisdiction.	Cllr	Lindiwe Mahlangu (Ward 3)	Kwazamokuhle Community	28 January 2021	Focus Group Meeting Hendrina Municipality Offices	Thank you and noted. Will ensure that Councillor Mahlangu is included in all engagements to be held during the EIA Phase consultations.
Requested to be registered as an Interested and Affected Party on the proposed Arnot South project.	Mr	Neil Volschenk Landowner	Farm Morgenstêr 204IS	22 February 2021	Email Correspondence	Thank you for your interest in the proposed project. Digby Wells has registered Mr Volschenk on the stakeholder database.
Requested to be registered as an Interested and Affected Party on the	Mr	Thulani Thukwana	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	Thank you for your interest in the proposed project. Digby Wells has

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
proposed Arnot South project.		Community Leader				registered Mr Thukwana on the stakeholder database.
Requested a public meeting to be held with the I&AP's at boundaries of Albert Luthuli Local Municipality to afford I&AP's the opportunity to provide input, comments and raise issues in respect of the process and content of the proposed development to enhanced benefits during the compilation of the draft	Mr	Thulani Thukwana Community Leader	Representing Farm Opgoedenhood	21 February 2021	Email and Letter Correspondences	The request has been noted. The Focus Group Meetings will be held during this phase of this project and will be determined based on the location of the directly affected community/ies.
Mooiplaas Community requested to be registered on the project as I&APs and further requested a meeting so that they	Ms	Florence Malinga Vice Chairperson	Mooiplaas Community Forum	12 May 2021	Email, Telephone and Letter Correspondence	As requested, the Mooiplaas Community Forum (MCF) has been added to the stakeholder database as an Interested and Affected Persons (I&APs). As part of the PPP, Focus Group Meetings will be announced and held with all registered I&APs between 30

Issue or Concern	Contributor			Date of Contribution	Means of Engagement	Response
can provide input on the project.						August and 1 October 2021. All registered I&APs, including MCF, will be notified via SMS and e-mail about these meetings and the availability of the Draft EIA report for public comment. The meetings will provide a platform for this community to raise any issues, comments and/or recommendations for consideration into the Final EIA report to be submitted to the DMRE.

11 Item 3(j): The environmental attributes associated with the alternatives

This section comprises the baseline environment of the proposed Project area as assessed by the relevant specialists. The purpose of understanding the environmental baseline conditions relates to the potential of the project to impact on the existing environment, and the potential for existing environmental aspects to influence a proposed development in terms of design, location, technology and layout.

A number of specialist studies were undertaken as part of the environmental regulatory process during the EIA phase for the proposed Project, as shown in Table 11-1 below.

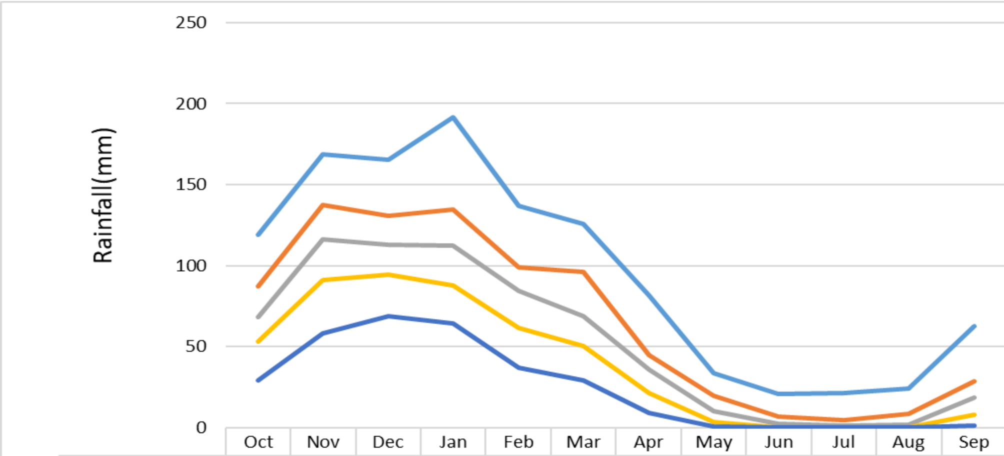
Table 11-1: Specialist reports and associated appendices

Specialist Study	Appendix
Soils, Land Use and Land Capability Assessment	Appendix D
Fauna and Flora Assessment	Appendix E
Wetland Assessment	Appendix F
Aquatic Ecology Assessment	Appendix G
Hydropedological Assessment	Appendix H
Surface water Assessment	Appendix I
Groundwater Assessment	Appendix J
Air Quality Assessment	Appendix K
Noise Assessment	Appendix L
Heritage Assessment	Appendix M
Visual Assessment	Appendix N
Traffic and Transport Assessment	Appendix O
Blast and Vibration Assessment	Appendix P
Socio-economic Assessment	Appendix Q
Greenhouse Gas Emissions Assessment	Appendix R
Rehabilitation and Closure Assessment	Appendix S

The subsection below provides the baseline bio-physical and socio-economic environmental conditions currently present on the Project site. The information provided in this section has been obtained from the abovementioned specialist reports.

11.1 Regional Climate

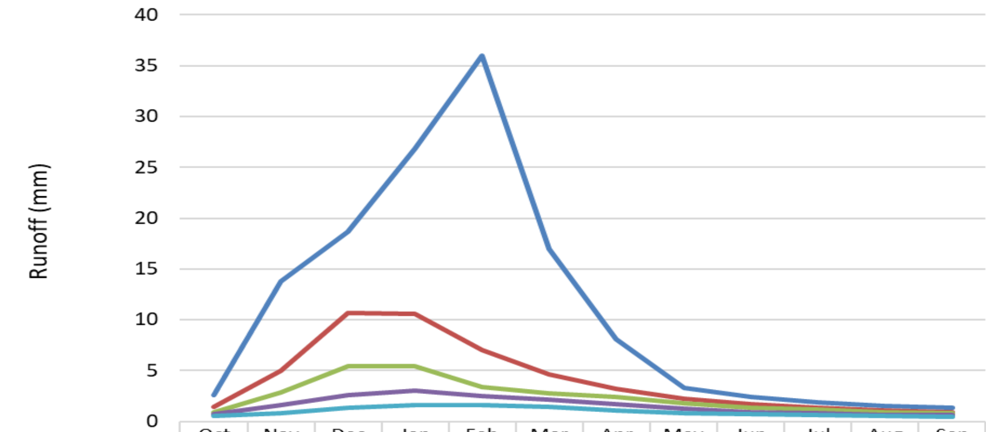
The Arnot South Project area is characterised by warm, rainy summers and dry winters with sharp frost (South African Weather Bureau, 1986). According to the Köppen-Geiger system, the climate here is classified as Cwb (Oceanic Subtropical Highland Climate). The Mean Annual Precipitation (MAP) for B12A, B12B and X11A is 695 mm, 672 mm, and 688 mm, respectively (WRC, 2015). The average MAP for the Project area is estimated at 685 mm, which is likely to be distributed as indicated in Figure 11-1. The wettest month is January with a 90th percentile of 192 mm and 10th percentile of 65 mm. This implies that the region experiences moderate to high volumes of rainfall.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90 Percentile	119	169	165	192	137	126	82	34	21	21	24	62
70 Percentile	87	138	131	135	99	96	45	20	7	5	8	28
50 Percentile	68	116	113	112	85	69	36	10	2	1	2	19
30 Percentile	53	91	95	88	62	50	21	4	0	0	0	8
10 Percentile	29	58	69	65	37	29	9	0	0	0	0	1

Figure 11-1: Monthly Rainfall Distribution

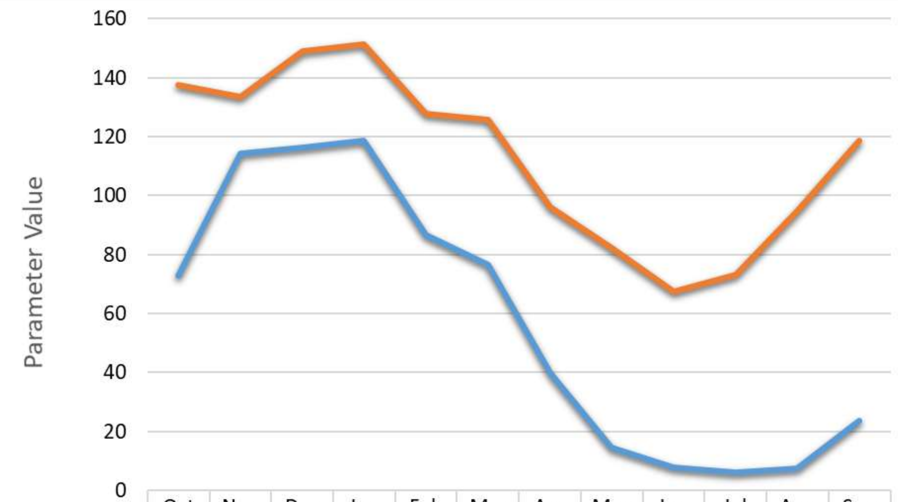
The Mean Annual Runoff (MAR) also differed with each quaternary catchment, however, the average MAR was calculated to be 55.02 mm which is 8% of the MAP. The highest amount of runoff was recorded in February with a 90th percentile of 36 mm and a 10th percentile of 1.6 mm. The indicated rainy months had moderate to high runoff depths. The MAR is likely to be distributed as indicated in Figure 11-2.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90 Perecentile	2,6	13,8	18,7	26,9	36,0	17,0	8,1	3,3	2,4	1,9	1,5	1,3
70 Percentile	1,4	5,0	10,6	10,6	7,0	4,6	3,2	2,3	1,7	1,3	1,1	0,9
50 Percentile	0,9	2,9	5,5	5,4	3,4	2,7	2,4	1,8	1,4	1,2	0,9	0,8
30 Percentile	0,7	1,6	2,6	3,1	2,5	2,1	1,7	1,3	0,9	0,8	0,7	0,6
10 Percentile	0,6	0,8	1,4	1,6	1,6	1,4	1,1	0,8	0,7	0,6	0,5	0,4

Figure 11-2: Monthly Percentile Distribution of Runoff

On average, the area has a Mean Annual Evaporation (MAE) of 1,358 mm, which is much greater than the average MAP of 685 mm. Figure 11-3 indicates the distribution of runoff, the highest evaporation loss is observed in January (151 mm) which is also the wettest month.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation(mm)	138	133	149	151	128	126	96	82	67	73	95	119
Rainfall(mm)	73	114	116	119	87	77	40	15	8	6	7	24

Figure 11-3: Monthly Distribution of Potential Evaporation and Rainfall

11.1.1 Temperature and Humidity

The monthly temperature and humidity records (three-year average) for the Project area are presented in Table 11-2 and Figure 11-4 below. The data indicate that the monthly temperature average varied between 10°C and 20°C. Ambient temperatures were observed to be higher during the summer months. The relative humidity records ranged between 62% and 73% with May as the highest humidity month and November presenting the lowest level at 62%.

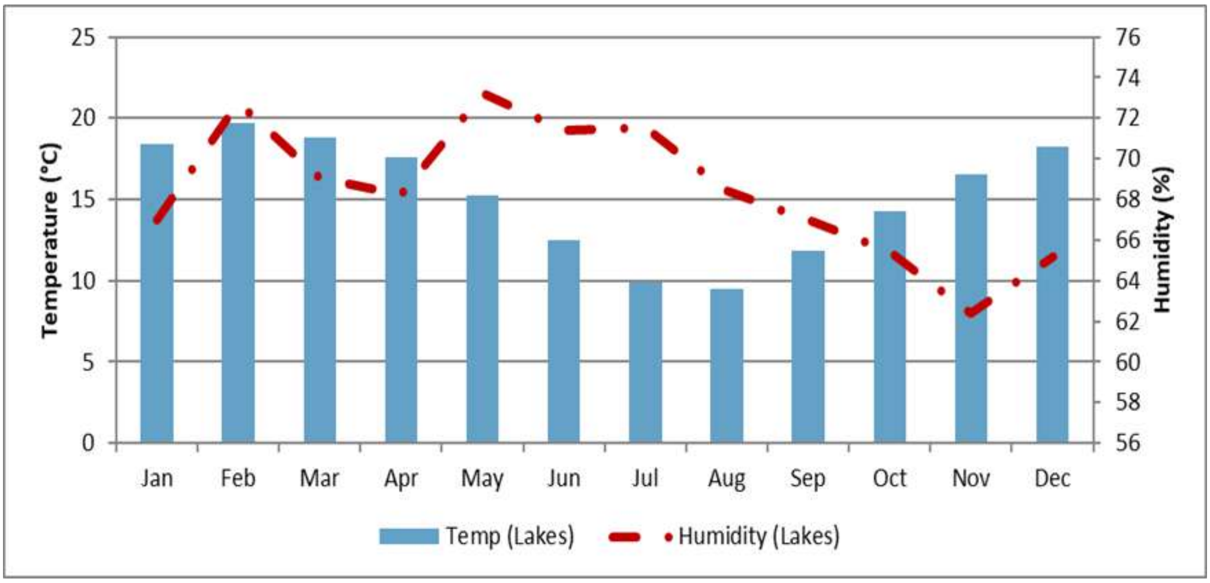


Figure 11-4: Monthly Temperature and Humidity (2017- 2019)

11.1.2 Rainfall

The total monthly rainfall records (three-year average) are provided in Table 11-2 and Figure 11-5. Based on the rainfall data, the summer months (December – February) received more rainfall (i.e. >66%) with December and January being the peak rainfall months (Figure 11-5), followed by Spring with 24% and Autumn with 10%. The least rainfall (less than 1%) was experienced in winter (June – August). The annual total rainfall is at 629 mm.

The average annual temperature of the nearest town, Hendrina (10 km east of the Project area), is 14.8°C and the rainfall is approximately 726 mm per year (Climate-data.org, n.d.).

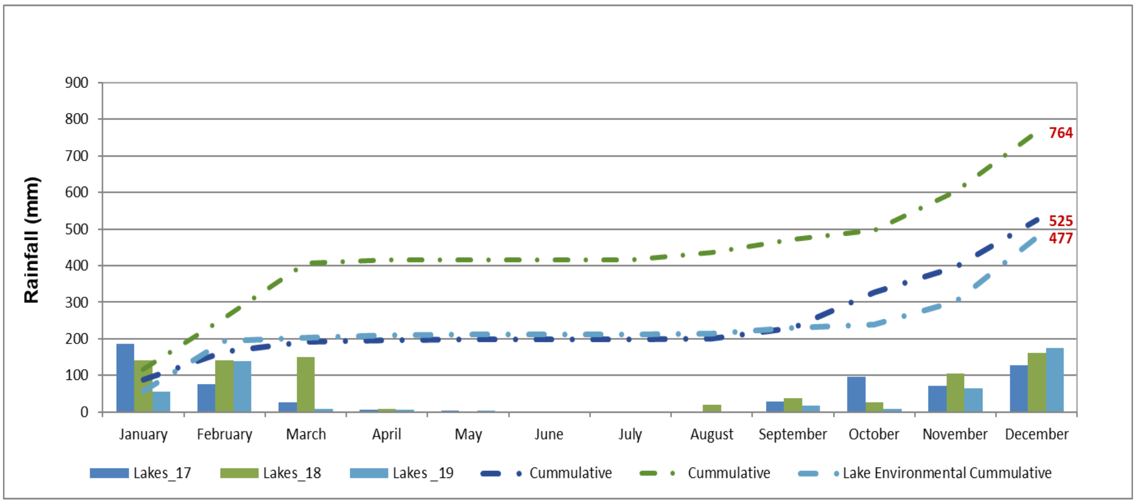


Figure 11-5: Rainfall (2017- 2019)

Table 11-2: Climate Statistics

Parameters	3-year average (2017-2019)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temp. (◦C)	18	20	19	18	15	13	10	10	12	14	17	18	15
Total Mon. Rain (mm)	127	119	62	6	2	1	0	7	27	43	80	155	629
Rel. Hum. (%)	67	73	69	68	73	71	72	68	67	65	62	65	68

(Source: Lakes Environmental)

11.1.3 Wind Speed

Hourly meteorological data was analysed and used to understand the prevailing wind patterns in the Project area. The wind rose for the Project area is depicted in Figure 11-6. The prevailing winds are from the east-north-east (15.7%) and west-northwest (10.3%). Secondary contributions are from the northwest (9.8%) and northwest (9.8%). The average wind speed at the Project area is 3.2 m/s and calm conditions (<0.5 m/s) occurred for some 3.6% of the time.

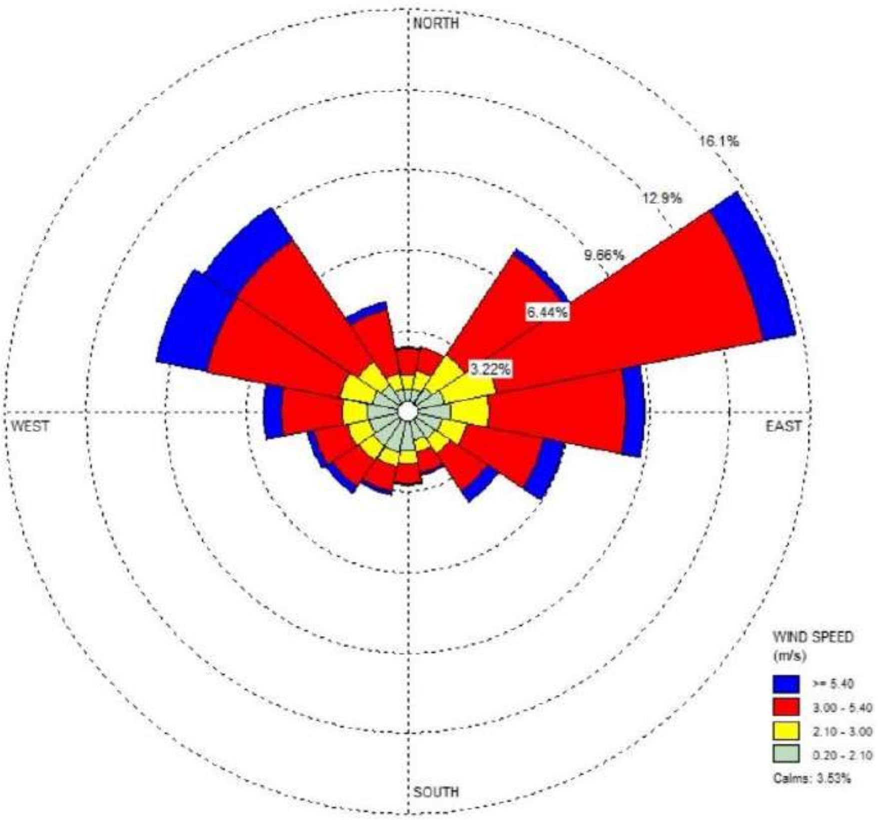


Figure 11-6: Surface Wind Rose

11.2 Topography and Drainage

The topography of the Project area is generally flat, with a gentle rise of 15 m from the western boundary to the centres of the Project area and dip of 60 m over 7 km to the eastern boundary. The topography ranges from high elevations on the northern and southern side of the Project area to lower elevations in the east and central area (Figure 11-7). The elevation of the Project area ranges from 1,565 to 1,745 metres above mean sea level (mamsl), which equates to a range of 180 m between the lowest and highest points of elevation within the area. The average slope for the entire Project area is approximately 2.8 degrees (°) (Figure 11-8).

One of the major tributaries of the Olifants River is the Klein Olifants River which flows within the portion of the Project area that is located within the Olifants Water Management Area (WMA). Drainage within the portion of the Project area that is located within the Inkomati-Usuthu WMA is facilitated by the Vaalrivierspruit, which drains into the Nooitgedacht Dam that adjoins the Komati River.

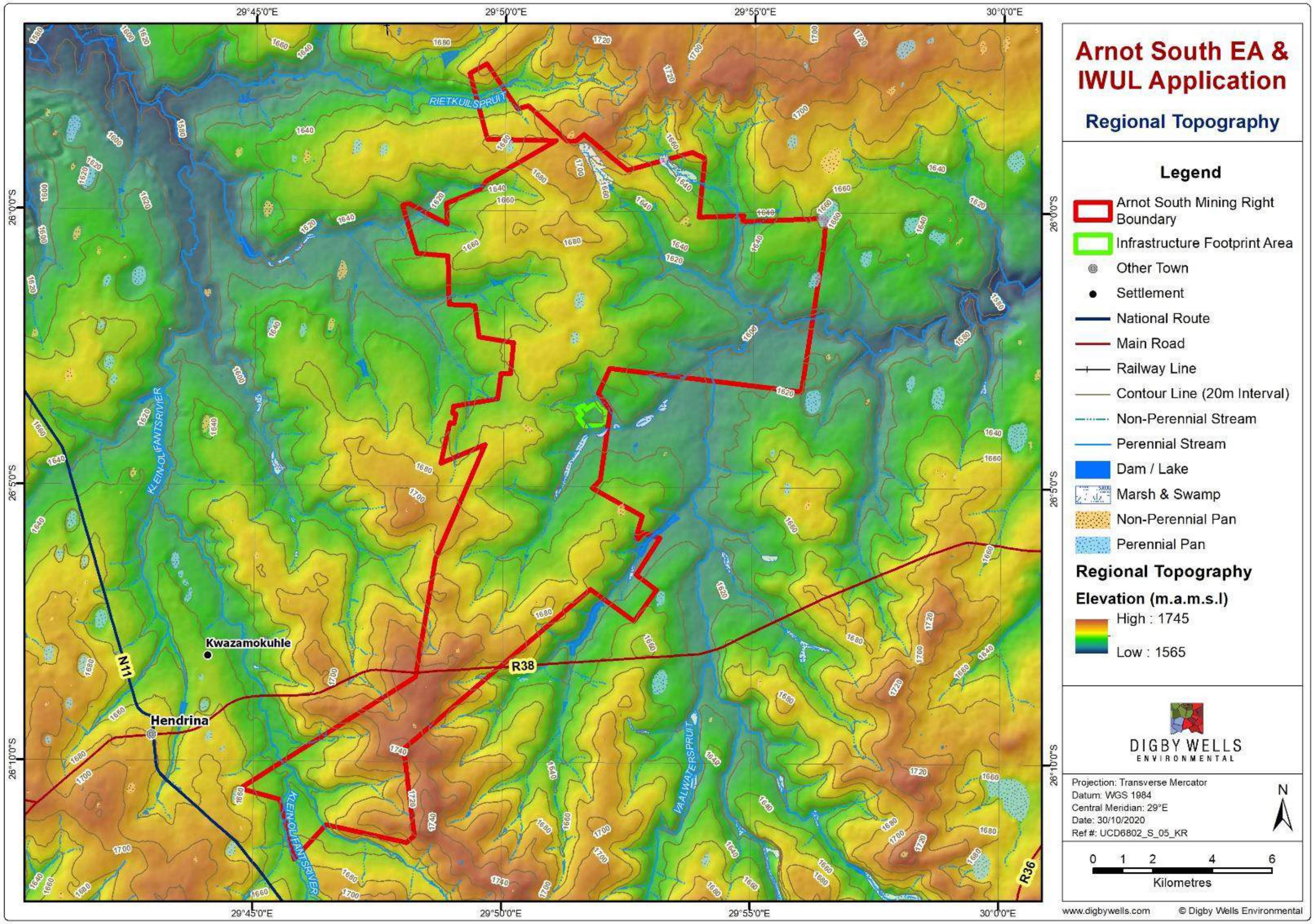


Figure 11-7:Topography of the Arnot South Project area

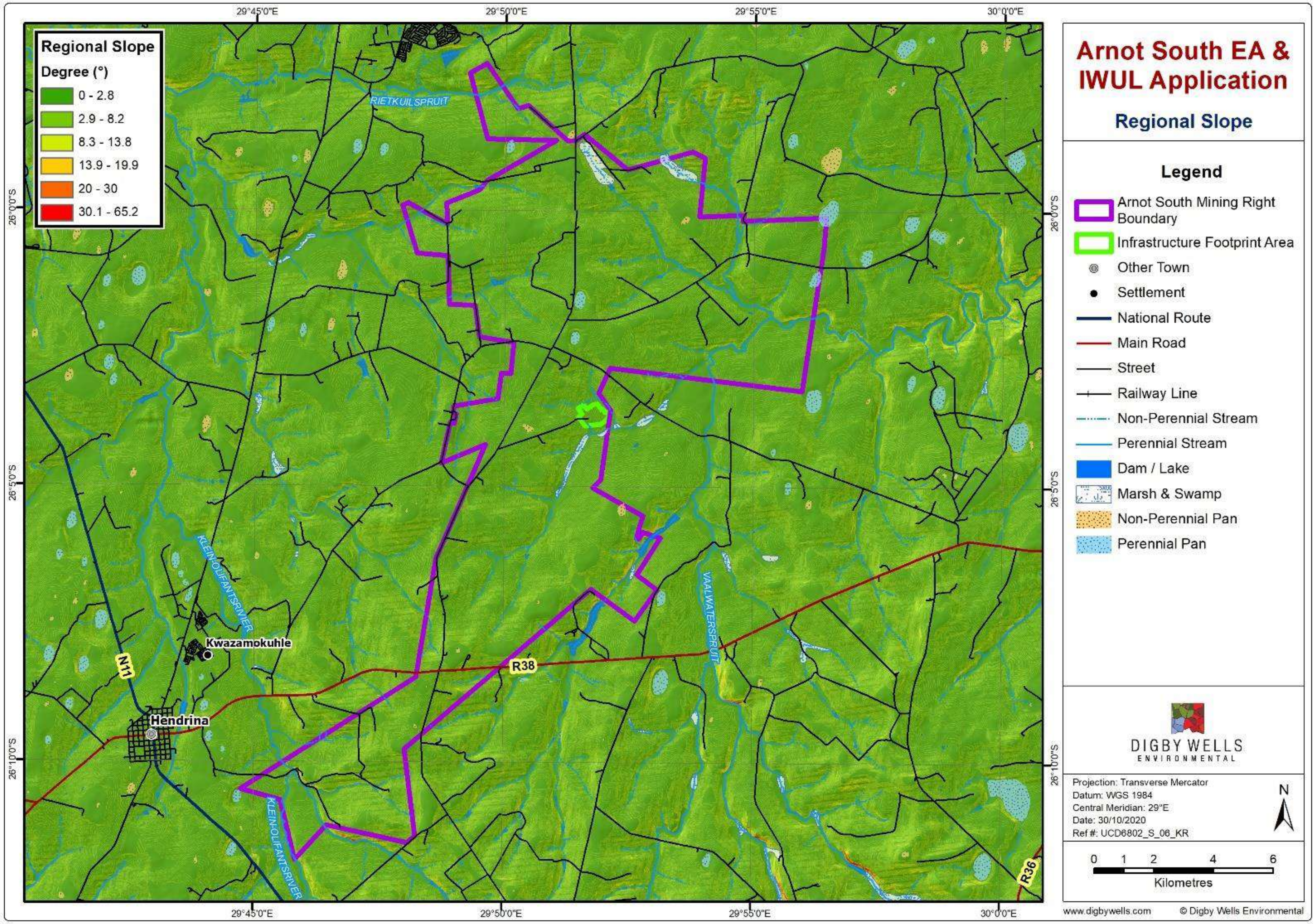


Figure 11-8: Slope of the Arnot South Project area

11.3 Geology

The Project area is situated within the Witbank Coalfield, which is underlain by formations of the Dwyka and Ecca Groups as shown in Figure 11-9.

Woodford & Chevallier (2002) states that the Dwyka Group is composed of glacial ice-shelf deposits, displaying well-developed striated glacial pavements in places. The group consists mainly of diamictite (tillite) and to a lesser extent also contains conglomerate, sandstone, rhythmite and mudrock. The Ecca Group comprises a total of 16 formations which are observed from the lateral facies changes that characterise this succession. The two groups collectively are known to host coal seams and sedimentary rocks, such as conglomerates, sandstone, shale and mudstone (siliciclastic rocks). In line with the area being located on the Ecca and Dwyka Groups, the surface geology presented in Figure 11-10 indicates that the Project area is predominantly underlain by siliciclastic rocks.

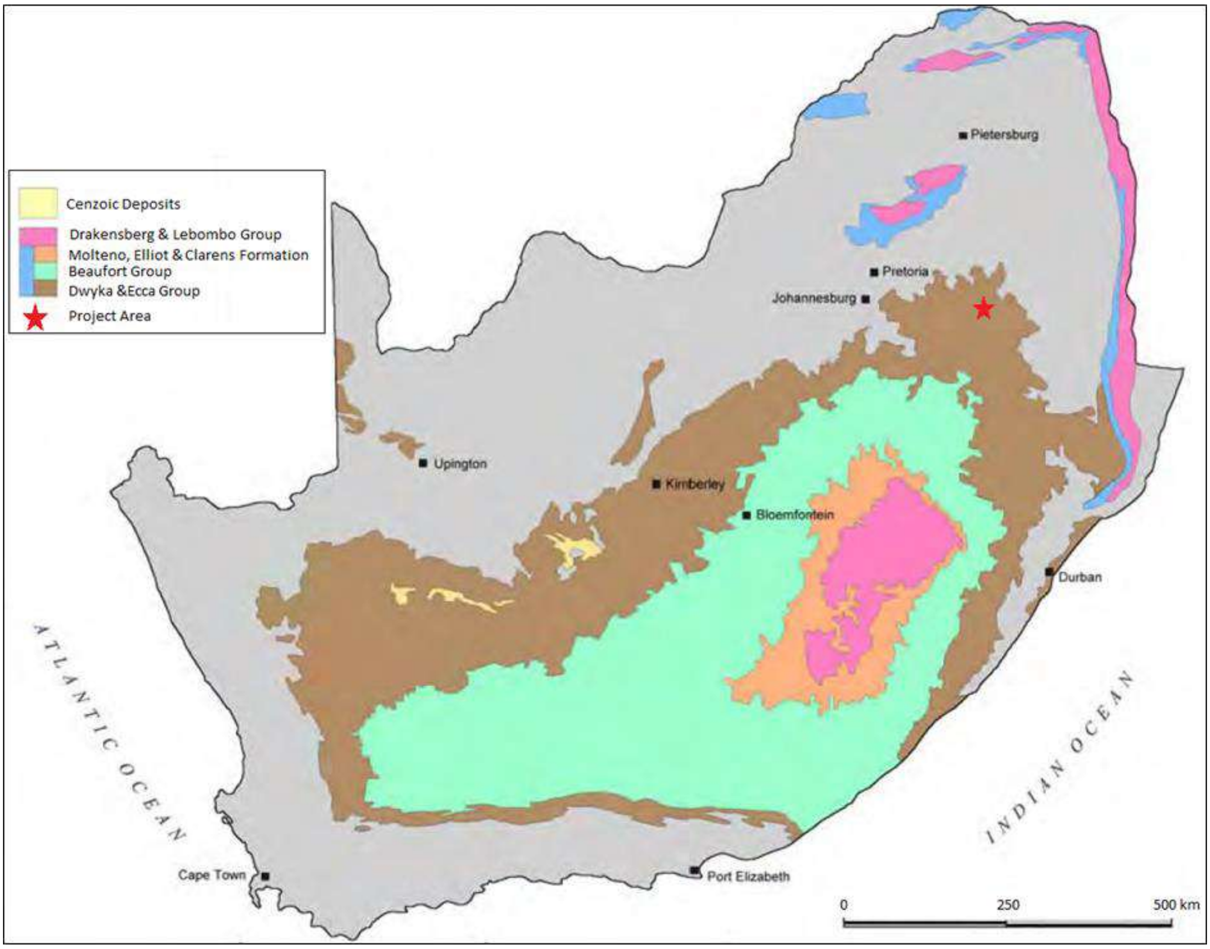


Figure 11-9: Simplified Geology of the Karoo Supergroup in South Africa (Woodford & Chevallier, 2002)

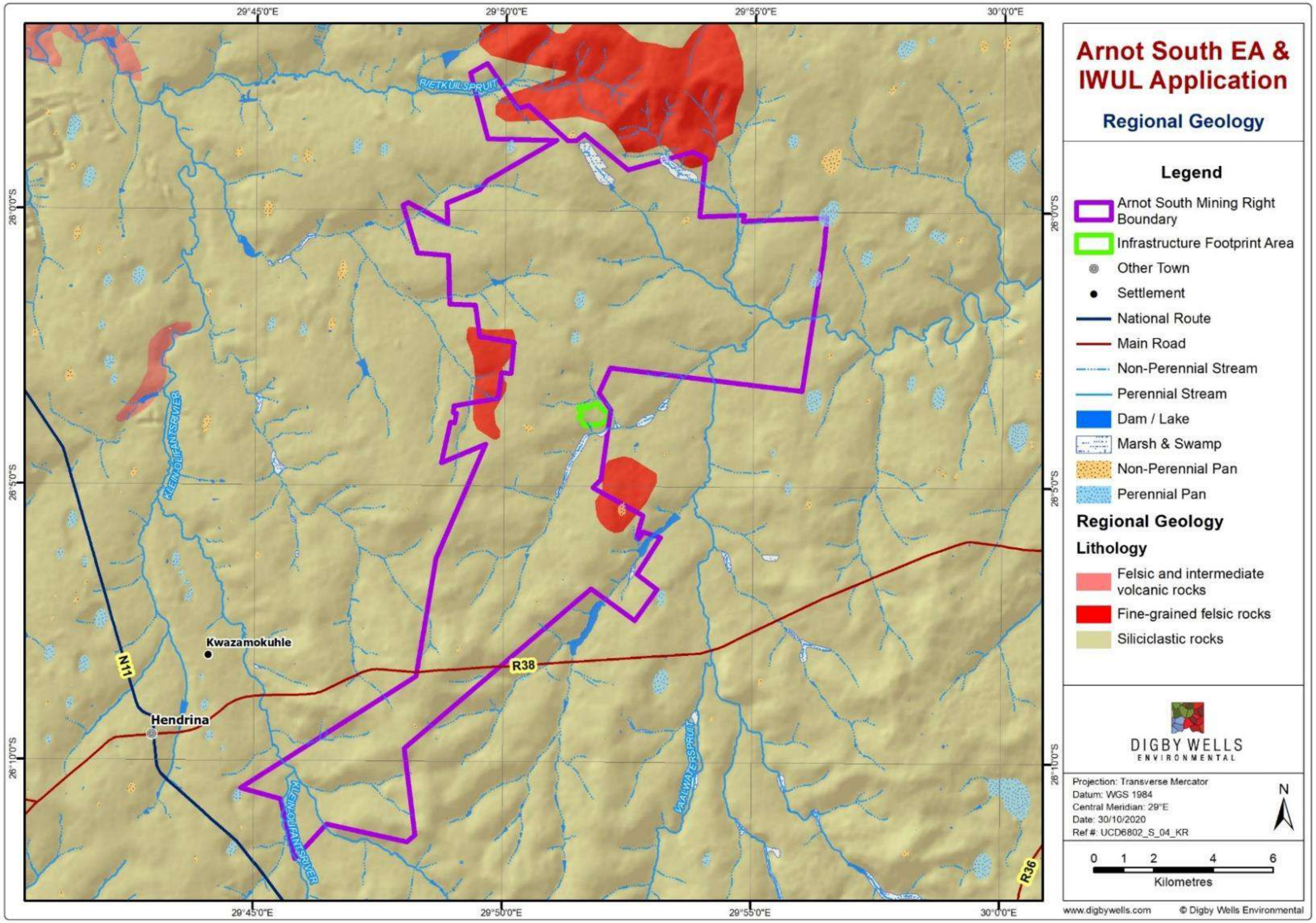


Figure 11-10: Regional Geology

11.4 Soils, Land Use and Land Capability

The field assessment for the Soil, Land Use and Land Capability Impact Assessment was undertaken on the 20th to the 23rd of April 2021. The baseline Soil, Land Use and Land Capability focusses mainly in the proposed Project area and is further discussed in Appendix D of this report. The subsections below provide a summary of the baseline findings.

11.4.1 Soil Forms

The soil forms within the Project area were delineated and are shown in Figure 11-11 below. Due to the extent of the Project area, limited access to the entire Project Area, time and budget constraints it was sought to group soil forms together by means of dominant soil horizon, functionality and land use (i.e., hydrogeomorphology, depth, topography and slope). The soil forms together with site photos and a short description area is further discussed in Appendix D.

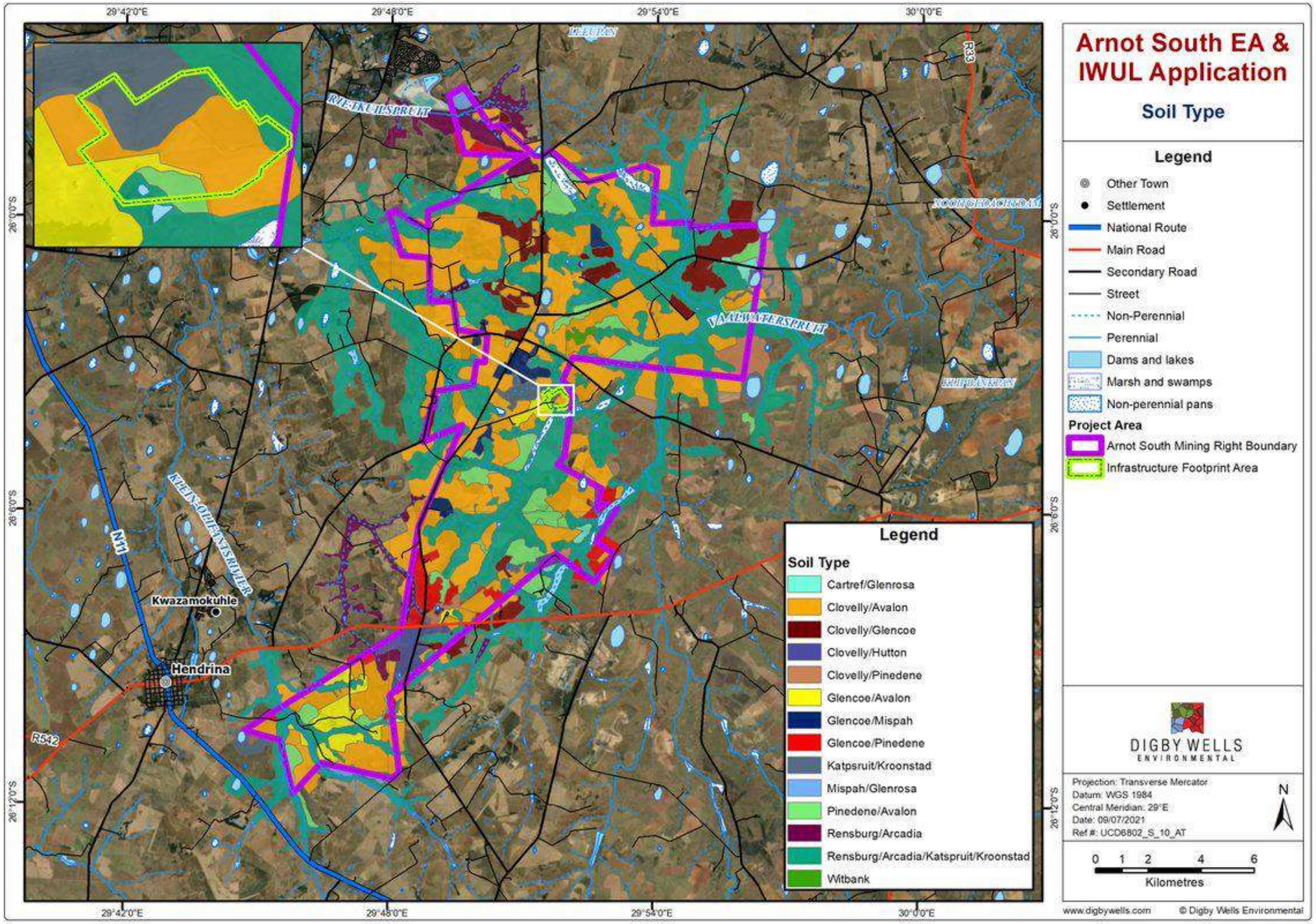


Figure 11-11: Soil Delineations

11.4.1.1 Soil Chemical and Physical Characteristics

Various soil samples were collected during the site visit. However, the results of the soil analysis for the five representative samples are presented in the Soils report in Appendix D.

As a basis for interpreting the data, Soil Screening Values (SSV) and local soil fertility guidelines are presented in Table 11-3, together with the pH guidelines.

The results highlighted in yellow present values below the SSV and red above the SSV. The pH colours are presented in Table 11-3 below.

Table 11-3: Soil Fertility Guidelines

Guidelines (mg per kg)			Source
Macro Nutrient	**Low**	**High**	
Aluminium (Al)	<10	>50	Australian Guidelines, (Department of Agriculture and Rural Affairs, 1986)
Boron (B)	<0.5	>1.5	USA Guidelines, (Allison, et al., 1954)
Calcium (Ca)	<200	>3000	South Africa Guidelines, (NEM:WA 2008)
Chlorides (Cl)	-	>12000	South Africa Guidelines, (NEM:WA 2008)
Copper (Cu)	<36.0	>190	Dutch Guidelines, (Dutch VROM, 2000)
F (Fluoride)	-	>200	Canadian Guidelines, (CCME, 2007)
Magnesium (Mg)	<50	>300	South Africa Guidelines, (NEM:WA 2008)
Nickel (Ni)	-	>45	Canadian Guidelines, (CCME, 2007)
Organic Carbon (OC)	< 2 %	>3 %	South Africa Guidelines, (du Preez, Mnkeni, & van Huyssteen, 2010)
Phosphorus (P)	<5	>35	South Africa Guidelines, (NEM:WA 2008)
Potassium (K)	<40	>250	South Africa Guidelines, (NEM:WA 2008)
Sodium (Na)	<50	>200	South Africa Guidelines, (NEM:WA 2008)
Zinc (Zn)	<140	>720	Dutch Guidelines, (Dutch VROM, 2000)
Electrical Conductivity (EC)	110 (mS/m)	570 (mS/m)	Australian Guidelines, (Department of Agriculture and Rural Affairs, 1986)
Cation Exchange Capacity (CEC)	5%	25%	Australian Guidelines, (Department of Agriculture and Rural Affairs, 1986)

pH					
Very Acid	**Acid**	**Slightly Acid**	**Neutral**	**Slightly Alkaline**	**Alkaline**
<4	4.1-5.9	6-6.7	6.8-7.2	7.3-8	>8

11.4.1.2 Soil Texture

The particle size distribution of the soil sampled in the Project Area was classed into the percentages of sand, silt and clay present. The textural classes were obtained from plotting the three fractions on a textural triangle. The size limits for sand, silt and clay used in the determination of soil texture classes are sand: 2.0 – 0.05 mm, silt: 0.05 – 0.002 mm and clay: < 0.002 mm.

The dominant soil textures in the Project Area were **sand** to **loamy-sand**. Soil texture are a direct attribute from the parent material (dominantly sandstone). The following characteristics are related to sand, clay and loam soils (Table 11-4):

Table 11-4 Soil Texture of the Project Area

Sandy soils	Loamy soils	Clay Soils
• High infiltration and drainage rate (low water-holding capacity);	• Moderate infiltration and drainage rate (moderate water-holding capacity);	• Low infiltration and drainage rate (high water-holding capacity);
• High leaching potential;	• Moderate leaching potential;	• Low leaching potential;
• Low soil fertility (OC, CEC, EC, pH);	• High fertility status (nutrients and OM);	• Very high fertility status (nutrients and OM);
• High lying areas; and	• Low-lying areas; and	• Low-lying areas; and
• Low erosion potential.	• High erosion potential	• High erosion potential

Due to the relatively small size of areas covered by clay rich soils, the low potential of these soils, and the fact that most of the impact will occur on the sandy soils the clayey soils were not sent for analysis. However, the high clay soils in the low-lying areas (wetlands) contribute to low infiltration, water ponding, has a high erosion potential and contain high concentration of chemicals. The higher the clay in the soil, the higher the Electrical Conductivity (EC), Cation Exchangeable Capacity (CEC), Organic Carbon (OC) and pH.

11.4.1.3 Soil pH

The pH of the soil samples collected ranged from **3.93** to **4.84**, indicating that the soils are **very acidic** to **acidic**. The optimal pH for agricultural crops range between 5.5 and 7.5. The following can be derived from the data:

- All the samples were below the optimal pH range for agriculture;
- Due to the sandy nature of the soils (siliciclastic sedimentary rocks - conglomerates, sandstones, and mudrock parent material), intensive crop production and high rainfall in the vicinity of the Project Area, the pH tends to decrease over time and require a liming and fertilizer programme to optimize crop production;

- Soils with a low EC, cations and clay content tend to have a lower pH than soils with higher clay and EC; and
- The pH in Sample 5 were the lowest. As soil pH decreases, Al is solubilized and the proportion of Al-ions increases in the soil solution (consequently the high levels of Al in Sample 5).

11.4.1.4 Exchangeable Cations

The Cation Exchange Capacity (CEC) values ranged from **4.66** to **7.99** cmol(+)/kg. This is on average a low CEC, indicating low clay soils with high permeability and low fertility. The following can be derived from the data regarding the CEC and the exchangeable cations:

- Sample 1 had the lowest CEC as well as the highest sand fractions (most sandy);
- The lower the clay content of soil, the lower the adsorption potential of cations and therefore the lower the CEC and EC;
- Na in all five samples were below the SSV;
- P, Ca, Mg and Na were below the SSV in Sample 5, however Al exceeded the SSV;
- The EC of all five samples were below the SSV;
- The low CEC and cations in the soils can be attributed to the sandy nature of the soil (sandstone parent material), low organic material (OM), low clay content and intensive cultivation practices; and
- Soils with a low CEC and cations have a low soil fertility and require fertilization for optimal crop production.

11.4.1.5 Phosphorus

The Phosphorus (P) in the samples ranged from **3.3** to **7.8** mg/kg. The following was derived from the data:

- Four of the five samples had P-levels below the SSV, these soils will require P-fertilizer for optimum crop production;
- Sample 1 had adequate P, however, is below the optimal P-level for agriculture;
- The low P indicates that the P in the soils is most likely fixed and not mobile in the soils and easily leached;
- The low P can be attributed to the sandy nature of the soils and high leaching potential; and
- P-fertilizer would be required to increase the P in the soils for optimum crop production, plant growth and vegetation cover.

11.4.1.6 Heavy Metals and Potential Harmful Elements

The heavy metals and potential harmful elements in all the samples were below the SSV, except Aluminium (Al) in S5. This is a good indication that there is currently no inorganic pollution in the Project Area. The following was derived from the data:

- Al, Fe, Mn, Cu, Zn, NI and F were analysed and were all within or below the SSV, excerpt for Fe in Sample 5;
- Due to the low soil pH, Al becomes soluble and the proportion of Al increases in the soil solution;
- Other potential harmful elements, including Chloride (Cl) and Nitrite (NO_2) were within the SSV in all the samples and will not cause harm to crop production; and
- The soils are not impacted by potential harmful elements, nor heavy metals. This baseline data should be used for future soil and water monitoring.

11.4.1.7 Organic Carbon

The soil OC ranged from **0.63** to **1.39** % in the five soil samples. The OC in all the samples were thus below the SSV. The following was derived from the data:

- The low OC can be attributed to the sandy nature of the soils, low pH and low CEC;
- All the samples had a low OC, and organic fertilizer would be required for optimum crop production; and
- The higher the clay content of the soil, the higher the CEC, EC, pH and adsorption potential. OC also tends to be higher in clay soils due to the low leaching potential of clays.

11.4.2 Land Use and Current Impacts

The dominant land use was identified by aerial imaginary during the desktop assessment and verified during the site survey as demonstrated in Table 11-5 and Figure 11-12. The area is dominated by cultivation, cattle grazing, grazing, wetlands and infrastructure (historical infrastructure).

The current impacts to the soils, land use and land capability of the Project Area are associated with agropastoral activities (i.e., cultivation, cattle grazing, infrastructure), mining (i.e., mine pits, infrastructure) and anthropological activities (roads, dams, powerlines, pipelines, culverts, bridges).

Table 11-5 Land Use Activities

Planted pastures

Historical and current infrastructure

Cattle grazing

Cultivation

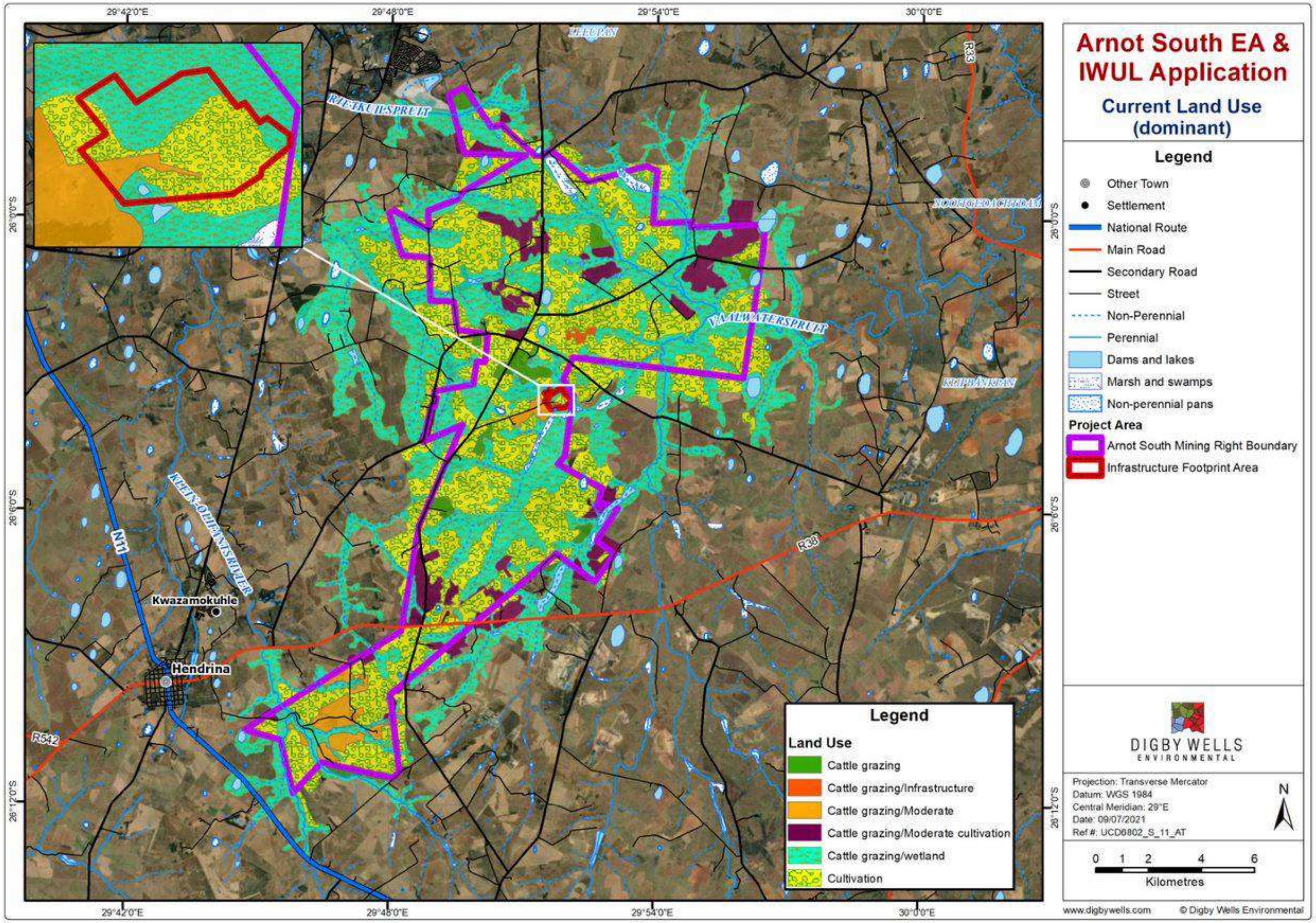


Figure 11-12: Current Land Use

11.4.3 Land Capability and Sensitivity Analysis

Land capability was determined by assessing a combination of soil, terrain and climate features. Land capability is defined by the most suitable land use under rain-fed conditions. The approach by U.S. Department of Agriculture (1973) and Schoeman et al. (2000) was used to assess the land capability. The classification system is made up of land capability classes and land capability groups.

Class	Increased Intensity of Use									Land Capability Groups	Sensitivity	
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable Land	High	W – Wildlife F – Forestry LG – Light Grazing MG – Moderate Grazing IG – Intensive Grazing LC – Light Cultivation MC – Moderate Cultivation IC – Intensive Cultivation VIC – Very Intensive Cultivation
II	W	F	LG	MG	IG	LC	MC	IC	-			
III	W	F	LG	MG	IG	LC	MC	-	-			
IV	W	F	LG	MG	IG	LC	-	-	-			
V	W	-	LG	MG	-	-	-	-	-	Grazing Land	Medium	
VI	W	F	LG	MG	-	-	-	-	-			
VII	W	F	LG	-	-	-	-	-	-	Wildlife	Low	
VIII	W	-	-	-	-	-	-	-	-			

Based on the soil delineations, land use and soil chemical and physical analysis, the following areas must be regarded as sensitive areas (areas with a high land capability and suitability) (Table 11-6):

Table 11-6: Soil Sensitivity

Soil Form	Current Land Use (dominant)	Current Land Capability (dominant) (Figure 11-13)	Land Class (Figure 11-14)	Sensitivity (Figure 11-15)
Cartref/Glenrosa	Cattle grazing	LG	VII	Low
Clovelly/Avalon	Cultivation	VIC	I	High
Clovelly/Hutton	Cultivation	VIC	I	High
Clovelly/Glencoe	Cattle grazing/Moderate cultivation	MC	III	High
Clovelly/Pinedene	Cultivation	IC	II	High
Glencoe/Avalon	Cattle grazing/Moderate cultivation	MC	III	High
Glencoe/Mispah	Cattle grazing	LG	VII	Low

Soil Form	Current Land Use (dominant)	Current Land Capability (dominant) (Figure 11-13)	Land Class (Figure 11-14)	Sensitivity (Figure 11-15)
Glencoe/Pinedene	Cattle grazing/Moderate cultivation	MG	VI	Moderate
Katspruit/Kroonstad	Cattle grazing/wetland	MG	V	Moderate
Mispah/Glenrosa	Cattle grazing	LG	VII	Low
Pinedene/Avalon	Cultivation	IC	II	High
Rensburg/Arcadia	Cattle grazing/wetland	MG	V	Moderate
Rensburg/Arcadia /Katspruit/Kroonstad	Cattle grazing/wetland	MG	V	Moderate
Witbank	Cattle grazing/Infrastructure	LG	VII	Low

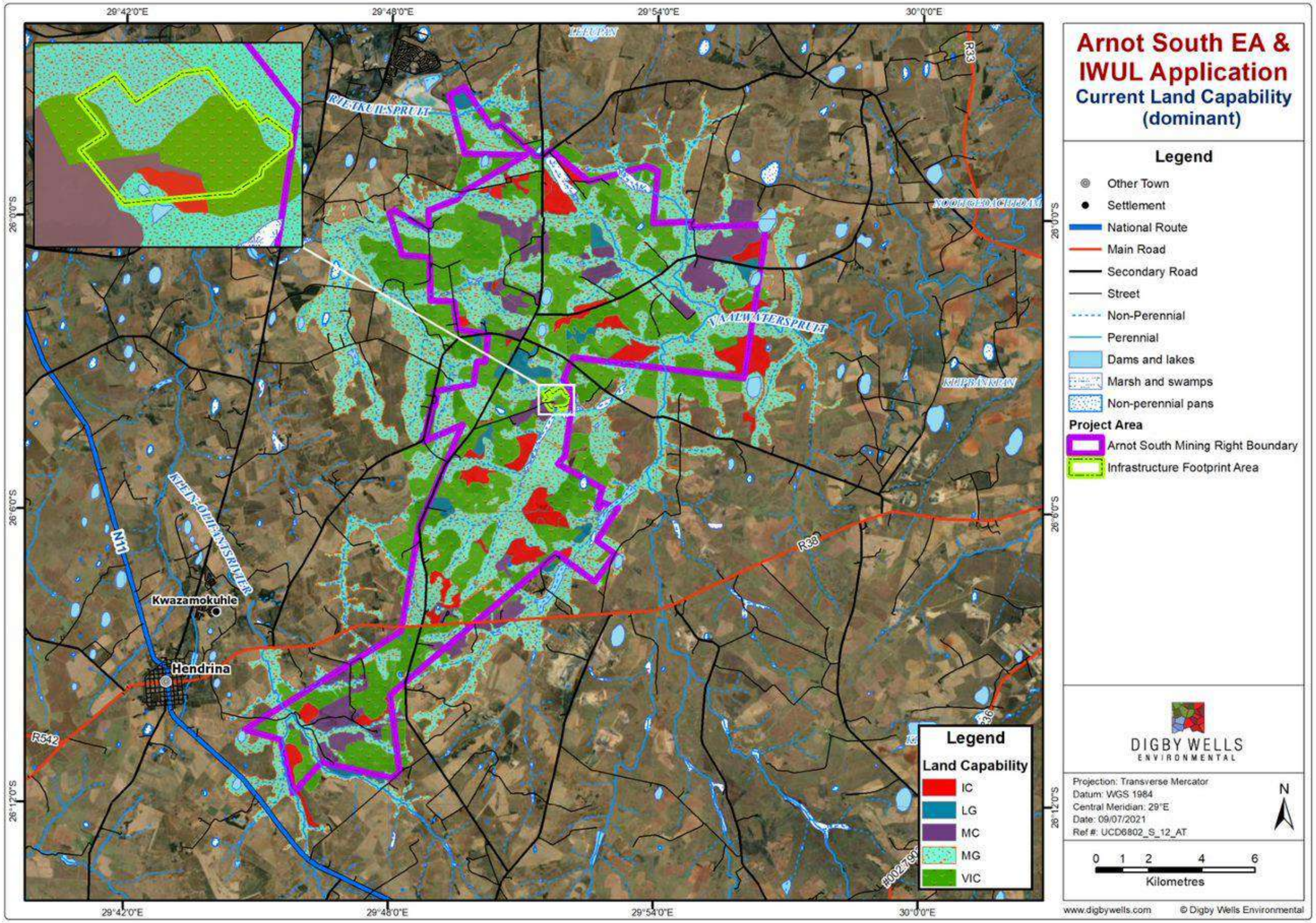


Figure 11-13: Current Land Capability

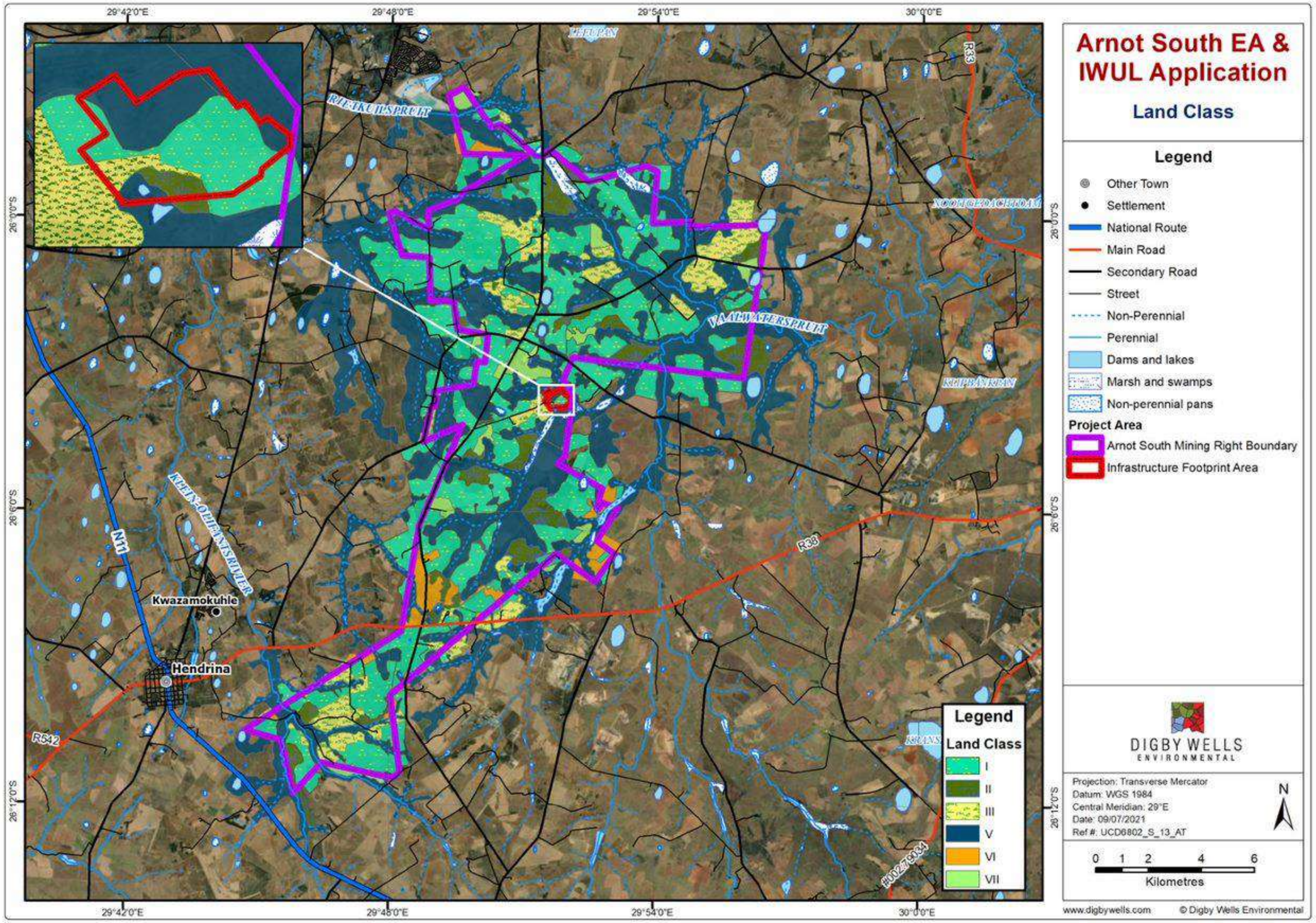


Figure 11-14: Current Land Class

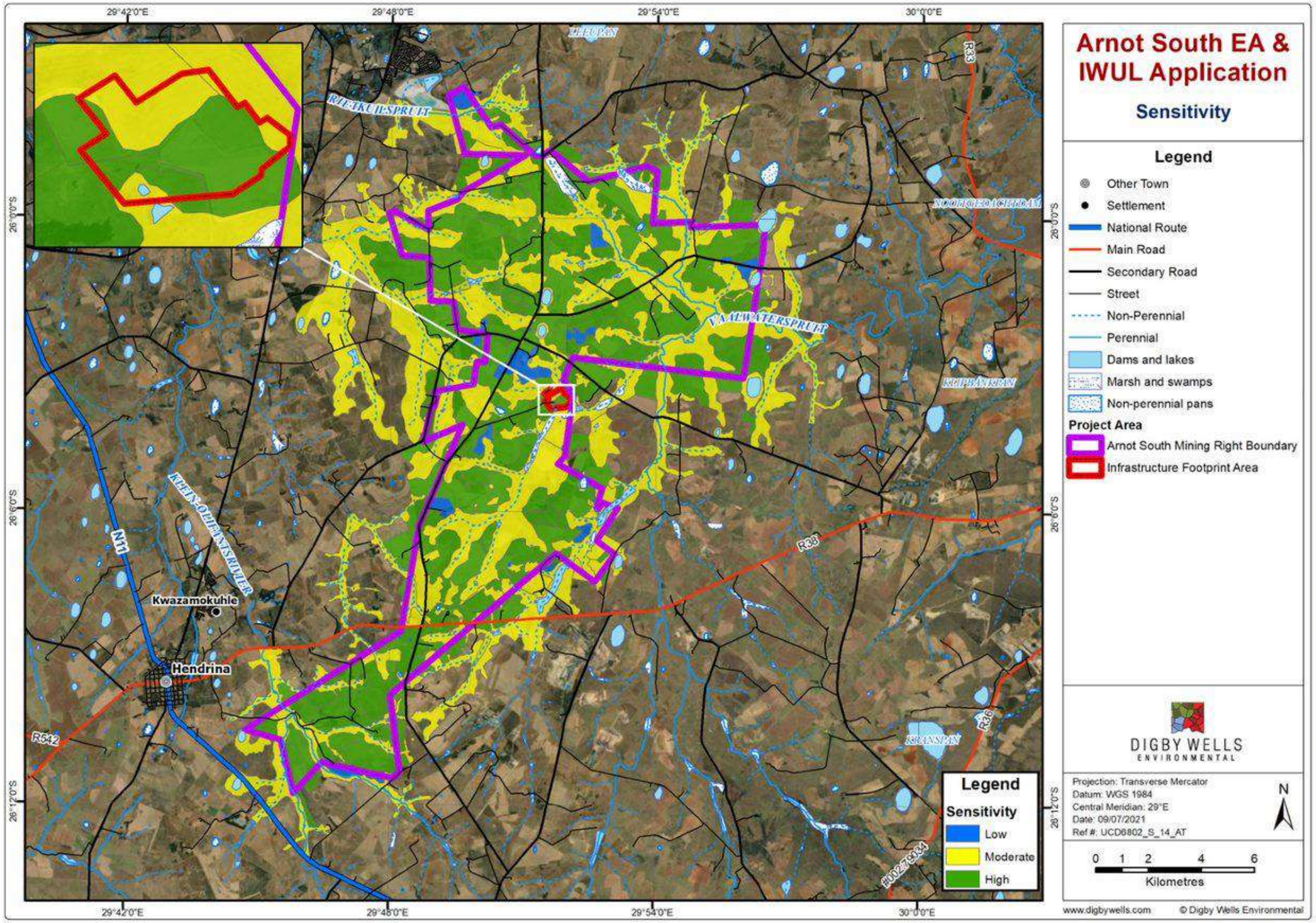


Figure 11-15: Land Sensitivity

11.5 Fauna and Flora

The Fauna and Flora Impact Assessment undertaken during the EIA Phase is appended to this report as Appendix E. This section discusses, in detail, the findings of the flora and fauna assessment conducted by Digby Wells in April 2021 during the EIA phase. Due to access limitations and restrictions, the time of the survey was not conducted during the ideal flowering time (wet season from December to January) and various properties within the Project Area were inaccessible. Together, these limitations may have hindered species data collection as some flowering species would have been missed.

11.5.1 Flora

A walkthrough of the site was undertaken to assess the vegetation. The survey searched for protected and listed plant species and declared Alien Invasive Plants (AIPs), with the overall aim to produce a full species list of all plant species present.

11.5.1.1 Vegetation Communities

The field investigation that was conducted in April 2021 concluded that the vegetation habitats within the Project Area include, grasslands, wetlands, outcrops of sandstone and ferricrete and modified areas. Four broadly defined vegetation units have been delineated and are discussed in detail below. The Project Area comprises of Wetlands, Grasslands (Primary and Secondary), Rocky Outcrops (Sandstone Sheaths and Ferricrete Outcrops) and Cultivated (transformed and/or modified) units. The vegetation units can be viewed in Figure 11-16 and Figure 11-17 below.

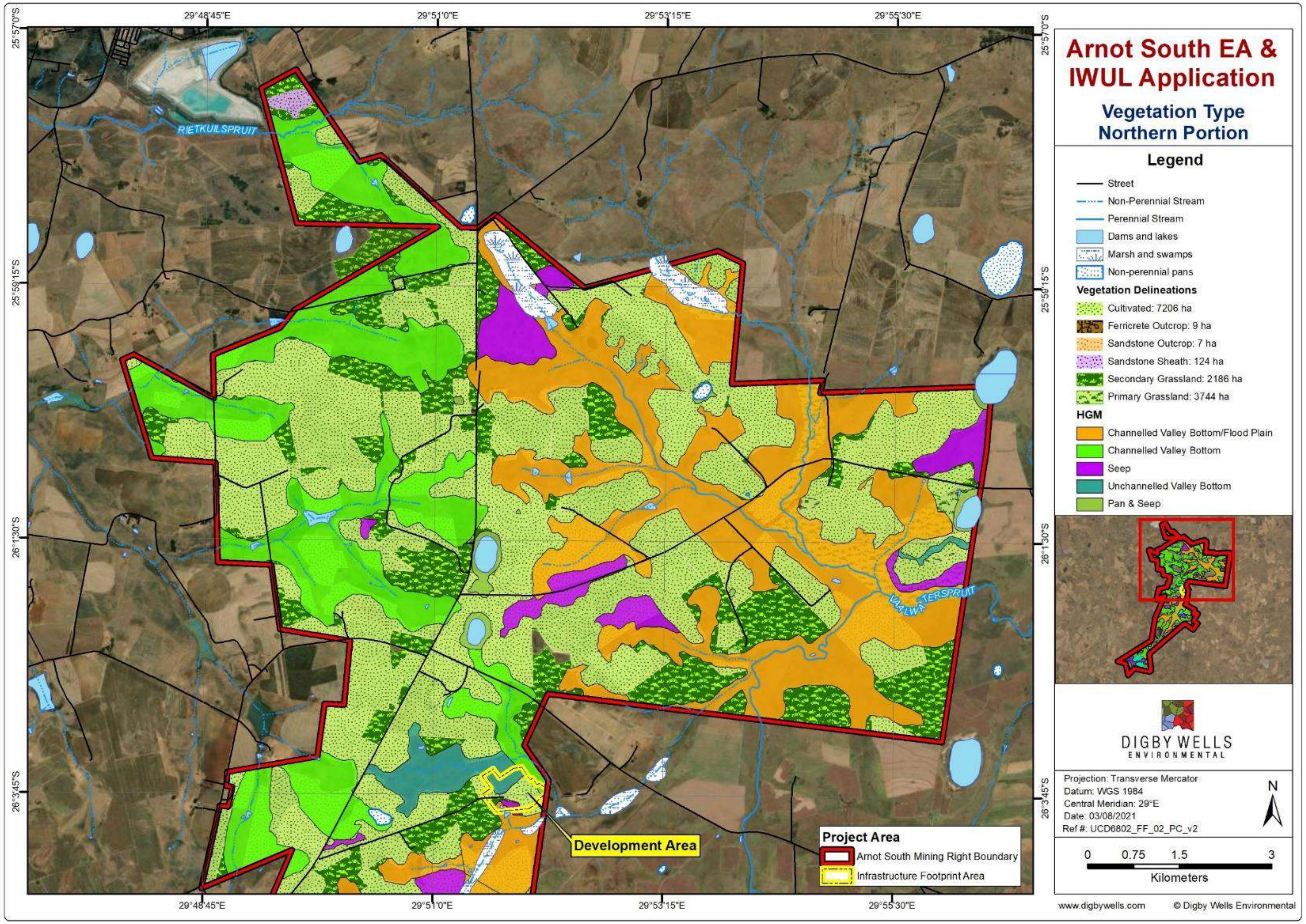


Figure 11-16: Vegetation types of the northern portion of the Project area

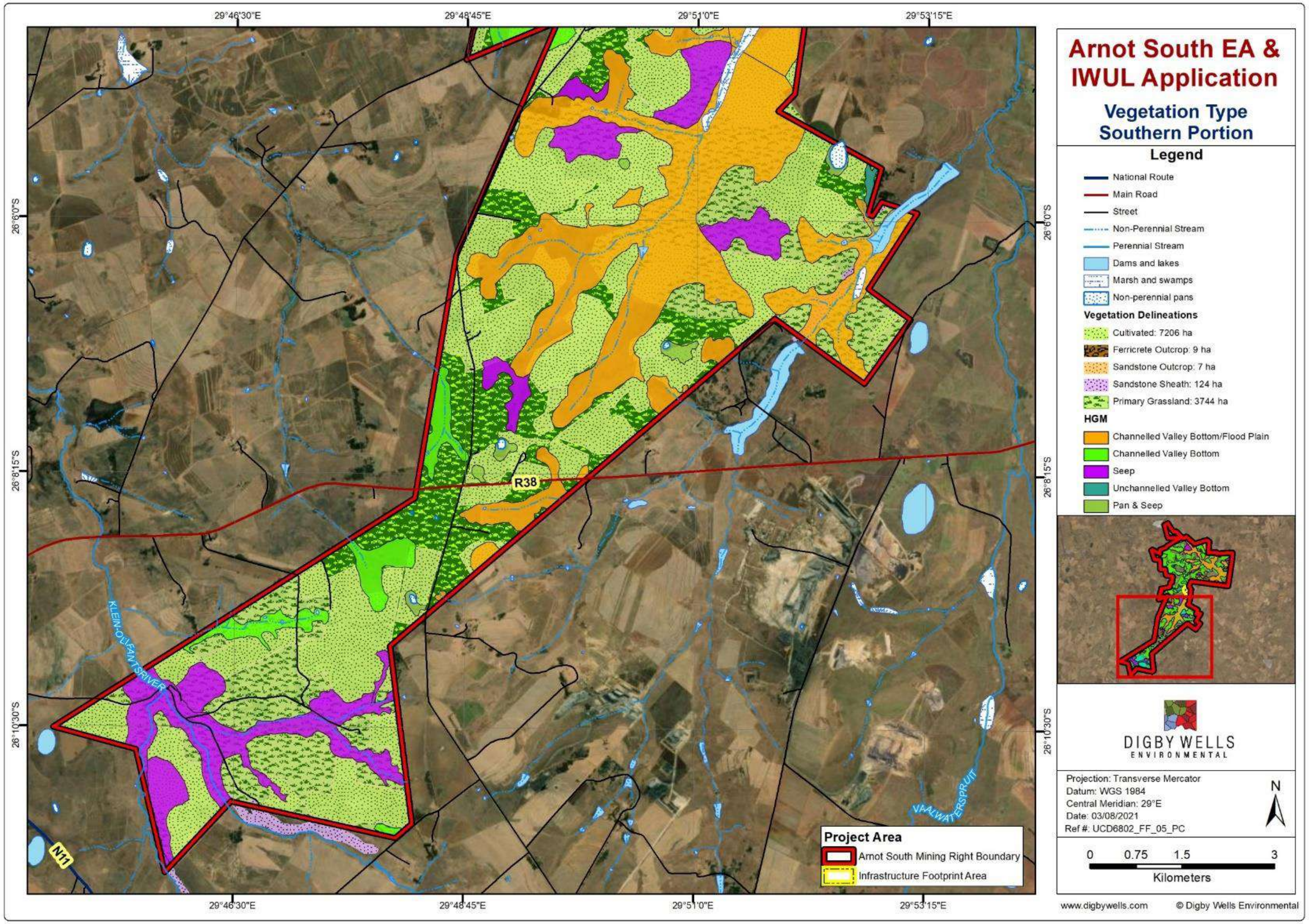


Figure 11-17: Vegetation types of the southern portion of the Project area:

11.5.1.1.1 Wetland Systems

The location of the wetlands is depicted in Figure 11-16 and Figure 11-17. Numerous faunal and floral Species of Conservation Concern (SCC) were encountered within the delineated wetlands. The Channelled Valley Bottom (CVB) Floodplain in the south-eastern portion of the Project Area had evidence of high faunal activity. As the wetland is situated within the outcrop of sandstone sheaths, the undulating topography has permitted limited anthropogenic access, isolating this region from potential disturbances. Accordingly, two faunal SCC were identified within this region and are discussed in Appendix E.

The vegetation description of the wetlands saw two types of vegetation trends: namely Moist Pasture Grasslands and Pan vegetation. These vegetation trends were associated with the listed HGM units. The Moist Pasture Grasslands were associated with the CVB and CVB Floodplains, while the Pan vegetation was associated with the Seeps and Pans. A full description of the vegetation dynamics is presented in Table 11-7 below.

Wetlands are highly sensitive habitats due to their levels of biodiversity and sensitivity to disturbances. They are highly ecologically important as the host numerous faunal assemblages and habitat for floral SCC. The overlay of aquatic and terrestrial habitat results in a varied habitat which attracts a high number of species. Invertebrate and Amphibian diversity is most remarkably high with particular note of avifaunal activity, most notably the Grass Owl (*Tyto capensis*) (VU), and although not recorded during the survey, may occur in these areas. The wetland habitats are regarded as being particularly sensitive as a result of the associated faunal species that rely on them.

Table 11-7: Vegetation description of the Wetland Systems

Eragrostis plana -Agrostis lacnantha - Moist Pasture Grasslands	
Photographic representation	
Description of area	Consists of hydromorphic grasslands, inundated pans and associated marginal grassland vegetation, and vegetated pans.
Current condition	Majority of the HGM units identified within the Project area have varying degrees of disturbances such as AIP proliferation, historical cultivation, impacts from cattle and uncontrolled grazing as well as excavated lands. Most of the HGM units displayed varying degrees of species homogeneity as majority have sustained disturbances from the aforementioned impacts. Most prominent AIPs included *Persicaria lapathafolia, Juncus effuses, Solanum sisymbriifolium, Verbena brasiliensis, and Cirsium vulgare.*
Species of Conservation Concern	*Floral SCC Crinum macowanni, Eucomis autumnalis, Gladioulus sp, Watsonia gladioloides and Brusnvigia* radulosa were encountered in the various HGM units, their locality is depicted in the Sensitivity Map (Figure 11-18 and Figure 11-19). Two faunal SCC were encountered near the Sandstone slopes of the CVB Floodplain (Figure 11-16 and Figure 11-17), namely *African Clawless Otter* and *Serval*. Further details of their location and description are described in Appendix E.
Common species	Common species within the wetlands are representative of moist grasslands and host numerous wetlands indicating species such as *Agrostis lacnantha, Chironia palustris, Eragrostis plana, Monopsis decipiens, Typha capensis, Helichrysum pillosellum, Juncus sp*., and *Hemarthria altissima*. Species encountered in the unit are depicted below.

Images	  Nidorella anomala and Helichrysum aureonitens
	  Limosella lineata and Mariscus congestus

<table>
<tr><th colspan="2">Imperata cylindrica – Leersia hexandra Pan Seep Vegetation</th></tr>
<tr><td>Photographic representation</td><td></td></tr>
<tr><td>Description of area</td><td>Consists of hydromorphic grasslands, inundated pan and associated marginal vegetation.</td></tr>
<tr><td>Current condition</td><td>Various Pans were observed within the Project Area, they are distinguishable as they are encompassed by cultivated fields and are composed of Imperata cylindirca and Leersia hexandra. They are also encompassed by disturbed areas of road verges that have high AIP proliferation consisting of Campuloclinium macrocephalum (1b), Solanum sisymbriifolium (1b), Pennisetum clandestium (1b), Conyza sumatriensis (AIP), and Verbena brasiliensis (1b). the surrounding agricultural activities are negatively impacting the pan and promoting AIP proliferation due the influx of nitrification of the water table. AIPs observed in the pan, included Lagarosiphon major, Myriophyllum aquaticum (1b), and Rumex crispus.</td></tr>
</table>

Imperata cylindrica – Leersia hexandra Pan Seep Vegetation	
Images	 Sebaea leiostyla (top left), Anthericum fasciculatum (right) and Cleome maculat (bottom left).

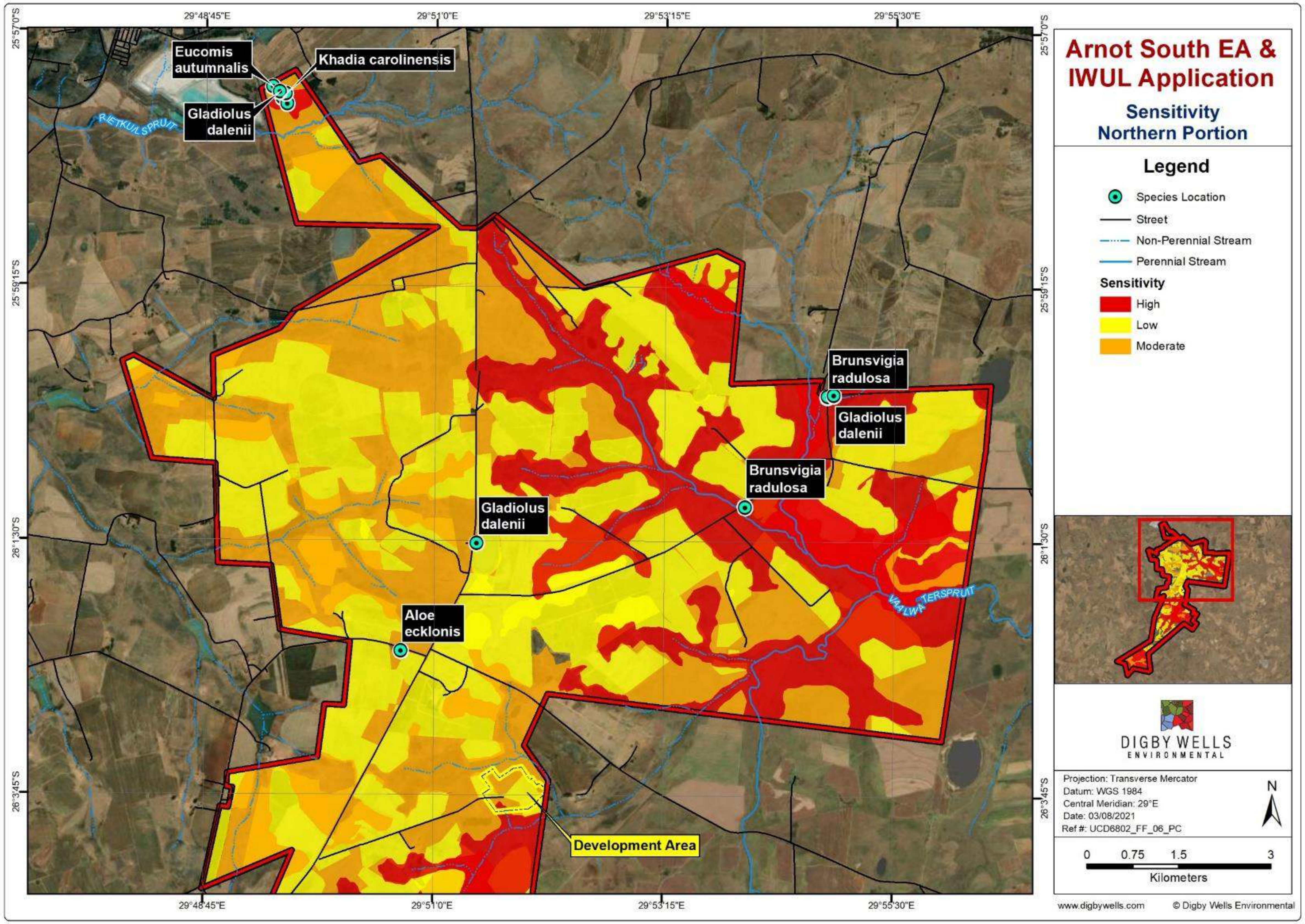


Figure 11-18: Sensitivity Map of the northern portion of the Project area

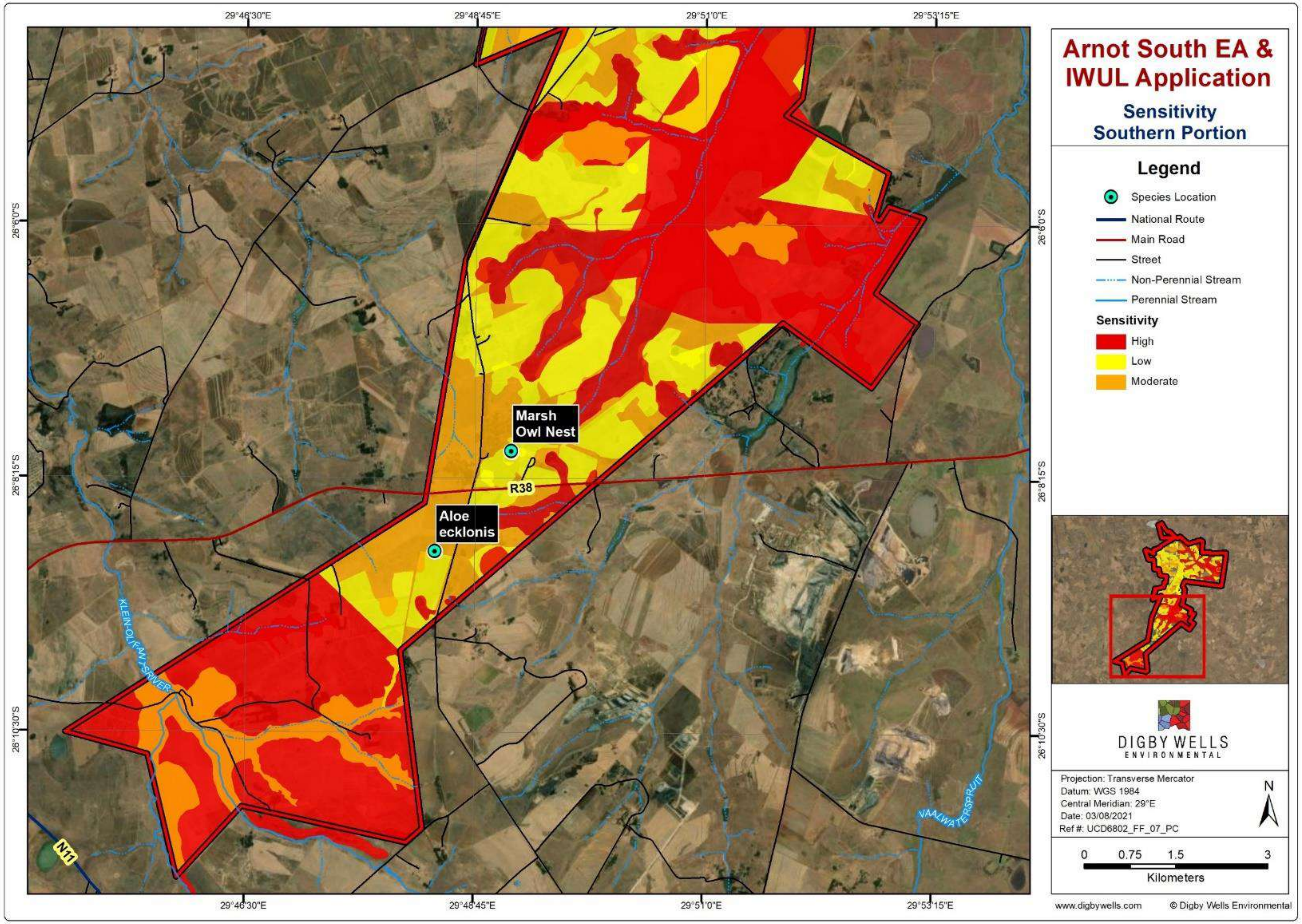


Figure 11-19: Sensitivity Map of the southern portion of the Project area

11.5.1.1.2 Transformed Habitat

Transformed land refers to areas that have been changed or disturbed to such an extent that all-natural habitats, biota and ecosystem functions have been fragmented or lost. The transformed areas within the Project Area were predominantly transformed due to the agricultural practises and cultivation of maize/corn (*Zea mays*) and soybean (*Glycine max*) which constitutes the majority of the total Project Area (7,602 ha). The current land use practices have completely altered the landscape and has permitted AIP proliferation and loss of sensitive habitats, such as wetlands and the existing natural grassland, namely the Eastern Highveld Grassland (Endangered) (Mucina & Rutherford, 2012).

Exotics

Previous natural grasslands have been altered and/or transformed and have been replaced by carpets of *Pennisetum clandestinum* and pioneering AIP shrubs, trees and forbs such as *Acacia mearnsii, Populus x canescens Eucalyptus camaldulensis, Datura stramonium, Cirsium vulgare, Solanum sisymbrifolium,* and *Verbena* brasiliensis, V. officianalis can be observed throughout the transformed areas. Table 11-8 lists all AIPs recorded and their respective NEM:BA Status Category. Cattle grazing was observed throughout the entire Project Area. Vegetation considered in a “natural” state (where no evidence of transformation was observed) were identified within the margins of the wetland areas and rocky outcrops. Dense stands of *Populus x canescens* were observed within the UVB Floodplain and Seep wetlands. Eucalyptus stands were observed encroaching and fringing around the Rocky Outcrop habitats. These dense stands of AIPs accelerate due to the favourable growing conditions, they consume large amounts of water, thereby lowing the water table and thereby threatening the water supplies in the ecology of the region (Bromilow, 2010). The numerous large bodies of water, Pans, within the Project Area had a laciniate of water AIPs around their shorelines. Species included *Periscaria longiseta, Pennisetum clandestinum, Lagarosiphon major, Centella asiatica, Amaranthus viridus* and *Nymphoides thunbergia.* Photographic images of the AIPs recorded are presented in Figure 11-20 below.

Table 11-8: AIPs recorded in the Project Area

Species	Category[2]
Acacia mearnsii*	2
Amaranthus viridus	Invasive
Bidens pilosa	Invasive
Campuloclinium macrocephalum*	1b
Centella asiatica	Invasive

[2] *In accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Alien and Invasive Species List, 2020

Species	Category[2]
Chenopodium alba	Invasive
Cirsium vulgare*	1b
Cosmos bipinnatus	Invasive
Conyza bonariensis	Invasive
Cuscuta campetris	1b
Datura stramonium*	1b
Eucalyptus camaldulensis*	1b
Eucalyptus diversicolor*	2
Gomphrena celosioides	Invasive
Hypericum forrestii	Invasive
Lagarosiphon major	Invasive
Myriophyllum aquaticum*	1b
Nymphoides thunbergiana	Invasive
Oenothera rosea	Invasive
Paspalum notatum	Invasive
Pennisetum clandestinum*	1b
Persicaria longiseta	Invasive
Populus x canescens*	2
Raphanus raphanistrum	Invasive
Richardia brasiliensis	Invasive
Solanum sisymbrifolium*	1b
Tagetes minuta	Invasive
Verbena brasiliensis*	1b

Figure 11-20: Examples of the AIPs identified in the Project area

11.5.1.2 Grassland

As majority of the Project Area has been subjected to anthropogenic (agriculture) activities, the remaining grasslands are broadly defined into two categories: Primary and Secondary grasslands. Primary grasslands are those that have not been significantly modified from their original state; even though they may no longer have their full complement of naturally occurring species, they have not undergone significant or irreversible modification and still retain their essential ecological characteristics see Table 11-9. Secondary grasslands are those that have undergone extensive modification and a fundamental shift from their original state (such as cultivated areas) but have then been allowed to return to a 'grassland' state and left to fallow, allowing a few grassland species to pioneer. Although secondary grasslands may superficially look like primary grasslands, they differ markedly with respect to species composition, vegetation structure, ecological functioning, and the ecosystem services they deliver (SANBI, 2013), refer to Table 11-10.

Table 11-9: Primary Grassland

Primary grassland	
Photographic representation	
Description of area	Primary grasslands species, particularly in mesic grasslands, show poor ability to re-colonise as they are outcompeted by fast-growing annual weeds that colonise when the primary vegetation is removed. When the topsoil has been transformed or removed, the process of natural regeneration is a decade-long process, and this exacerbates the degradation of the grassland. Primary grassland areas were observed in the margins of the Rocky Outcrops and various Pans located in the Project area. They comprise of a high density of forbs and a diverse graminoid component.
Coverage of area	3,744 ha
Current condition	The primary grasslands in the Project area have had the least exposure to cattle grazing and very little AIP composition, indicating they have not been ploughed.
Species of Conservation Concern	Several floral SCC were recorded, including provincially protected (MNCA, 1998) *Aloe ecklonis, Gladiouls delanii* and *Watsonia gladioloides*.
Common species	Dominant grasses include Eragrostis curvula and Hyparrhenia hirta with other species including Aristida congesta, Hyparrhenia filipendula, and Setaria pallide-fusca Forbs included: Chaenostoma leve, Dimorphotheca spectabilis, Haplocarpha lyrata, Ipomoea ommanneyi, Helichrysum coriaceum, H. aureonitens. and Hilliardiella oligocephala.

Primary grassland	
Images	  Helichrysum coriaceum and Hilliardiella oligocephala   Aloe ecklonis (SCC) and Dimorphotheca spectabilis

Table 11-10: Secondary Grassland

Secondary Grassland	
Photographic representation	 High density of Serphium plumosum
Description of area	The secondary grasslands are distinguishable from the primary grasslands in their notable depleted diversity. They generally miss resprouting species and do not respond in the same way as natural grasslands to fire disturbances. They also have a much lower below-ground root biomass compared to the high below-ground root biomass of natural grasslands. The impacts associated with ploughing disturbances can be observed both above and below the ground (Zaloumis, 2013).
Coverage of area	2,186 ha
Current condition	The secondary grasslands had evidence of loosened topsoil, previous ploughing and AIPs. The dominance of *Serphium plumosum* is indicative of overgrazed grasslands (see image above). Previously burnt grasslands showed signs of soil erosion as they have a lower establishment of plants to hold the soil intact when faced with high levels of water runoff. Forb species composition was very low and graminoid homogeneity was high in comparison to primary grasslands.
Species of Conservation Concern	No floral SCC were encountered in the secondary grasslands
Common species	Dominant grasses included Eragrostis curvula, Eragrostis gummiflua, and Themeda triandra. Pioneering forbs and AIPs included Conyza bonariensis (AIP), Gomphocarpus fruticosus, Pseudognaphalium luteoalbum and Solanum pandiforme (AIP).

<table>
<tr><th colspan="2">Secondary Grassland</th></tr>
<tr><td>Images</td><td>
Secondary grassland adjacent to Maize field</td></tr>
</table>

11.5.2 Fauna

A walkthrough of the site was conducted during the site survey whereby faunal species were identified by visual sightings as well as using spoor, droppings and roosting sights and available habitat. Camera traps and Sherman traps were set up in various locations where high faunal activity was observed and expected.

11.5.2.1 Mammals

A total of 15 mammals were recorded during the infield assessments. The mammal species were encountered and observed throughout the Project area within the various habitat units. Various mammals of the Herpestidae (Mongoose) family were observed throughout the numerous wetlands. Tracks of a Water Mongoose were observed throughout the numerous CVB wetlands. Numerous sightings of Black-backed Jackal and Scrub Hare were recorded throughout the Project area. Meerkats were observed within the Helpmakaar 168 IS farm portions (see Figure 11-21) with numerous Aardvark burrows adjacent to the large dam in the northern area of the farm portion. The CVB Floodplain associated with the sandstone outcrop in the portions of Vaalwater 173 IS, showcased high activity of crepuscular species such as Porcupine, Water Mongoose, Serval, and African Clawless Otter. The latter two, Serval and African Clawless Otter, are both listed as Near Threatened according to the Regional Red List Assessment of the IUCN. A list of all mammals recorded in the Project area is presented in Table 11-11 below.

The Otters are inhabiting the CVB Floodplain in the above-mentioned portion as they are predominantly aquatic and are seldom found far from permanent water sources. Scats and tracks were encountered in this area (see Figure 11-22). Generally, they are found in marine habitats, but they are also associated with riverine habitats, particularly with rocks, dense vegetation, and undisturbed long grasses (Perrin, 2000). Fresh water is an essential habitat requirement not only for drinking but for rinsing their coats. The African Clawless Otter is predominantly crepuscular, meaning they are mostly active at dawn and dusk. The major threat to the African Clawless Otter is the deterioration of freshwater ecosystems. In South Africa, 84% of the river ecosystems are threatened, while 54% are Critically Endangered (Nel, 2011). Riverside, wetland and coastal habitats must be protected to allow sufficient breeding and foraging environments necessary for them to persist and disperse between habitats (Okes N., 2016).

Evidence of Serval tracks and scats were observed within the sandstone outcrop of the above-mentioned wetland, see below in Figure 11-23. Servals are found in many protected areas within South Africa and are included on CITES Appendix II and protected under national legislation (TOPS regulations) (SANBI, 2018). It is listed as Least Concern (LC) globally and Near Threatened (NT) nationally on the IUCN Red List. Effective conservation of Serval depends on the conservation of wetlands. If wetlands are protected in a mosaic of farmland use, the landscape may support the persistence of Serval populations.

Table 11-11: Mammals recorded in Project area

Family	Species	Common Name	Conservation status
Bovidae	Sylvicapra grimmia	Bush Duiker	LC
Canidae	Canis mesomelas	Black-backed Jackal	LC
Felidae	Leptailurus serval	Serval	NT
Herpestidae	Atilax paludinosus	Water Mongoose	LC
Herpestidae	Cynictis penicillata	Yellow Mongoose	LC
Hystricidae	Hystrix africaeaustralis	Cape Porcupine	LC
Leporidae	Lepus saxatilis	Scrub Hare	LC
Muridae	Aethomys namaquensis	Namaqua Rock Mouse	LC
Muridae	Gerbilliscus brantsii	Highveld Gerbil	LC
Muridae	Otomys angoniensis	Angoni Vlei Rat	LC
Muridae	Rhabdomys pumilio	Four-striped Grass Mouse	LC
Mustelidae	Aonyx capensis	African Clawless Otter	NT
Orycteropodidae	Orycteropus afer	Aardvark	LC
Sciuridae	Xerus inauris	Ground Squirrel	LC
Herpestidae	Suricata suricatta	Meerkats	LC

Figure 11-21: Meerkats

Figure 11-22: Scats and tracks of African Clawless Otter

Figure 11-23: Scats and tracks of Serval

11.5.2.2 Birds

Birds are viewed as good ecological indicators, as their presence or absence tends to represent conditions of a functioning ecosystem. The direct link between bird diversity and land cover portrays a direct indication of the habitats in the area of interest.

According to the SABAP2 database, over 140 species of birds have been identified in the area (see Appendix E). The majority of these birds are comprised of grassland and waterbird species. Seventy-four (74) birds were recorded during the field assessment in April 2021. It should be noted that April is not an ideal bird viewing frame as many wading birds may have been missed due to the late season observation. The identified birds are listed in Appendix E. Numerous pans are scattered throughout the Project area and hosted many waterfowl including Egyptian Geese, Grey Herons, Whiskered Terns, Reed Cormorant, Yellow-billed Ducks, Red Knobbed Coots, Cormorants, Egrets, and Red-billed Teals. The pan in the farm portion Groblersrecht 175 IS (RE/6), was composed of the grass *Imperata cylindrica*, and efforts were undertaken to search for African Grass Owls (*Tyto capensis*), as this is their preferred nesting material.

No African Grass Owls were identified; however, an active Marsh Owls (*Asio capensis*) nest, with egg, was identified within this pan. It is thus highly recommended, that a thorough screening of the *Imperata cylindrica* dense wetlands within the Project area be screened for the potential presence of the African Grass Owl, during their breeding season in February prior to any Project activities.

11.5.2.3 Herpetofauna

Herpertofauna is defined as reptiles and amphibians inhabiting a given area. Reptiles are ectothermic (cold-blooded) meaning they are organisms that control body temperature through external means. As a result, reptiles are dependent on environmental heat sources. Due to this, many reptiles regulate their body temperature by basking in the sun, or in warmer areas. Substrate is an important factor determining which habitats are suitable for which species of reptile.

During the field assessment, three amphibian species were identified within the wetland, and pans, via its call and by direct sightings. The Delalande's River Frog (*Amietia delalandii*), Bubbling Kassina (*Kassina senegalensis*) and the Boettger's Caco (*Cacosternum boettgeri*) (all Least Concern) were recorded within the wetlands.

Reptiles are notoriously difficult to comprehensively detect during short field surveys, due to many species in this group naturally occurring at low densities and being inherently illusive. Five species of reptile were identified, namely Speckled Rock Skink (*Trachylepsis punctatissima*), Rinkhals (*Hemachatus haemachatus*), African Helmeted Turtle (*Pelomedusa subrufa*), Spotted Skaapsteker (*Psammophylax rhombeatus*) and the Common Brown Water Snake (*Lycodonomorphus rufulus*) (all Least Concern). The Skink was encountered basking on the outcrops of the sandstone sheaths. The snakes were unfortunately found as roadkill in the interconnecting dirt roads of the Project area. The remaining grassland and wetland habitats provide both hunting sites and shelter for herpetofauna, primarily amphibians colonizing the wetlands which in turn attracts reptile predators.

The observed species diversity for both reptiles and amphibians was considerably low. The weather during the field survey was wet and overcast, this may have hindered the presence of herpetofauna (specifically reptile) species within the Project area.

Figure 11-24: Delandes River Frog (top left), Speckled Rock Skink (bottom left), African Helmeted Turtle (middle) and Rinkals (right)

11.5.2.4 Invertebrates

Invertebrates are the main components of faunal diversity in grasslands, playing substantial roles in ecosystem processes including nutrient cycling and pollination. Grassland invertebrate communities are heavily dependent on plant diversity and production within a given system (Barnett and Facey, 2016). During the field assessment in April 2021, a total of thirty-three (33) invertebrates were identified and are listed in Appendix E of this report. Various images of invertebrates were captured during the field assessment and are presented in Figure 11-25.

Various species of the Nymphalidae family were recorded despite the survey being conducted during Autumn. The presence and frequency of wetlands in the Project area provide ideal habitat for the SCC Marsh Sylph (*Metisella meninx*) (Near Threatened). *M.* meninx is an obligate wetland species and depends on the occurrence of *Leersia hexandra* (Rice Grass), of which has been recorded in majority of the wetland habitats. Henning (2009) states that this species requires unpolluted marsh habitats. The adults tend to roost low down in the wetland vegetation, above the water level – which makes the susceptible to unexpected flooding. Adults rely on nectar to replenish their energy demands, of which has been noted to be obtained from *Verbena bonariensis, V. brasililiensis,* and *Persicaria spp* (all of which were recorded within the wetland habitats).

Figure 11-25: Painted Lady (top left), Jaunty Dropwing (bottom left), Short Horned Grasshopper (middle) and Common Threadtail (right)

11.6 Wetlands

The Wetland Impact Assessment undertaken during the EIA Phase is appended to this report as Appendix F. Wetlands associated with the Project area have been delineated at a desktop level using detailed aerial imagery and identifying wetland signatures. These were then confirmed during a rapid site survey undertaken between the 20th and the 23rd of April 2021. The site survey was used to refine the wetland delineation and to determine the Present Ecological State (PES), ES and the Ecological Importance and Sensitivity (EIS).

Land use activities and in-field studies have shown that some of the wetland systems are similar from a catchment management perspective, as they would be subject to similar overall land use impacts. Therefore, it was considered practical to group the HGM units by systems that have similar land use and impacts to calculate more accurately the PES, ES, as well as EIS scores.

Fifteen (15) wetland HGM systems were identified, some comprising several HGM units. The HGM units were grouped and named into various systems as explained in Table 11-12.

Table 11-12 HGM System Names

HGM System Number	System Name	Grouping method
1	Infra CVB	Proposed infrastructure area
2	Infra CVB/FP	Proposed infrastructure area
3	Infra Seep	Proposed infrastructure area
4	Infra UVB	Proposed infrastructure area
5	CVB	Combined system
6	CVB	Combined system
7	CVB	Combined system
8	CVB	Combined system
9	CVB/FP	Combined system
10	Pan & Seep	Dominant land use: Cultivated
11	Pan & Seep	Dominant land use: Grazed
12	Seep	Dominant land use: Cultivated
13	Seep	Dominant land use: Grazed
14	UVB	Dominant land use: Cultivated
15	UVB	Dominant land use: Grazed

Following the wetland assessment, an impact assessment was completed to determine the significance each proposed activity will have on the associated wetlands.

11.6.1 Wetland Indicators

The wetland delineation was undertaken according to a combination of the accepted methodologies from 'A practical field procedure for identification and delineation of wetlands and riparian areas' (Department of Water Affairs and Forestry, 2005) and the "Updated manual for identification and delineation of wetlands and riparian areas" (Department of Water Affairs and Forestry, 2008).

11.6.1.1 Terrain Unit Indicators

The topography of the Project area is typical of the Eastern Highveld Grassland with gentle, rolling grassland slopes and many valley systems and depressions scattered across the landscape. Typical terrain indicators identified in the Project area can be seen in Figure 11-26. Due to the size of the Project area, the terrain indicator was used as the dominant wetland indicator for the wetland delineations.

Typical valley bottom system. Well vegetated with open water bodies, grazed fields and AIPs in the catchment.

Natural pan with hillslope seep wetland. Area is heavily grazed with low basal cover and fence line.

Figure 11-26: Terrain Indicators

11.6.1.2 Soil Indicators

Soil indicators, including soil forms (i.e., Katspruit, Kroonstad and Rensburg) and soil wetness (i.e., mottling, gleying and leaching) were used, where possible, to identify and confirm wetland delineations. The low-lying areas of the Project area were characterised by increased clay content and increased soil wetness. These soils were identified as hydromorphic soils and are saturated for long periods with a fluctuating water table, altering the morphology of the soils. These soils are somewhat limited for cultivation and highly mobile (high erosion probability). The delineated wetlands were mostly defined as **permanent** and **seasonal** wetlands due to their setting in the landscape and clear SWI (mottles and gleying). Various land use activities limited SWI and SFI due to geomorphological changes, hydrogeomorphic changes and changes to the natural vegetation (Table 11-13).

Table 11-13 Soil Indicators

Dominant hydromorphic soils	• Arcadia; • Rensburg; • Avalon; • Champagne;	• Katspruit; • Kroonstad; • Clovelly; and • Pinedene

Hydromorphic soil (G-horizon) with high clay content and iron (Fe) mottles. Typically located within seep wetlands.	*Hydromorphic soil (Vertic A-horizon overlying a G-horizon) with clear mottling of Fe and high clay content. Typically located within valley bottom and pan wetlands.*

11.6.1.3 Vegetation Indicators

Plant communities undergo distinct changes in species composition along the wetness gradient from the centre of the wetland to the edge and into adjacent terrestrial areas. Vegetation communities of the various wetlands and their respective HGM units were relatively variable. Large portions of the natural vegetation communities had been historically altered, impacting the natural vegetation communities (Table 11-14). Refer to the Fauna and Flora Impact Assessment Report for a detailed list of species (DWE, 2021).

Table 11-14 Vegetation Indicators

Dominant Species	*Juncus effusus*, *Monopsis decipiens, Schoenoplectus brachyceras, Typha capensis*, *Cyperaceae Sp*., *Agrostis lachnantha, Leersia hexandra, Paspalum distichum, Hemarthria altissima, Hyparrhenia tamba, Setaria sphacelata; Aristida junciformis, Themeda triandra, Eragrostis plana, Eragrostis gummiflua, Chironia palustris, Helichrysum pillosellum* and *Imperata cylindrica*.
	*Eucomis autumnalis* SCC within seep and valley bottom wetlands.
	*Salix Sp., Juncus effusus, Typha capensis and Eragrostis Sp.* in valley bottoms and pans.

11.6.2 Wetland Delineation and HGM Unit Identification

The delineated wetlands cover approximately **7,555.5 ha**, comprising approximately **47.2%** of the total Project area. The infrastructure area is proposed to cover approximately **65 ha** of wetlands. Figure 11-27 below depicts the delineated wetlands with details of each HGM unit subsequently provided in Table 11-15.

The HGM units were categorised into 15 HGM systems refer to Table 11-12. The wetland delineations are illustrated in Figure 11-27.

Table 11-15 HGM System Names

HGM System Number Name	Area (ha)
1 Infra CVB	120.4
2 Infra CVB/FP	135.6
3 Infra Seep	4.9
4 Infra UVB	140.9
5 CVB	116.6
6 CVB	1,247.6
7 CVB	242.4
8 CVB	344.7
9 CVB/FP	4,006.9
10 Pan & Seep (cultivated)	141.8
11 Pan & Seep (grazed)	18.5
12 Seep (cultivated)	258.6
13 Seep (grazed)	755.6
14 UVB (cultivated)	11.9
15 UVB (grazed)	9.1
Total Area	**7,555.5**

Following the wetland assessment, an impact assessment was completed to determine the significance each proposed activity will have on the associated wetlands. Field verification focused specifically on the proposed infrastructure areas as well as on areas proposed for high extraction (shallow coal resources). Wetlands that will be impacted to a lesser extent, such as wetlands located within the 500 m Zone of Regulation were verified at a desktop level.

The Zone of Regulation and each HGM unit type identified within the Project area are described in the subsections below.

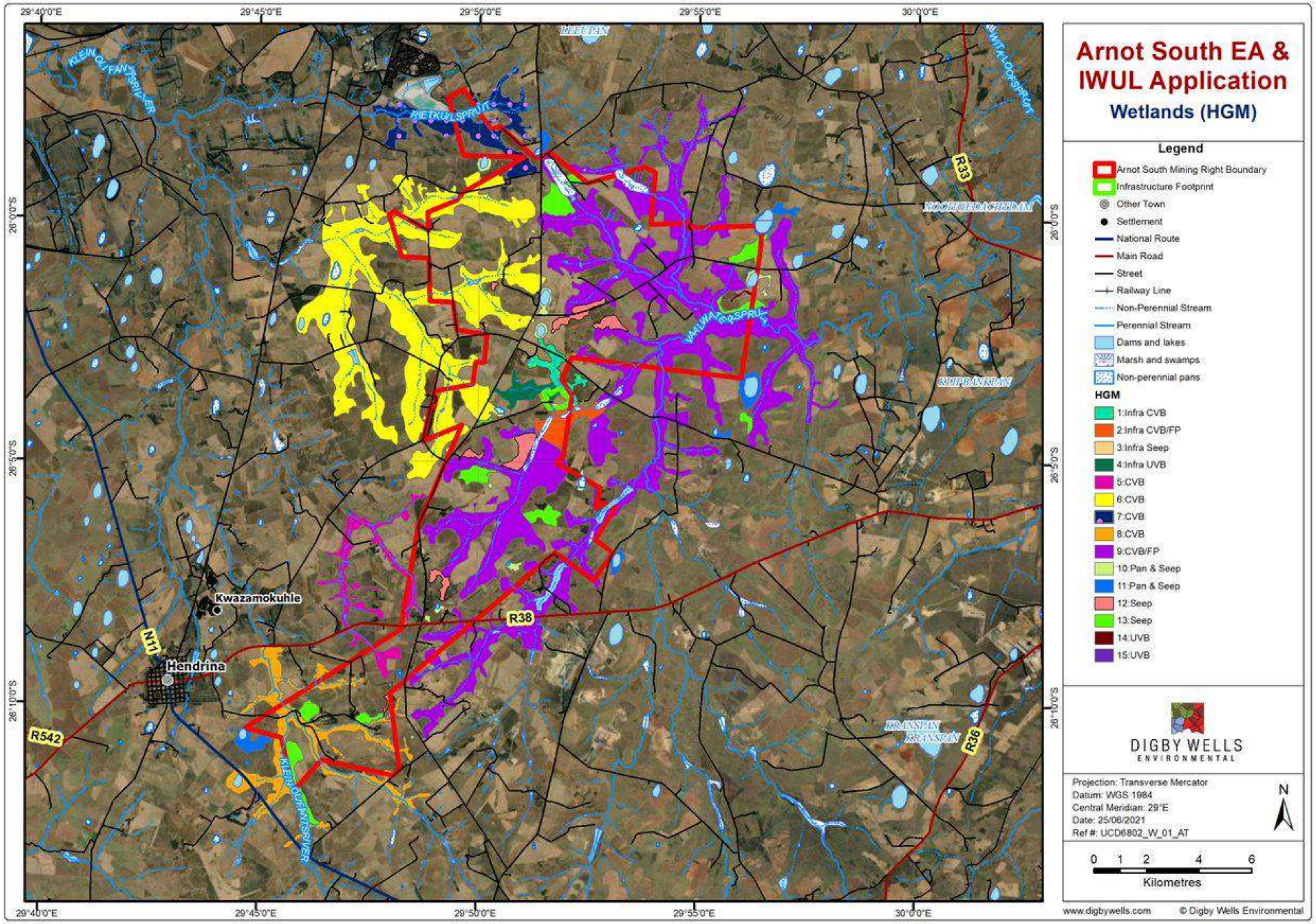


Figure 11-27: Wetland Delineations

11.6.2.1 Floodplains

The general features that are typical of floodplain wetlands such as oxbows and depressions, were identified in the floodplain wetlands (HGM Systems 2 and 9). Floodplains have however been impacted by historical and current land uses (e.g., agropastoral activities, mining and anthropological activities) altering the hydrology, geomorphology and vegetation.

The floodplains are unlikely to contribute significantly to stream flow regulation. The generally clayey nature of floodplain soils retain water, which is likely to be lost through evapotranspiration, thereby limiting their contribution to stream flow regulation and groundwater recharge (Kotze *et al.,* 2005). However, due to the deep incisions, erosion gullies and increased runoff, the floodplains are contributing more than natural flow to the catchment.

11.6.2.2 Channelled Valley Bottoms

CVBs within the Study Area (HGM Systems 1, 2, 5, 6, 7, 8 and 9) are narrow, deeply eroded and somewhat well vegetated. The systems however have indications of cattle trampling and overgrazing in some areas reducing the natural vegetation cover leading to loss of basal cover, erosion and sedimentation. These systems are an important service provider to both the environment (e.g., habitat, food source, sediment trapping, toxicant removal and flood attenuation) and humans (e.g., water provisions, food sources and fishing).

11.6.2.3 Unchannelled Valley Bottoms

Unchannelled Valley Bottoms (UVB) delineated include HGM Systems 4, 14 and 15. The UVB wetlands are generally well vegetated and characterised by gentle slopes that are dominantly used for cultivation and cattle grazing. The agricultural impacts on this wetland will ultimately result in the formation of channels whereby the HGM unit will be converted to a CVB where the associated ecosystem services will be lost/ changed. By forming a channel, the wetland will be narrowed and concentrated, drying out the sides of the UVB and seeps. These may arise because of overgrazing, the establishment of farm roads, infrastructure, culverts and dams that initiate the process of erosion, compaction and increased runoff. The UVBs of the Project area were generally well functioning and accommodated various SCC.

11.6.2.4 Depressions (Pans)

Depressions are usually hydrologically disconnected from the stream network as they are inward draining wetlands. Most of the depressions together with their catchments within the Project area are impacted by cultivation, cattle grazing and historical mining activities. Impacts include cattle trampling, excavations, construction of berms, loss of vegetation cover in the catchments, sedimentation, cultivation and increased nitrates and phosphates. The pans were grouped into two categories:

- Cultivated Pans & Seeps (HGM System 10) – Cultivation was the dominant land use in these systems, where impacts include:
  - Complete/partial destruction of the natural geomorphology;

- Changes to the natural hydrology; and
- Compete/partial removal of natural vegetation and increased AIPs.

- Grazed Pans & Seeps (HGM System 11) – Cattle grazing was the dominant land use in these systems, where impacts include:
  - Partial destruction of the natural geomorphology (e.g., erosion, compaction, hardened surface);
  - Changes to the natural hydrology (e.g., increased runoff, drying out of seeps, water ponding); and
  - Partial removal of natural vegetation and increased AIPs.

11.6.2.5 Hillslope Seep Wetlands

The Seeps (HGM 3, 12 and 13) were all connected to a watercourse. The dominant land use is intensive cultivation and cattle grazing where the soil depth was not adequate for cultivation. The Seeps contribute significantly to the groundwater as the soils are dominantly interflow and recharge soils (deep, sandy soils). The Seeps were grouped according to the dominant land use:

- Infrastructure-impacted Seep – The Seep wetlands within the proposed infrastructure area were assessed separately as these wetlands will most likely be impacted by the proposed activities, these include:
  - Complete/partial removal of Seep wetlands (geomorphology);
  - Complete/partial removal of natural vegetation (e.g., soil stripping, stockpiling, construction of infrastructure, linear infrastructure);
  - Complete/partial destruction of the natural hydrology (e.g., hardened surfaces, increased flow, erosion and sedimentation).

- Cultivated Seeps (HGM System 12) – Cultivation was the dominant land use in these systems, where impacts include:
  - Complete/partial destruction of the natural geomorphology;
  - Changes to the natural hydrology; and
  - Compete/partial removal of natural vegetation and increased AIPs.

- Grazed Seeps (HGM System 13) – Cattle grazing was the dominant land use in these systems, where impacts include:
  - Partial destruction of the natural geomorphology (e.g., erosion, compaction, hardened surface);
  - Changes to the natural hydrology (e.g., increased runoff, drying out of seeps, water ponding); and

- Partial removal of natural vegetation and increased AIPs.

11.7 Aquatic Ecology

The Aquatic Ecology Impact Assessment undertaken during the EIA Phase is appended to this report as Appendix G. The site survey was conducted in April 2021. Details pertaining water quality, aquatic and riparian habitat, aquatic macroinvertebrates, fish communities and integrated ecostatus determination is discussed in the subsections below.

11.7.1 Water Quality

The *in situ* water quality results of the 2021 late wet season survey for the watercourses associated with the proposed Project are presented in Table 11-16 and further discussed in the below sections. For the purposes of the assessment, each of the values were compared against various water quality guidelines, including:

- Temperature, pH and saturation percentage guidelines obtained from Department of Water Affairs and Forestry (1996a);
- Conductivity guideline value of 500 µS/cm stipulated in U.S. Environmental Protection Agency (2010); and
- Dissolved oxygen concentration guideline for macroinvertebrates from Nebeker et al. (1996). And dissolved oxygen saturation for aquatic biota from Department of Water Affairs and Forestry (1996).

Table 11-16: *In situ* Water Quality Results for Watercourses Associated with the proposed Project

River System	Site	Time	Temperature (°C)	pH	Conductivity (µS/cm)	Dissolved oxygen (mg/l)	Dissolved oxygen (Saturation %)
Guideline	-	-	5 - 30	6 - 8	≤ 500	> 5	80 - 120
Klein-Olifants Tributary	**KO1**	11H35	20.2	**8.14**	**820.0**	5.53	**42.8**
	KO2	12H10	23.1	**8.19**	**699.0**	5.61	**66.1**
	KO3	10H20	18.7	**8.23**	157.4	7.64	80.4
Rietkuilspruit	**RK1**	10H32	20.1	**8.01**	**1230.0**	5.53	**62.5**
	RK2	09H56	18.3	7.91	**1287.0**	**4.34**	**45.6**
	RK3	09H00	15.8	**8.04**	**8880.0**	**4.63**	**34.2**
Vaalwaterspruit	**VW1**	13H01	24.0	**8.24**	**691.0**	5.42	**64.8**
	VW2	14h00	21.9	**8.23**	**905.0**	7.26	81.6
	VW3	11H38	20.1	**8.24**	409.0	7.11	88.1
	VW4	15H46	20.6	**8.19**	**863.0**	6.06	87.3
	VW5	16H33	19.3	**8.18**	**938.0**	6.86	84.3

***Red values indicate constituents exceeding recommended guideline values**

11.7.1.1 Temperature

The temperatures of inland waters in South Africa generally range from 5-30ºC which is the range within which most aquatic invertebrates in southern Africa thrive (DWAF, 1996). Temperature values recorded at monitoring sites associated with the proposed Project ranged from 15.8ºC to 24.0ºC, typical of the summer season temperatures in South Africa. Therefore, all recordings were within the normal temperature ranges for inland waters, thus all sites were expected to support temperature-sensitive aquatic biota.

11.7.1.2 pH

The pH values recorded exhibited close to neutral to slightly alkaline conditions, ranging from 7.91 pH units to 8.24 pH units during the present study. The DWAF (1996) guideline upper limit of 8 pH units was exceeded at all sampled sites except at the Site RK2 along the Rietkuilspruit, which was one of two sites (the other site being KO2) with no obvious signs of abundant algae being present at the time of the survey. The recorded pH levels were likely influenced by natural processes such as photosynthesis and to some extent to a state of eutrophication as was evidenced by the presence of algae at some of the sites see Figure 11-28 for example.

11.7.1.3 Electrical Conductivity

Conductivity values recorded during the present study were predominantly high and recorded above the recommended guideline of 500 µS/cm (USEPA, 2010) at all the sites, except at Sites KO3 and VW3 (157.4 µS/cm and 409.0 µS/cm). These sites supported moderately fast flows in relation to other sampled sites, thus potential pollutants were likely flushed downstream and not allowed to settle or accumulate within the reach. The conductivity levels at the other sampled sites were likely attributed to nutrients stemming from the surrounding farming activities. Most notably, Site RK3 recorded a drastically elevated conductivity level (8880.0 µS/cm), which in consideration of its location below an ash dump, potential contamination may be implicating these values.

Figure 11-28: Algae suggesting a potential state of eutrophication at Site VW3 along the Vaalwaterspruit

11.7.1.4 Dissolved Oxygen

Dissolved oxygen levels were predominantly low throughout the sampled sites, however only recorded below the recommended guideline of 5 mg/l (Nebeker *et al*., 1996) at sites RK2 and RK3. The flow of water at the assessed watercourses was predominantly low with no bubbling water at rapids, except at Site VW3, thus aeration was limited and the low dissolved oxygen levels were expected. Some sites however recorded dissolved oxygen levels above 7 mg/l, all these sites were observed to have some aquatic vegetation (Figure 11-29). Similarly, dissolved oxygen saturation levels were predominantly low and exceeded the recommended guideline levels of 80 – 120 % at most of the sites (Department Of Water Affairs And Forestry, 1996).

The relatively low dissolved oxygen levels were considered a potential concern for sensitive aquatic biota.

Figure 11-29: Photo Showing Filamentous Algae at Site VW3 (Left), Water Lilies and Reeds at Site KO3 (Middle) and Oxygen Weed at Site VW2 (Right)

11.7.2 Aquatic and Riparian Habitat

Assessment of aquatic habitat within the study area was based largely on the application of recognised assessment indices at each of the selected sampling points, as well as associated reach) within the assessed watercourses, namely the Index for Habitat Integrity (IHI). While the IHI is a rapid, field-based, visual assessment of modifications to a few pre-selected biophysical drivers (i.e. semi-quantitative) used to determine the Present Ecological State (PES, or Ecological Category) of associated instream and riparian habitats.

11.7.2.1 Index for Habitat Integrity

The Index for Habitat Integrity (IHI) was completed on a desktop level for each aquatic ecosystem considered in the present survey and populated with observations recorded during the field survey (Table 11-17).

The findings from the IHI assessments conducted during the current survey indicate that the habitat integrity along each of the assessed tributaries were *Moderately Modified* (Ecological Category C) for the instream components and *Largely Natural* (Ecological Category B) for the riparian component.

Table 11-17: IHI Findings for the Watercourses Associated with the Proposed Project

Habitat Component	IHI Score	Ecological Category	Major Impacts	Description of the Findings
Klein-Olifants				At the Klein-Olifants reach, major impacts of the instream habitat were water quality deterioration and flow modification, whilst major impacts of the riparian habitat include inundation and flow modification.
Instream	71.3	**C**	Water quality deterioration and flow modification	
Riparian	80.5	**B**	Inundation and flow modification due to presence of dams	
Rietkuilspruit				At the Rietkuilspruit reach, major impacts were water quality deterioration and inundation.
Instream	78.3	**C**	Water quality deterioration due to high prevalence of farm lands and mining activities	
Riparian	86.1	**B**	Inundation and water quality deterioration	
Vaalwaterspruit				At the Vaalwaterspruit reaches, major impacts of the instream habitat were water quality deterioration and flow modification, whilst major impacts of the riparian habitat include inundation, flow modification and exotic vegetation.
Instream	79.8	**C**	Water quality deterioration due to high prevalence of farm lands	
Riparian	80.1	**B**	Isolated infestations of alien-invasive Blue Gum trees observed along the channel	

The assessed watercourses were predominantly flanked by farmlands with a significant number of dams. These result in apparent water quality deterioration due to fertilisers/nutrients entering the watercourses and dam/weirs acting as barriers which cause flow and channel modifications.

11.7.3 Aquatic Macroinvertebrate Assessment

The following sections provides insights into the available habitat that was sampled at each respective monitoring sites at the time of the current survey, as well as the South African Scoring System (SASS, Version 5) metrics obtained and the subsequent determination of the ecological condition of the observed assemblages in relation to reference conditions.

11.7.3.1 Invertebrate habitat Assessment Systems

During the survey, the sampled Klein-Olifants and Rietkuilspruit systems varied between shallow to deep, slow to moderately-flowing water. Gravel, sand, mud (GSM) and marginal vegetation were the dominant biotopes whilst the lack of the stones biotope was a common feature throughout the sites. Consequently, all assessed sites exhibited *Poor* aquatic macroinvertebrate habitat availability. A relatively wider diversity in habitat biotope availability were observed at the assessed Vaalwaterspruit sites, from shallow to deep, still to be moderately-flowing water and all SASS5 biotopes (stones, GSM and Vegetation) were available. The macroinvertebrate habitat availability therefore ranged between *Poor* to *Good*.

Table 11-18 shows the adapted IHAS scores at the sites assessed during the current survey.

Table 11-18: IHAS Values and Interpretation for the Sampled Sites

Site	IHAS Score (%)	Interpretation
Klein-Olifants		
KO1	30.1	**Poor**
KO2	36.4	**Poor**
KO3	54.1	**Poor**
Rietspruit		
RK1	45.5	**Poor**
RK2	34.5	**Poor**
RK3	52.7	**Poor**
Vaalwaterspruit		
VW1	41.8	**Poor**
VW2	49.1	**Poor**
VW3	60.0	**Adequate / Fair**
VW4	72.7	**Good**
VW5	61.8	**Adequate / Fair**

11.7.3.2 Benthic Communities and Composition

A total of 29 macroinvertebrate taxa or families (out of the expected 51) were sampled throughout the three sampled sites along the Klein-Olifants tributaries. The aquatic macroinvertebrate community assemblages were predominantly composed of taxa that have *"Low"* water quality requirements (i.e. SASS sensitivity score of 1-7). Only two families with a *Moderate* water quality requirement (i.e. SASS sensitivity score of 8-12) were sampled, namely Hydracarina and Elmidae. At the Rietkuilspruit, a total of 25 macroinvertebrate families (out of the expected 41) were sampled throughout the three sampled sites. The aquatic macroinvertebrate community assemblages were predominantly composed of taxa that have *"Low"* water quality requirements. Only three families with a *Moderate* water quality requirement were sampled, namely Hydracarina, Lestidae and Aeshnidae. At the Vaalwaterspruit, a total of 30 macroinvertebrate families (out of the expected 45) were sampled throughout the three sampled sites. The aquatic macroinvertebrate community assemblages were predominantly composed of taxa that have *"Low"* water quality requirements. Four families with a *Moderate* water quality requirement were sampled (Hydracarina, Lestidae, Aeshnidae and Dixidae).

Table 11-19 presents the SASS5 results for the assessed monitoring sites within the proposed Project area.

Table 11-19: SASS5 Data Obtained for the Assessed Sites

Site	SASS5 Score	Taxa/Family	Average Score Per Taxon
Klein-Olifants Tributary			
KO1	55	13	4.30
KO2	54	16	3.40
KO3	62	15	4.10
Rietkuilspruit			
RK1	61	14	4.36
RK2	79	19	4.16
RK3	78	18	4.33
Vaalwaterspruit			
VW1	81	17	4.76
VW2	78	18	4.33
VW3	68	15	4.53
VW4	59	14	4.21
VW5	59	16	3.69
ASPT = Average Score Per Taxon			

11.7.3.3 Ecological Condition of the Aquatic Macroinvertebrates Assemblages

The macroinvertebrate assemblage at all assessed watercourses around the Study Area exhibited *Largely Modified* conditions (Ecological Category D). At the assessed Klein-Olifants tributaries, the water quality metric constituted the highest overall percentage change in macroinvertebrate assemblage. This suggests that of the three assessed metrices, water quality was the main contributor to the state of macroinvertebrate assemblages at these sites. At both assessed Rietkuilspruit and Vaalwaterspruit sites, the flow metric constituted the highest overall percentage change in macroinvertebrate assemblage. This suggests that flow modifications at these sites were the main contributor to the state of macroinvertebrate assemblages.

Results for the MIRAI at the assessed sites are shown in Table 11-20 and discussed below.

Table 11-20: MIRAI data for the Assessed Sites

		Klein-Olifants	Rietkuilspruit	Vaalwaterspruit
Flow	Overall % Change	52	52	49
Habitat		33	41	35
Water Quality		58	38	48
MIRAI Value		**52.7**	**56.1**	**55.7**
Ecological Category		**D**	**D**	**D**
Description		Largely Modified	Largely Modified	Largely Modified

11.7.4 Fish Communities

The electro-narcosis technique was applied to sample the available fish species within watercourses associated with the proposed Project area. The sampled species and subsequent ecological condition of the fish communities is discussed in the below sub-sections.

11.7.4.1 Catch Record

A total of six fish species were sampled, one of which was regarded as alien invasive species (*Micropterus salmoides* or Largemouth Bass). The number of fish sampled per site sampled is shown in Table 11-21.

Table 11-21: Fish sampled within the sampled reaches

Site	*Amphilius uranoscopus*	*Chiloglanis pretoriae*	*Clarias gariepinus*	*Enteromius anoplus*	*Enteromius paludinosus*	*Labeobarbus polylepis*	*Pseudocrenilabrus philander*	*Tilapia sparrmanii*	*Micropterus salmoides*
Klein-Olifants									
KO1	-	-	-	-	-	-	-	-	-
KO2	-	-	-	-	-	-	-	-	-
KO3	-	-	-	-	-	-	-	7	
Rietkuilspruit									
RK1	-	-	-	-	-	-	-	-	-
RK2	-	-	-	1	3	-	-	-	-
RK3	-	-	-	-	-	-	-	-	-
Vaalwaterspruit									
VW1	-	-	-	-	-	-	-	-	-
VW2	-	-	-	-	-	-	-	-	-
VW3	-	-	1	-	7	-	1	-	1
VW4	-	-	-	-	10	-	9	7	-
VW5	-	-	-	-	16	-	11	7	-
*** Alien species; Values in parenthesis indicated observed specimens**									

Along the assessed Klein-Olifants tributaries, a single fish species was sampled at Site KO3. At the Rietkuilspruit sites, only two species were sampled, whilst the most number of fish species were sampled at the Vaalwaterspruit (a total of five species). All five sampled indigenous fish species are known to be tolerant, to varying extents, only *Amphilius uranoscopus* and *Chiloglanis pretoriae* are known to be sensitive towards water quality and flow modifications, thus the absence of these two species from the sampled fish assemblages may suggest that there were water quality and or flow modifications at the sampled watercourses at the time of the survey.

The *Enteromius paludinosus* (Straightfin Barb) was the most abundant and prevalent species and was sampled at four sites, at the Rietkuilspruit Site KR2 and Vaalwaterspruit sites VW3, VW4 and VW5 (Figure 11-30).

Figure 11-30: *Enteromius paludinosus* (Straightfin Barb) specimen sampled at sites RK2, VW3, VW4 and VW5

A single specimen of the alien invasive *Micropterus salmoides* (Largemouth Bass; Figure 11-31) was sampled at Site VW3. The specimen was observed to be in an unhealthy state with skin lesions possibly caused by copepods, bacteria or fungi (NOGA, 1986). The Largemouth Bass is a popular, freshwater gamefish species which favours clear, standing or slow-flowing waters with submerged or floating vegetation (Skelton, 2001).

Figure 11-31: *Micropterus salmoides* (Largemouth Bass) specimen sampled at Site VW3

11.7.4.2 Ecological Category of Fish Assemblages

The REMP uses the FRAI which is based on the preferences of various fish species as well as the frequency of occurrence. The FRAI results for the sampled river reaches are shown in Table 11-22 and discussed below.

Table 11-22: FRAI Results for the current aquatic assessment

River System	FRAI Score	Ecological Category	Description
Klein-Olifants	24.0	**E**	Seriously Modified
Rietkuilspruit	34.6	**E**	Seriously Modified
Vaalwaterspruit	49.5	**D**	Largely Modified

A single fish species was sampled at the assessed Klein-Olifants tributaries, and two species were sampled at the assessed Rietspruit reaches. Consequently, both river systems were representative of *Seriously Modified* (Ecological Category E) condition. The greatest number of species (four) and total number of specimens (80) were sampled at the Vaalwaterspruit reaches, thus, the assessed Vaalwaterspruit reaches were representative of *Largely Modified* (Ecological Category D) condition at the time of the survey.

These findings could be attributed to a number of factors including the no-flow conditions observed at most of the sites during the survey; potential water quality modifications such as excessive nutrients within the watercourses which was evidenced by mild eutrophication at some of the sites and or the effectiveness of the electro-narcosis technique. The effectiveness of this technique has been shown to be hampered in high-conductivity water (Hill & Willis, 1994). Site KO3 recorded the lowest conductivity and was the only site along the assessed Klein-Olifants tributaries where fish were sampled. Site VW3 recorded the second lowest conductivity and the most number fish species. At the other sites which recorded elevated conductivity, the voltage setting on the electro-narcosis devise had to be reduced to a minimum during sampling, this resulted in a very weak current being transmitted in the water and inability to shock any fish.

11.7.5 Integrated EcoStatus Determination

The EcoStatus represents an integrated ecological state representing the drivers (hydrology, geomorphology, physico-chemical) and responses (fish, aquatic invertebrates and riparian vegetation; Kleynhans & Louw, 2008). The Instream Biological Integrity, as well as the integrated EcoStatus, for the sampled river reaches associated with the Project area were determined below (Table 11-23).

It was determined that the sampled Klien-Olifants tributaries, the Rietkuilspruit and Vaalwaterspruit reaches represented an integrated EcoStatus of *Moderately Modified* (Ecological Category C). In relation to the Recommended Ecological Category (REC), the assessed sections of the Upper Olifants River Catchment i.e. the Klein-Olifants and Rietkuilspruit systems were determined to attain to the Recommended Ecological Category (REC) of a C, as gazetted in April 2016 (*Classes and Resource Quality Objectives of Water Resources for The Olifants Catchment of Section 13(1)(A) and (B) of the National Water Act, 1998 (Act No.36 of 1998)*, 2016). Similarly, the assessed sections of the Inkomati River Catchment i.e. the Vaalwaterspruit systems (X11A-01295 and X11A-01248; excluding the X11A-01300 SQR) were determined to attain to the REC of a C, as gazetted in April 2016 (*Classes and Resource Quality Objectives of Water Resources for The Catchments of The*

Inkomati of Section 13(1)(A) and (B) of the National Water Act, 1998 (Act No.36 of 1998), 2016).

Table 11-23: The PES of the reaches under study at the time of the November 2020 field survey through the use of the ECOSTATUS4 (Version 1.02; Kleynhans & Louw, 2008)

River System	Response Indices			EcoStatus		
	MIRAI EC	FRAI EC	Instream EC	Riparian Vegetation EC (IHI)	Score	Category
Klein-Olifants	D	E	D	B	64.1	C
Rietkuilspruit	D	E	D	B	69.8	C
Vaalwaterspruit	D	D	D	B	68.4	C

11.8 Hydropelogy

The Hydropedological Impact Assessment was conducted during the EIA Phase and appended hereto as Appendix H. The site assessment was undertaken on the 9th of April 2021 to understand and verify hillslope hydrology which determines the dominant water flow paths within the demarcated landscape units. The subsections below describes the baseline environment within and around the Project area.

11.8.1 Land Types

The land types that occur within the Arnot South Mining Right Boundary and the extent it cover are summarized in Table 11-24. The proposed mine infrastructure is solely within the dominant Land Type Ba22, see Figure 11-33 below. Based on the Land Types Inventory, the area is dominated by red-apedal, well-drained Hutton soil form and the Glencoe and Avalon soil forms. The Glencoe soil form consists of an orthic A horizon overlying a yellow brown apedal B and hard plinthic B horizon. The Avalon soil form consists of an orthic A horizon overlying a yellow brown apedal B and a soft plinthic B horizon.

The general terrain type within the Ba22 land type is presented in Figure 11-32. The Ba22 land type is dominated by terrain unit Type 3, which is characterised by a slope of 2 to 8% (Land Type Survey Staff, 1972-2006). Terrain unit 1 represents the crests while unit 5 represents the lowest point in the topography of the land type, which are the streams. These terrain units are correlated to the Land Type Inventory from which the distribution of the expected soil type within each terrain unit is given. The soils are described as dystrophic and mesotrophic, which defines the leaching class. Dystrophic soils are highly leached, while mesotrophic soils are moderately leached (Land Type Survey Staff, 1972-2006). The plinthic subsoil is characterized by an accumulation of iron (and frequently Manganese) oxides and hydroxides, with the localization of high chroma mottles and concretions. In a hard plinthic B horizon, an indurated zone of accumulation of iron and manganese oxides forms which is relatively impermeable.

Table 11-24: Distribution of Land Types at the Arnot South Project area

Land Type	Area (km^2)	Area (%)	Description of broad soil pattern code
Ba19	1.1	0.71	Red and yellow, dystrophic/mesotrophic, apedal soils with plinthic subsoils (plinthic soils comprise >10% of land type, red soils comprise >33% of land type)
Ba22	142.7	91.47	
Bb15	12.2	7.82	Red and yellow, dystrophic/mesotrophic, apedal soils with plinthic subsoils (plinthic soils comprise >10% of land type, red soils comprise <33% of land type)

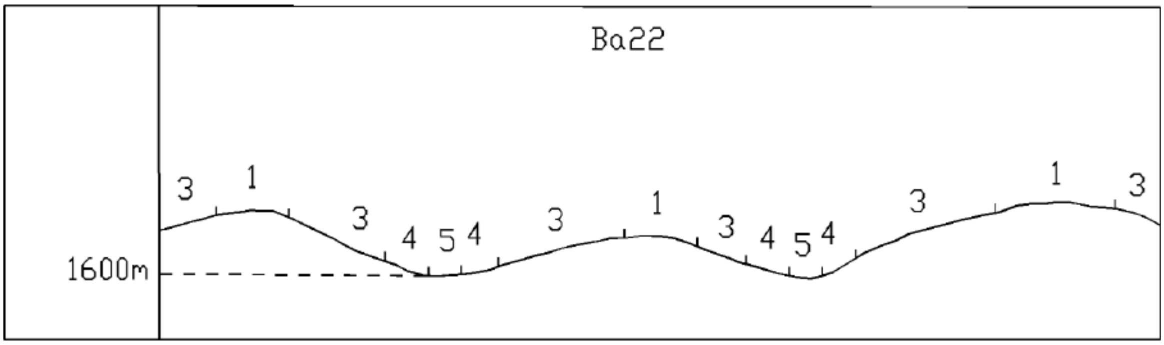


Figure 11-32: General Terrain Type for the Dominant Land Type Ba22 (Adapted from (Land Type Survey Staff, 1972-2006))

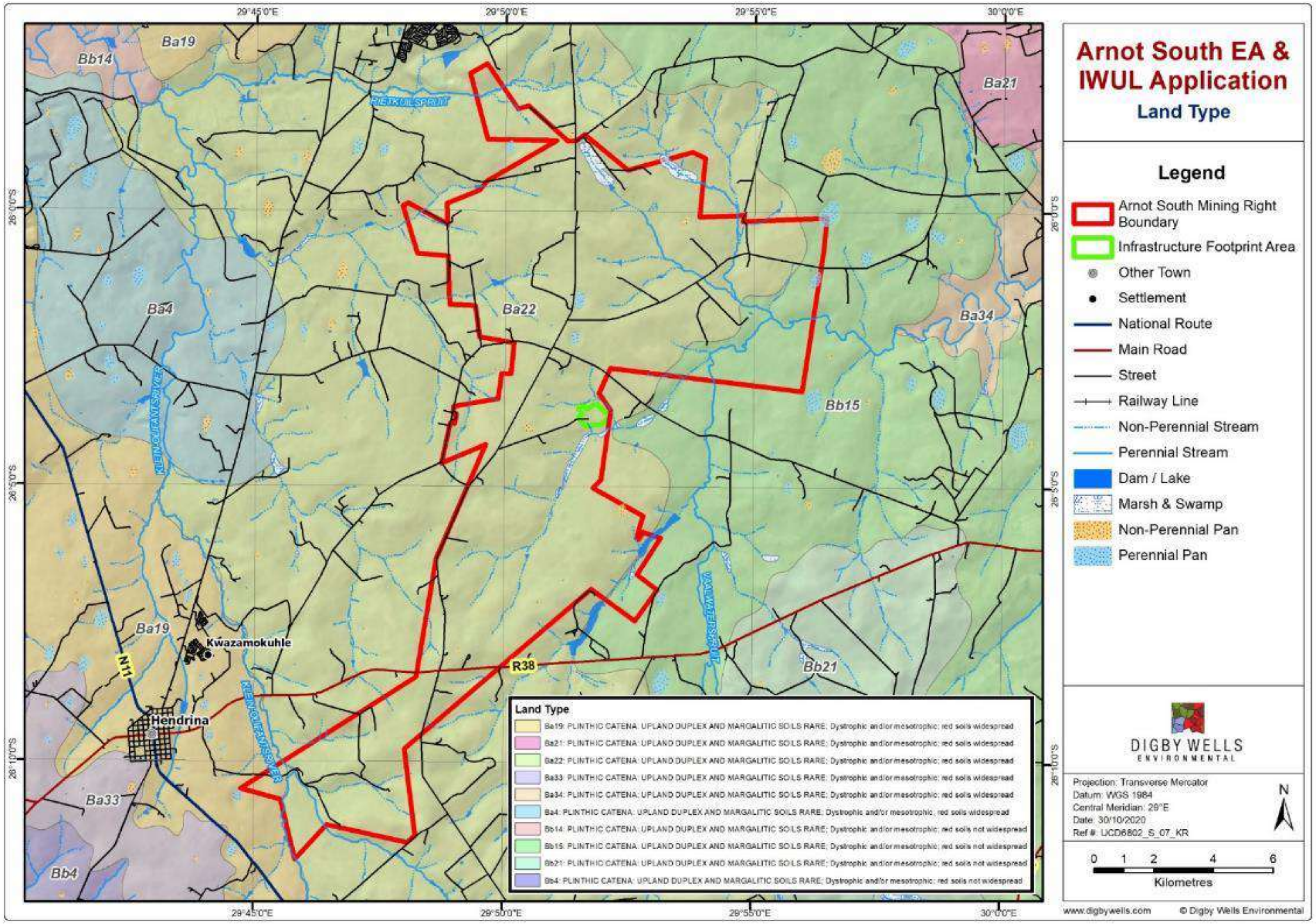


Figure 11-33: Land Types within the Arnot South MR area

11.8.2 Land Use

The current land use of the Arnot South Project area has been discussed in Section 11.4.2 above. The land use can be described as predominantly grassland and cultivated area. Minor areas with wetland, plantation/woodlot, thicket/dense bush, urban area and bare/non-vegetated land also exist within and around the Arnot Project area.

11.8.3 Hydropedological Responses and Implications

Hydropedological responses were at the Arnot South Infrastructure Area were closely assessed. Dominant flow paths within the infrastructure area are Interflow (A/B) and Interflow (Soil/Bedrock). The interflow (A/B) is a lateral flow path resulting from differences in soil permeability which cause temporary build-up of water on a less permeable underlying soil layer. The interflow (soil/bedrock) occurs when water encounters an impermeable hardrock after passing through a permeable soil horizon(s). Prolonged saturation with evidence of mottles, concretions and illuviation were observed at the footslope of hillslopes and within valley bottoms. These hillslope positions are dominated by responsive soils where saturation overland flow occurs (Figure 11-35).

Contribution of groundwater to surface water resources including wetlands was conceptually implied but not quantified during this phase of the study. Disruption of flow paths will occur where the Box cut will be constructed and the underground mine shaft sunk with potential reduction of water that reports to the Vaalwaterspruit. This disruption will likely not be significant due to a relatively small area (approximately 0.03 km^2) that will be occupied by the Box cut on Hillslope Number 2 within interflow soils at the midslope (Figure 11-34). The Discard Dump and Stockpiles will slow down or reduce infiltration into the vadose zone by increasing the depth of seepage. However, eventually the water will likely follow original flow paths as it gets to less permeable soil layers in the subsurface. Overland flow will likely increase on hard park areas which include the car park area due to compaction of soils.

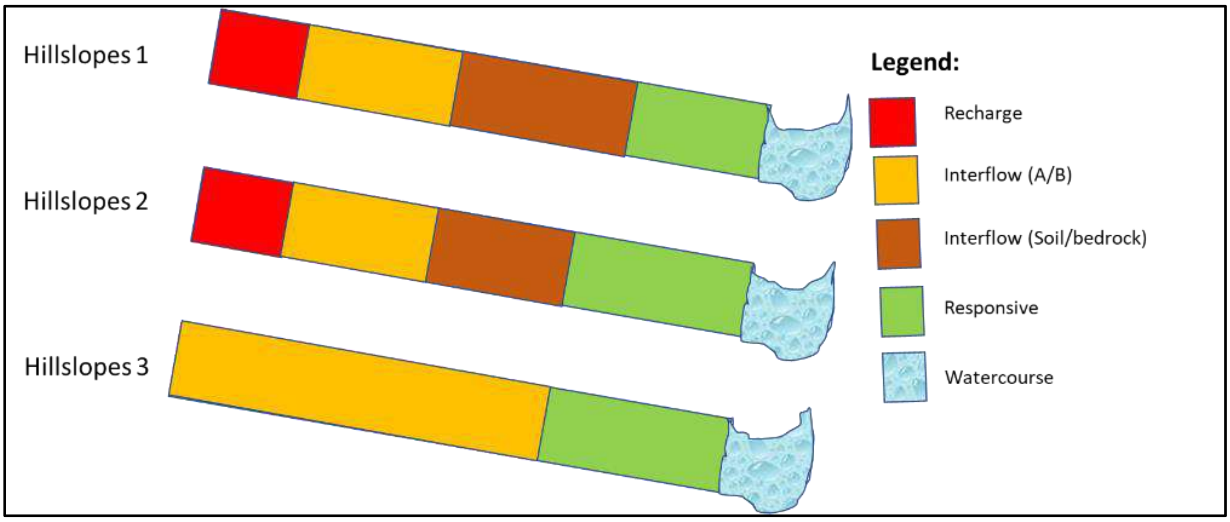


Figure 11-34: Conceptual hydropedological responses at the Arnot South Infrastructure Area

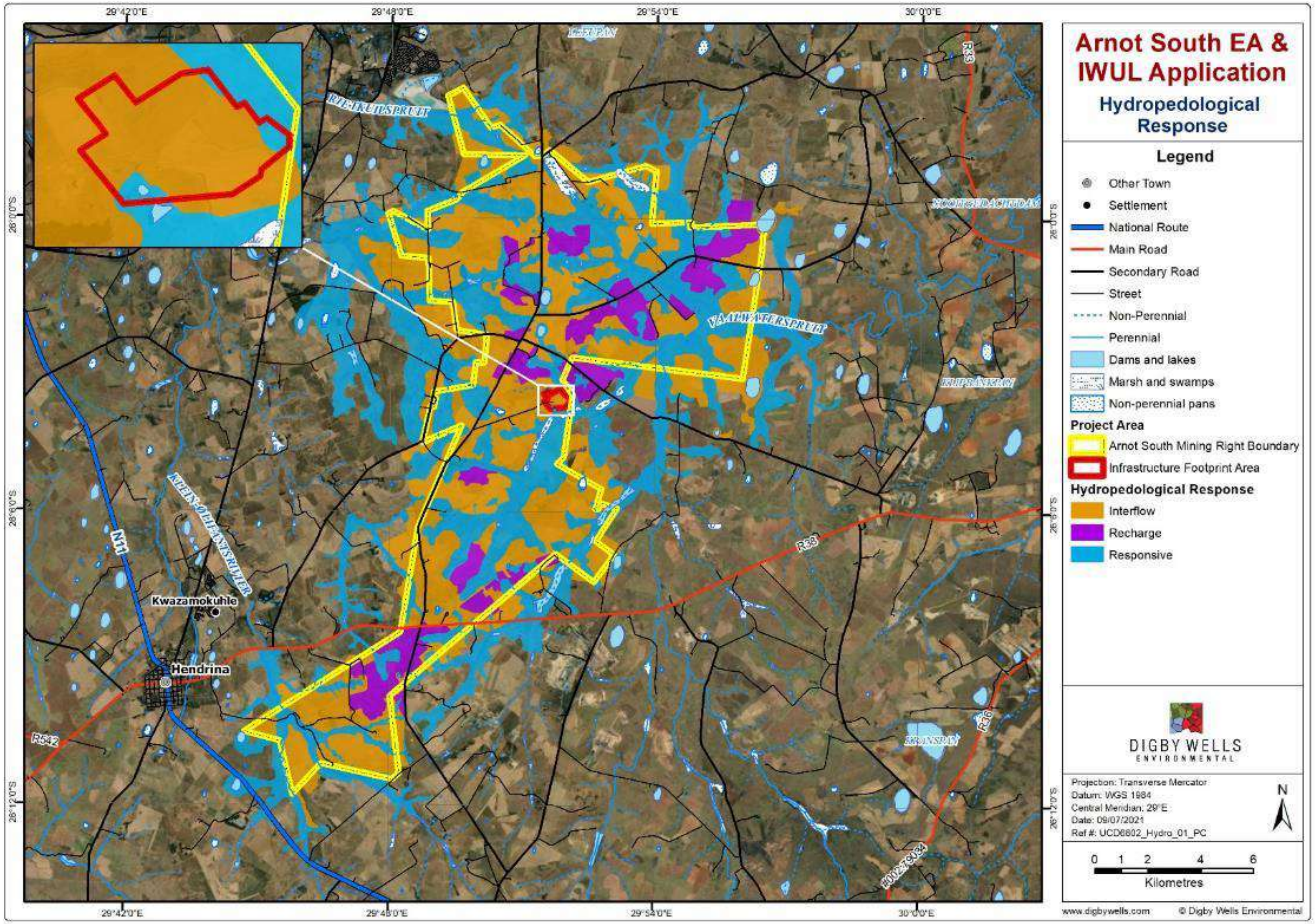


Figure 11-35: Hydrological Soil Types within the Arnot South MR area

11.9 Surface Water

The Surface Water Assessment undertaken during the EIA Phase is appended to this report as Appendix I. A site visit was undertaken on the 9th of April 2021 to physically assess and verify the hydrological characteristics of the proposed Project area and the surrounds.

11.9.1 Catchment Area

The Project area is found within three quaternary catchments, namely, B12A and B12B falling under the Olifants Water Management Area 2 (WMA2) and X11A which falls within the Inkomati-Usuthu WMA3, see Figure 11-36 below. The B12A and B12B quaternary catchments are found within the Olifants River Catchment. The X11A quaternary catchment is found in the Inkomati River Basin which is shared between South Africa, Eswatini and Mozambique. Within the project site, lies one of the major tributaries of the Olifants River called the Klein Olifants River. The site is also drained by several streams from the Inkomati River Basin. The Vaalrivierspruit which passes through the project site drains into the Nooitgedacht Dam which adjoins the Komati River. There are several small dams located on farms in and around the MRA, and the Nooitgedacht Dam is located within a radius of approximately 12 km from the northern end of the project.

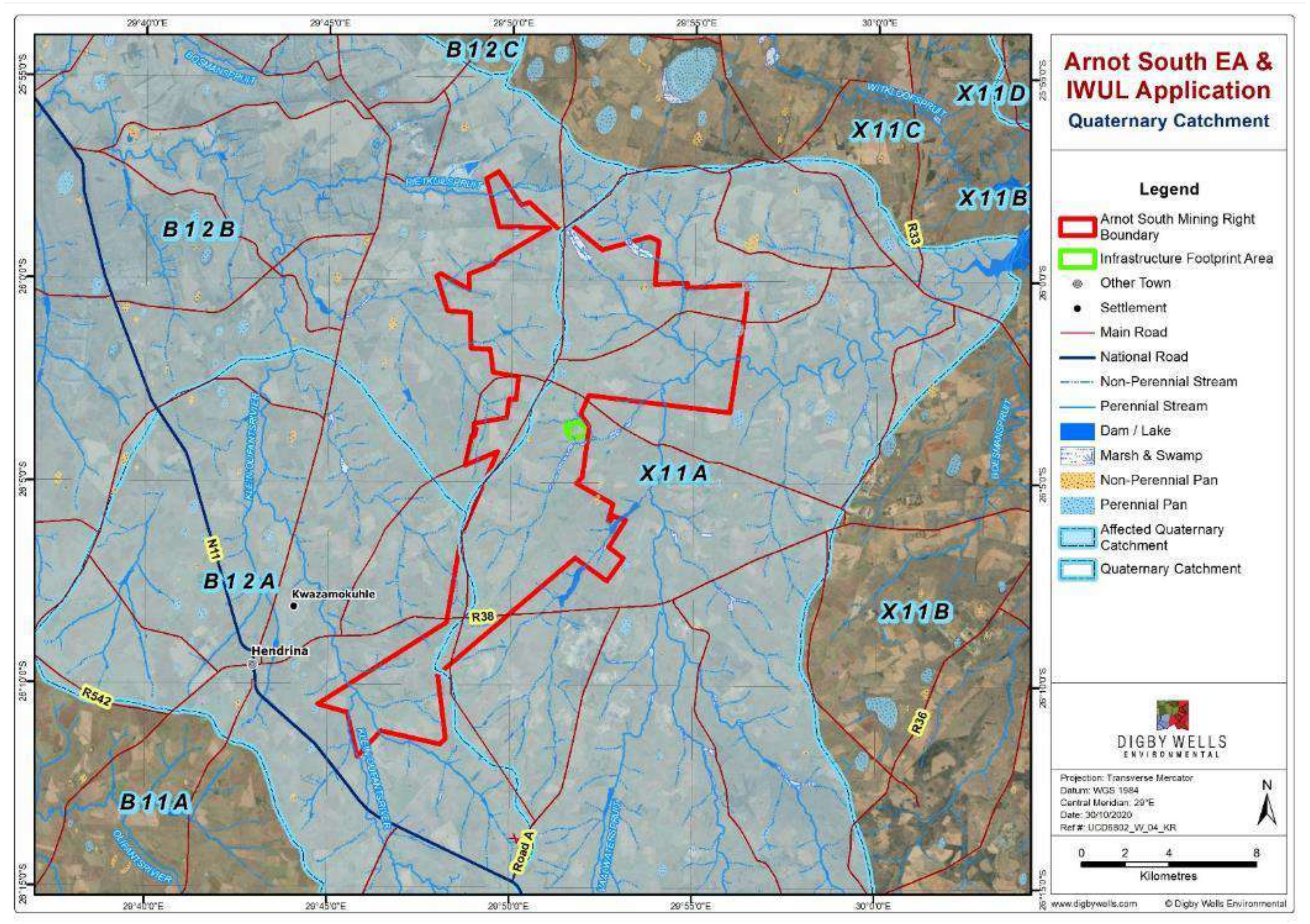


Figure 11-36: Quaternary Catchments Showing Drainage Within and Around the Project Site

11.9.2 Surface Water Assessment

Eight surface water samples were collected during the site visit from the Vaalwaterspruit, Klein-Olifantsrivier and their tributaries upstream and downstream of the project site in order to determine upstream and downstream water quality for the site. The sampling points are presented in Figure 11-37. The samples were analysed at Waterlab, a SANAS accredited laboratory. Water quality results were benchmarked against Department of Water and Sanitation (DWS) Resource Water Quality Objectives (RWQO) for the region.

11.9.3 Water Quality Results

Most of the analysed parameters are within the RWQO of the region in which the proposed Arnot South project site is located, see Table 11-25 below. Exceedances were, however, variably noted for Chloride (Cl), Ortho Phosphate (P), Aluminium (Al) and Copper (Cu) both upstream and downstream of the project site. Higher P, Cu, Cl and Al concentrations are likely due to industrial effluents or agricultural chemical released from upstream areas of the Arnot South project site. Sampling point ANTSW1 indicated further RWQO exceedances for Arsenic (As), Cadmium (Cd), Hexavalent Chromium as Cr (VI), Lead (Pb), Manganese (Mn) and Mercury (Hg) while at the other sampling points these parameters were below detection levels. The higher levels of heavy metals at the ANTSW1 point possibly result from already existing mining activities within the region.

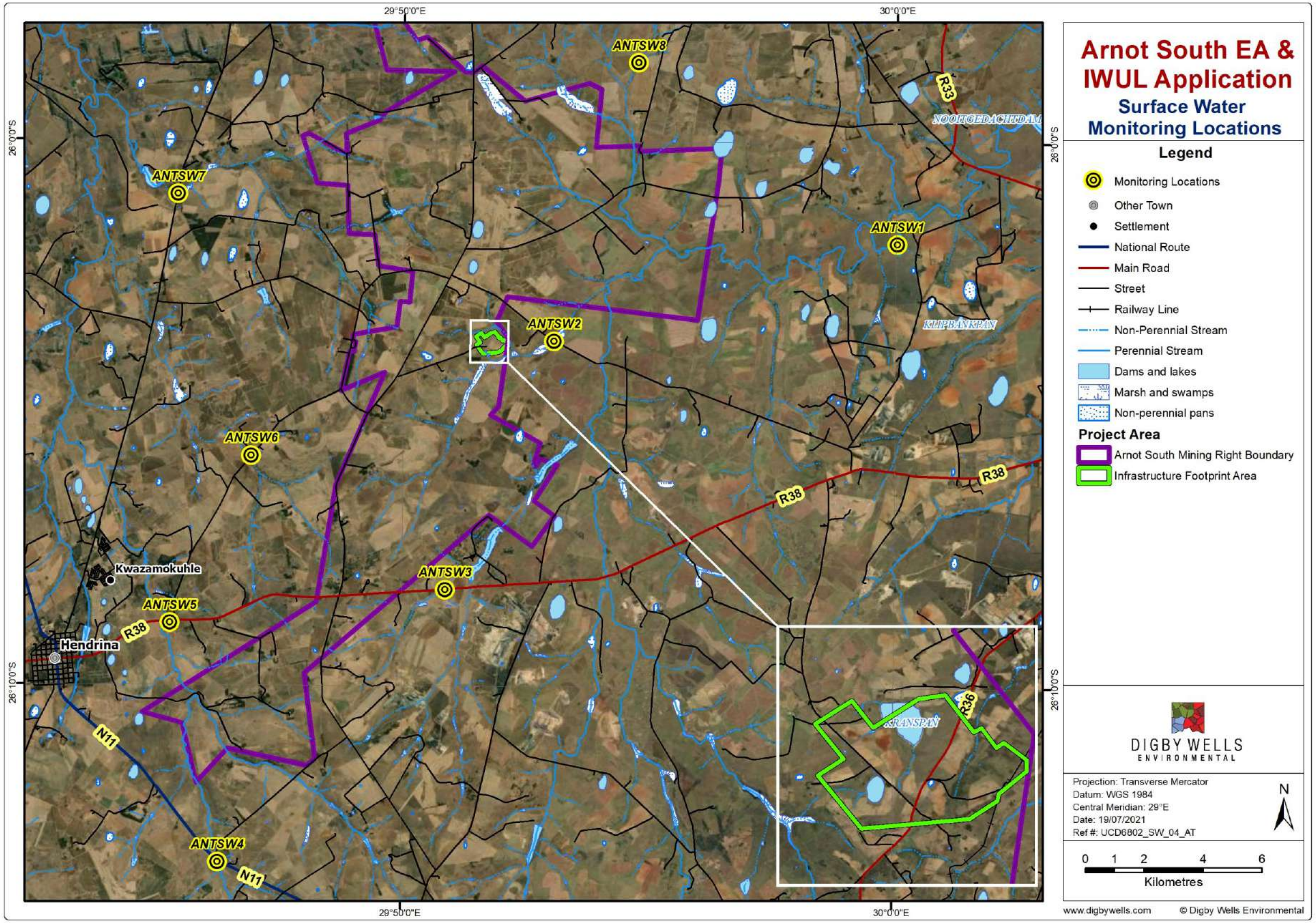


Figure 11-37: Surface Water Quality Sampling Points for Arnot South Mining Right Area

Table 11-25: Surface Water Quality in Rivers Within and Adjacent to the Arnot South Mining Right Area

Parameters		Sampling Site							Resource Quality Objectives
	Units	ANTSW1	ANTSW2	ANTSW3	ANTSW4	ANTSW5	ANTSW6	ANTSW7	
pH - Value @ 25 ºC	pH meter units	7.70	7.30	7.50	8.40	7.60	6.90	7.00	5.9 - 8.8
Electrical Conductivity @ 25°C	mS/m	25.70	27.80	35.80	45.20	38.50	19.00	21.80	≤ 111
Total Dissolved Solids @ 180°C	mg/L	186.00	232.00	240.00	290.00	262.00	148.00	168.00	N/S
Suspended Solids at 105°C	mg/L	18.00	13.30	36.00	12.70	66.00	16.00	8.70	N/S
Chloride as Cl	mg/L	16.00	27.00	26.00	28.00	29.00	24.00	27.00	≤ 0.05
Sulphate as SO_4	mg/L	55.00	44.00	66.00	28.00	43.00	38.00	18.00	500
Fluoride as F	mg/L	0.20	0.20	0.40	0.40	0.40	0.40	0.30	≤ 3.00
Nitrate as N	mg/L	0.20	0.10	0.10	0.10	0.10	0.20	<0.1	≤ 4.00
Ortho Phosphate as P	mg/L	0.20	0.10	0.20	0.10	0.20	0.10	<0.1	≤ 0.025
Free and Saline Ammonia as N	mg/L	0.20	0.20	0.20	0.30	0.40	0.30	0.20	N/S
Sodium as Na	mg/L	12.00	14.00	21.00	30.00	27.00	13.00	13.00	N/S
Potassium as K	mg/L	4.10	6.50	6.00	5.30	5.50	8.60	6.70	N/S
Calcium as Ca	mg/L	18.00	20.00	23.00	31.00	25.00	8.00	12.00	N/S
Magnesium as Mg	mg/L	19.00	11.00	13.00	19.00	14.00	5.00	8.00	N/S
Aluminium as Al	mg/L	20.00	0.17	0.13	0.12	0.19	0.27	<0.100	≤ 0.150
Arsenic as As	mg/L	21.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	≤ 0.095
Cadmium as Cd	mg/L	22.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	≤ 0.003
Hexavalent Chromium as Cr (VI)	mg/L	23.00	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	≤ 0.121
Cobalt as Co	mg/L	24.00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	N/S
Copper as Cu	mg/L	25.00	0.14	0.14	0.14	0.14	0.14	0.14	≤ 0.08
Iron as Fe	mg/L	26.00	0.34	0.66	0.17	0.57	1.05	0.76	N/S
Lead as Pb	mg/L	27.00	<0.001	<0.001	<0.001	0.00	0.00	<0.001	≤ 0.0095
Manganese as Mn	mg/L	28.00	<0.025	0.22	0.06	0.11	<0.025	<0.025	≤ 1.300
Mercury as Hg	mg/L	29.00	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	≤ 0.0097
Molybdenum as Mo	mg/L	30.00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	N/S
Nickel as Ni	mg/L	31.00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	N/S
Selenium as Se	mg/L	32.00	<0.001	<0.001	0.00	0.00	<0.001	0.00	≤ 0.022
Zinc as Zn	mg/L	33.00	<0.025	<0.025	0.03	<0.025	<0.025	<0.025	≤ 14.4

11.9.4 Floodline Determination

11.9.4.1 Delineated Catchments

Eight subcatchments were delineated that cover the Arnot South project site and the catchments are shown in Figure 11-38.

11.9.4.2 Design Rainfall Depths and Peak Flows

Design Rainfall Depths for the 1:2-year to 1:100-year return periods were calculated using the Design Rainfall Software for South Africa (Smithers and Schulze, 2000). The rainfall depths are presented in Table 11-26. Rainfall depths with durations equal to the time of concentration (Tc) of the delineated catchments were used to calculate peak flows using the RM3 method. The recalibrated modified Hershfield equation was used to determine precipitation depths used in the SDF method (Alexander, 2002). Results of the RM3 method were used in hydraulic modelling since these were representative of the area due to site-specific runoff coefficients which were generated using an in-built RM3 module. The MIPI results helped in the selection of suitable peak flows because these were of the same order of magnitude to the RM3 method. The SDF results were deemed an over-estimate of peak flows for the site due to high regionalised runoff coefficients. The calculated peak flows are presented in Table 11-27.

Table 11-26: 24-Hour Design Rainfall Depths for Arnot South Project Site

	Return Period					
Duration	**2year**	**5year**	**10year**	**20year**	**50year**	**100year**
5 m	8.5	11.9	14.4	17.1	21.1	24.5
10 m	12.3	17.1	20.8	24.8	30.5	35.4
15 m	15.3	21.3	25.8	30.7	37.9	43.9
30 m	19.6	27.2	33	39.3	48.4	56.1
45 m	22.6	31.4	38.1	45.3	55.8	64.8
1 h	25	34.7	42.2	50.2	61.8	71.7
1.5 h	28.8	40.1	48.7	57.9	71.4	82.8
2 h	31.9	44.4	53.9	64.1	79	91.6
4 h	38	52.8	64.1	76.2	94	109
6 h	42	58.4	71	84.4	104	120.6
8 h	45.2	62.8	76.3	90.7	111.8	129.6
10 h	47.8	66.4	80.6	95.9	118.2	137.1
12 h	50	69.5	84.4	100.4	123.7	143.5
16 h	53.7	74.7	90.7	107.8	132.9	154.2

Return Period						
Duration	**2year**	**5year**	**10year**	**20year**	**50year**	**100year**
20 h	56.8	79	95.9	114	140.6	163
24 h	59.5	82.7	100.4	119.4	147.1	170.6

Table 11-27: Peak flows for delineated catchments at the Arnot South project site

Catchment	Method					
	RM3		**SDF**		**MIPI**	
	1:50yr	1:100yr	1:50yr	1:100yr	1:50yr	1:100yr
	(m^3/s)					
C1	531.60	743.14	538.52	686.51	529.51	668.85
C2	164.03	229.16	191.47	244.09	163.93	207.07
C3	141.13	197.18	167.44	213.45	139.42	176.11
C4	249.54	348.73	414.60	528.54	240.51	303.80
C5	134.94	188.52	152.60	194.54	126.62	159.94
C6	137.52	192.14	157.58	200.88	138.16	174.52
C7	225.83	315.51	338.71	431.79	211.01	266.53
C8	194.06	271.13	232.99	297.01	188.84	238.54

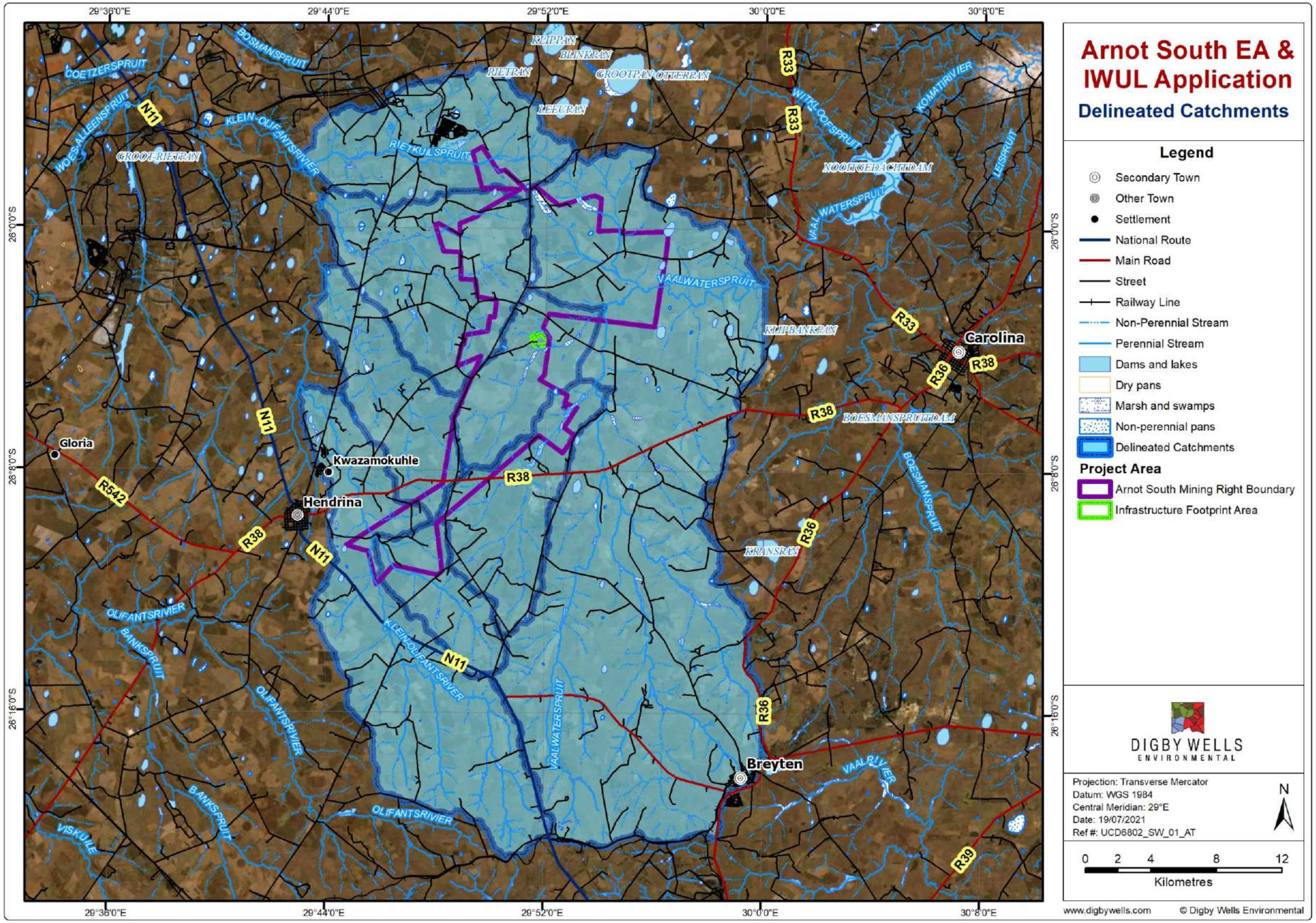


Figure 11-38: Delineated catchments for the Arnot South Mining Right Area

11.9.4.3 Floodlines

The floodlines show that the proposed infrastructure is outside both the 1:50-year and 1:100-year floodlines. The proposed Pollution Control Dam (PCD) is, however, too close to the 1:100-year floodline such that it is recommended that it be slightly moved approximately 30 m away from the nearby watercourse so that it is clearly off the flood waterway. The floodlines are presented in Figure 11-39.

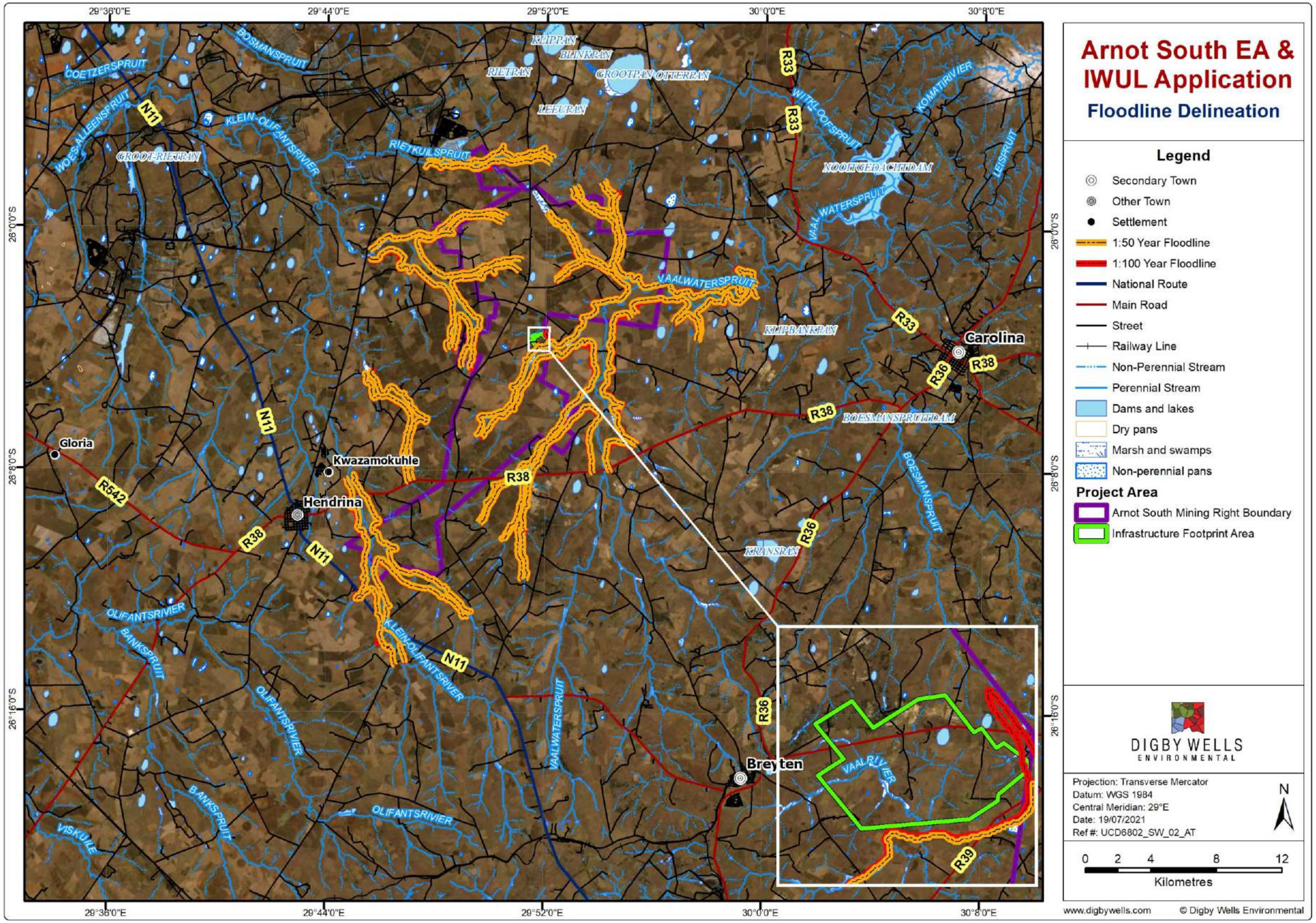


Figure 11-39: 1:50-year and 1:100-year Floodlines for Rivers Draining the Arnot South Mining Right Area

11.9.5 Clean and Dirty Stormwater Catchments

The dirty areas identified on the project site are:

- Discard Dump;
- Workshop and Wash bay;
- Mine Plant area;
- Stockpile area;
- Overburden Dump; and
- Box cut area.

Simulated peak flows and runoff volumes for delineated storm water subcatchments are summarised in Table 11-28 for the 1:50-year recurrence interval, 24-hour flood event.

Table 11-28: Simulated peak runoff rates and volumes at Arnot South

Name	Description	Classification	Area (m^2)	Precipitation (mm)	Runoff Volume (ML)	Peak Runoff (m^3/s)
S1_1	Discard_Dump	Dirty	9.241	147.09	9.11	3.8
S1_2	Discard_Dump	Dirty	4.445	147.09	4.38	1.83
S3	Boxcut_Laydown_area	Dirty	1.3106	147.09	1.29	0.54
S4	Overburden_Dump	Dirty	2.9304	147.09	2.89	1.2
S5	Boxcut	Dirty	2.6064	147.09	2.57	1.07
S6_1	Mine_Plant &_Stockpiles	Dirty	5.1394	147.09	5.07	2.11
S6_2	Mine_Plant &_Stockpiles	Dirty	3.522	147.09	3.47	1.45
S7_1	Laydown_area	Dirty	0.6905	147.09	0.68	0.28
S7_2	Laydown_area	Dirty	0.7011	147.09	0.69	0.29
S8_1	PCD	Dirty	0.746	147.09	0.74	0.31
S8_2	PCD	Dirty	0.811	147.09	0.8	0.33
S9_1	Workshop_Washbay	Dirty	0.0583	147.09	0.05	0.02

Name	Description	Classification	Area (m^2)	Precipitation (mm)	Runoff Volume (ML)	Peak Runoff (m^3/s)
S9_2	Workshop_Washbay	Dirty	0.0543	147.09	0.05	0.02
S10	Offices, Car Park	Clean	131.0008	147.09	129.12	53.82

11.10 Groundwater

The baseline Groundwater report has been compiled and appended as Appendix J. However, the Impact Assessment has been excluded in this report as the land access was compromised or not granted by landowners on time, thus leading to borehole drilling being delayed. The Impact Assessment Report will therefore be included in the final EIA report.

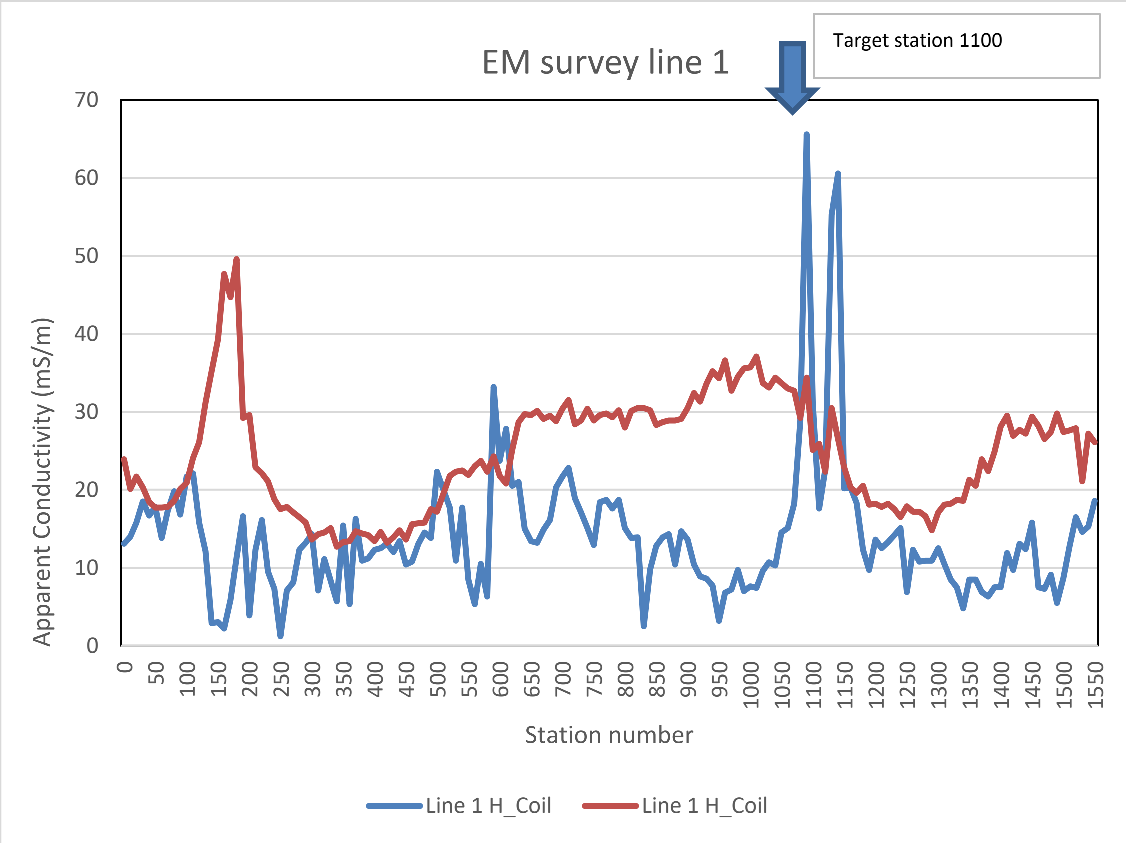
11.10.1 Geophysical Survey

Digby Wells carried out a geophysical survey for the purpose of generating monitoring borehole drilling targets. A total of four survey lines of between 600 m and 1.7 km in length were carried out in the project area based on the geology, geophysical data, topography and drainage.

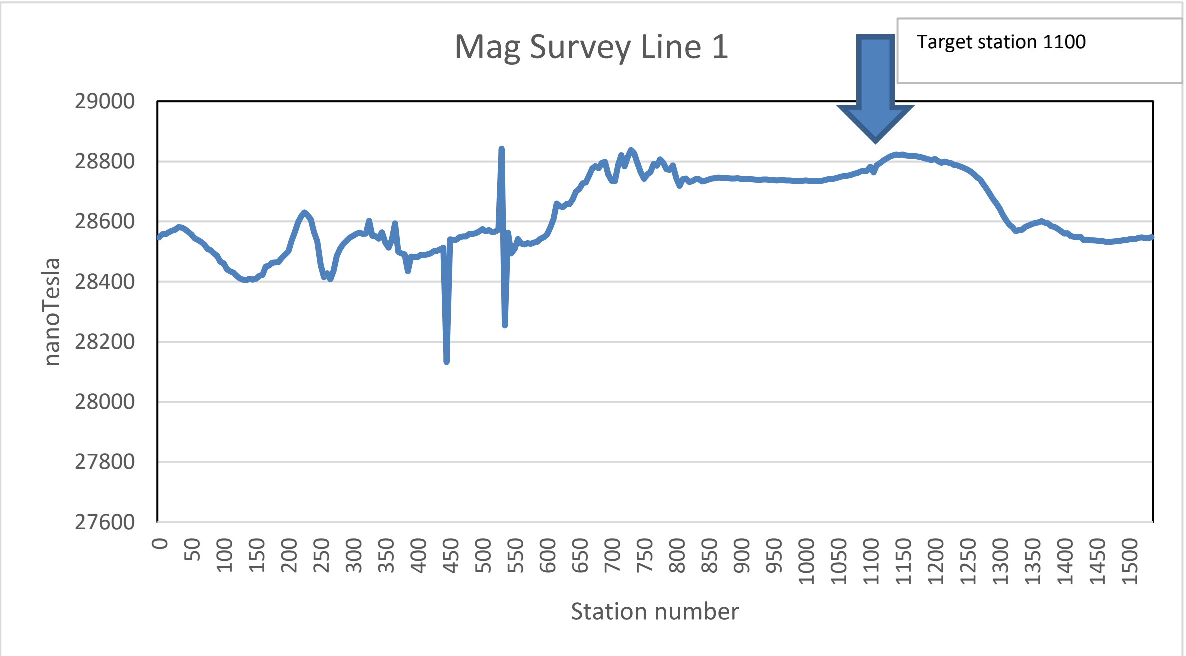
The lines were interpreted based on anomalies in the EM and Mag data in conjunction with lithological units and geological structures as indicated on the regional geological map Figure 11-10and Table 11-29.

Table 11-29: Identified drill targets with details

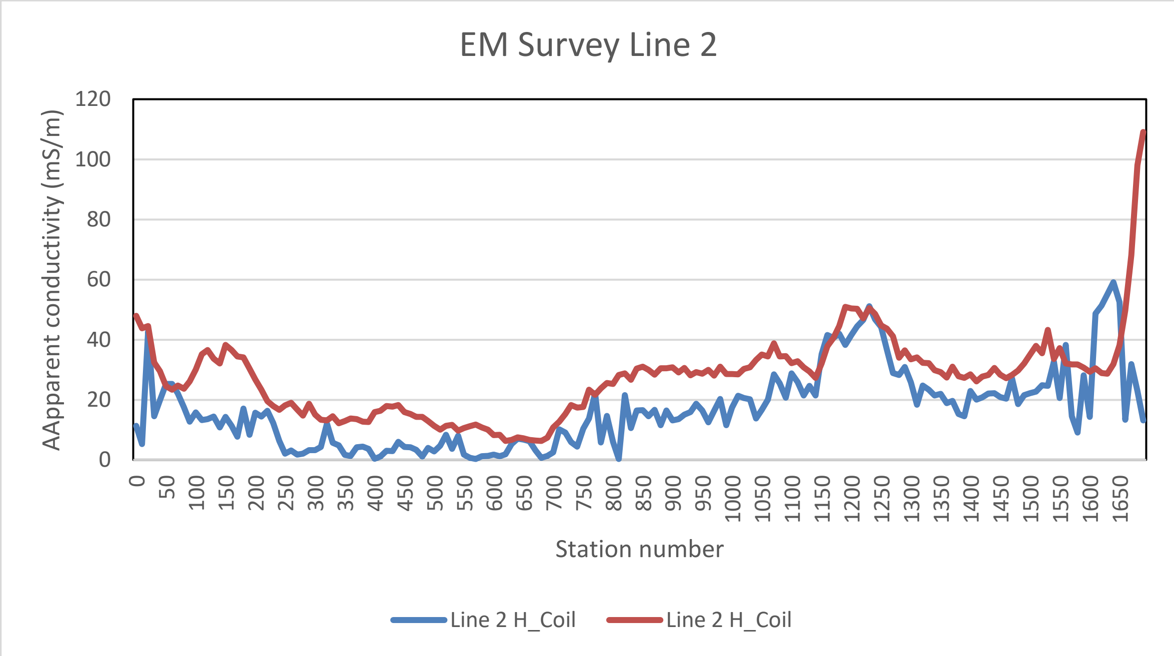
Drill target	Coordinates (UTM 36, WGS 84)		Targeting	Status
	X	Y		
VFBH8	29.834589	-26.01854	Anomaly in EM and Mag data-Line 1	No Access
VFBH9	29.819046	-26.02276	Anomaly in EM and MAG data; regional structure- Line 2	No Access
WVBH2	29.849014	-26.05861	Anomaly in EM and Mag data-Line 3. Target moved due to wetland in vicinity. Borehole was shifted to 29.8508, -26.0569.	Drilled
WVBH3	29.85541	-26.0543	Targeting regional structure- No anomaly in EM and Mag data	Drilled
MPBH3	29.85537	-26.0306	Anomaly in EM and Mag data-Line 4	Drilled



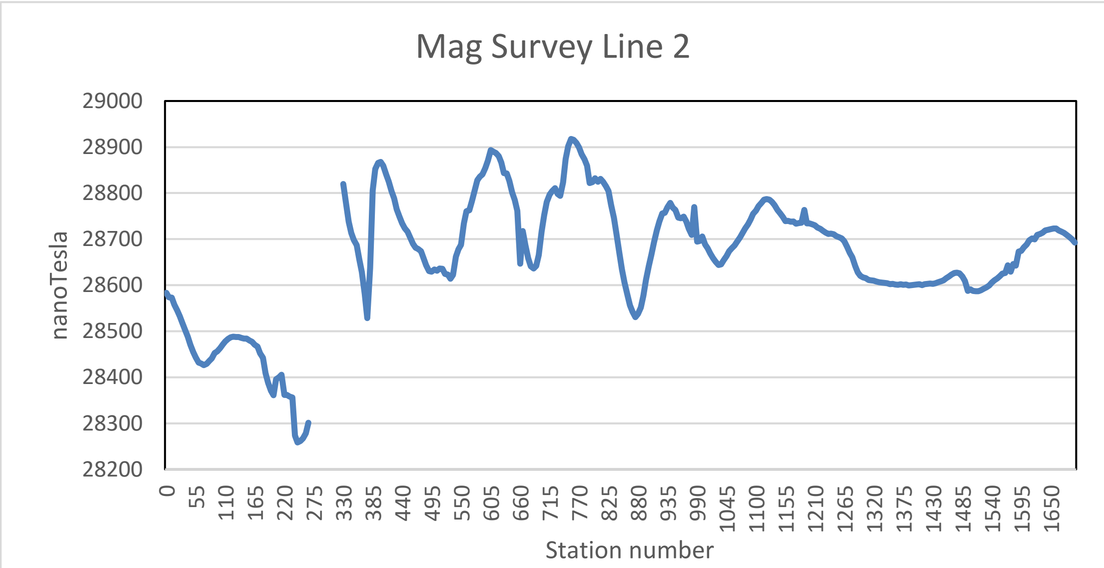
Line 1 Electromag



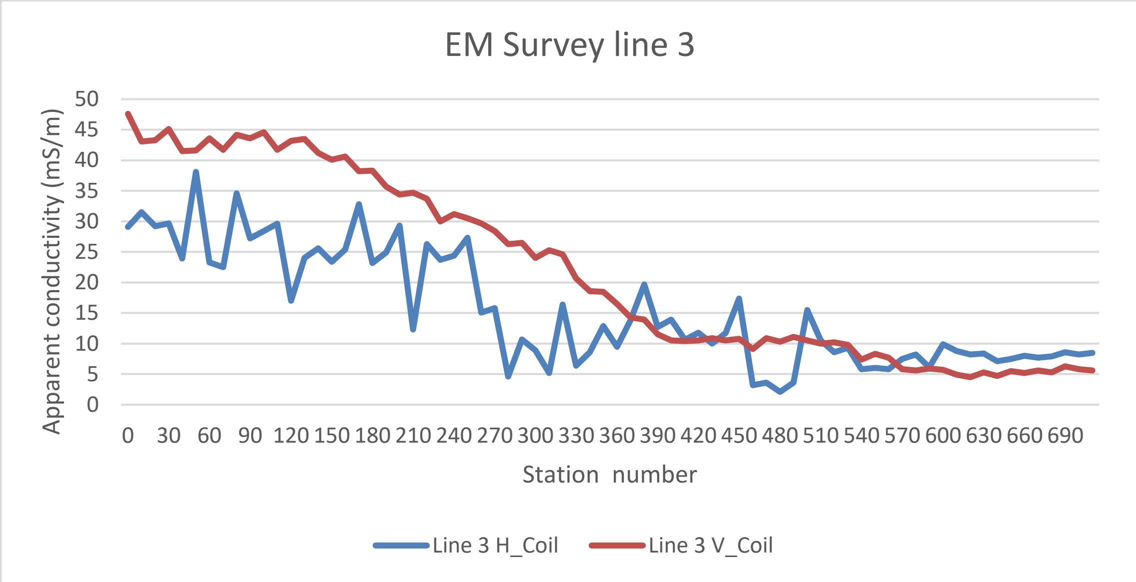
Line 1 Magnetometer



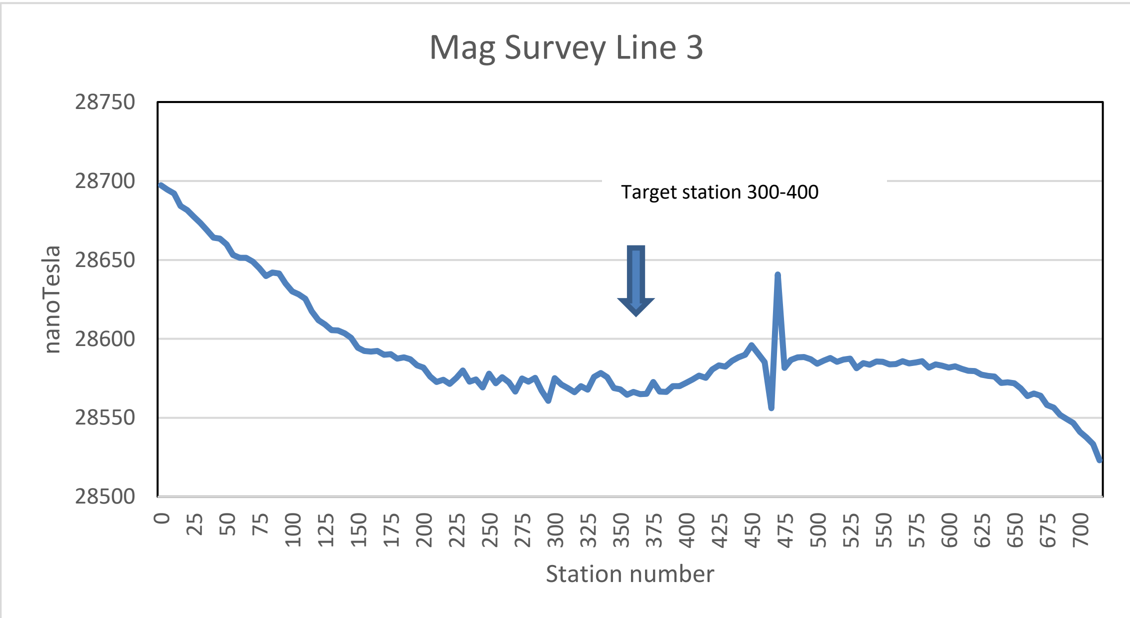
Line 2 Electromag



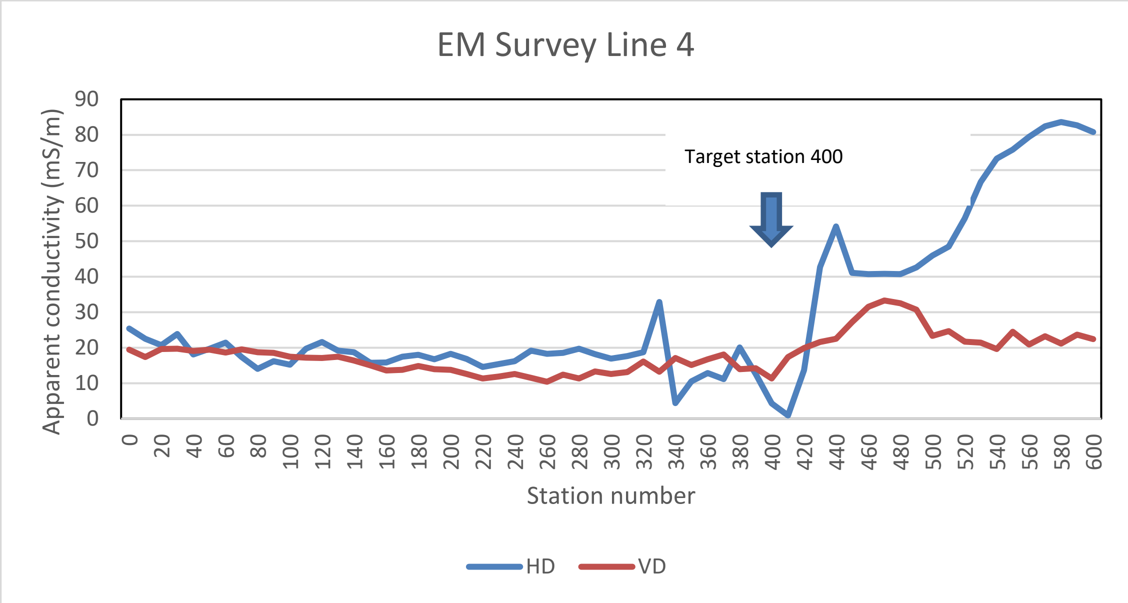
Line 2 Magnetometer



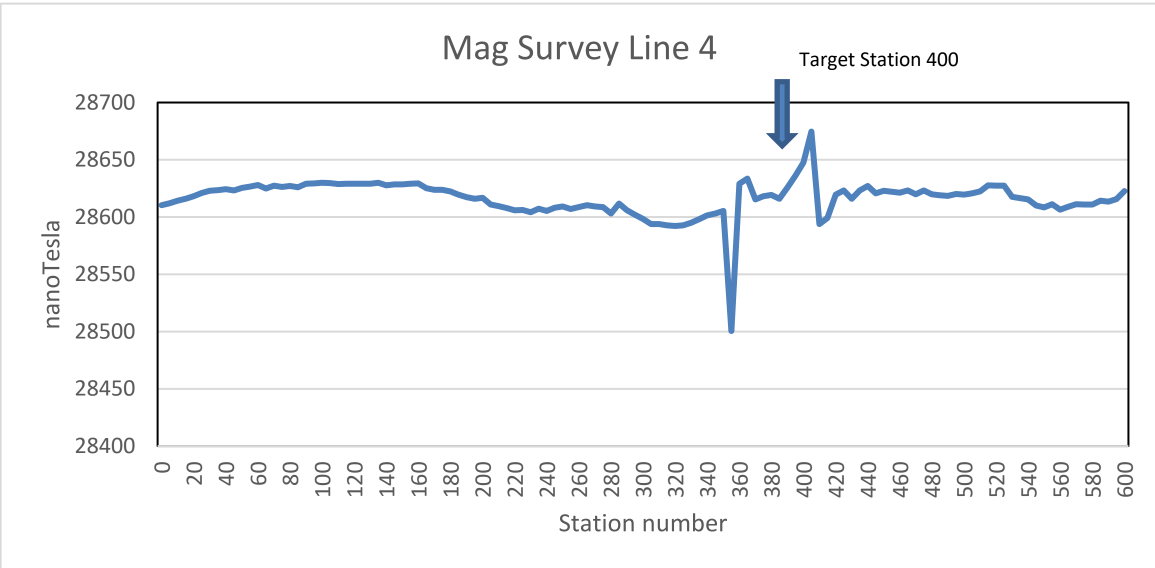
Line 3 Electromag



Line 3 Magnetometer



Line 4 Elctromag



Line 4 Mag

Figure 11-40: Magnetometer

11.10.2 Borehole Drilling

Three boreholes were drilled between the 16th of July and the 21st of July. The summary is provided below and in Table 11-30. The borehole logs will be included in the groundwater impact assessment study.

11.10.2.1.1 MPBH3

MPBH3 was drilled on the 16th of July 2021 to a final depth of 66 m. Alternating layers of sandstone, carbonaceous shale and coal were intersected in MPBH3. The first 15 m of sandstone were moderately to completely weathered. The first coal seam was intersected at approximately 29 m and the last coal seam (S2 seam) was intersected between 56 m and 61 m. There were no water strikes in this borehole. A static groundwater level of 3.7 mbgl was measured in this borehole.

11.10.2.1.2 WVBH2

WVBH2 was drilled on the 21st of July to a final depth of 41 m. WVBH2 intersected alternating layers of sandstone, mudstone, carbonaceous shale and coal until a depth of 38 m. The first 8 m of sandstone were completely weathered. Dolerite was intersected in the last 3 m. The first coal seam was located between 11 m and 15 m which also contained carbonaceous shale. The last seam (S2 Seam) was located between 24 m and 30 m. There were no water strikes in this borehole. A static groundwater level of 3.59 mbgl was measured in this borehole.

11.10.2.1.3 WVBH3

WVBH3 was drilled on the 18th of July to a final depth of 46 m. Overburden was intersected in the first 3 m after which there were alternating layers of sandstone, carbonaceous shale and coal. Moderate to complete weathering occurred to a depth of 17 m. The first coal seam was intersected at a depth of 25 m and the last seam (S2 Seam) at 38 m. No water strikes were intersected in this borehole and the groundwater level was still recovering by the 22nd of July.

Table 11-30: Borehole Summary

Borehole ID	X	Y	Borehole Depth (m)	Water Strike (mbgl)	Static Water Level (mbgl)	Final Blow Yield (L/s)	Lithology summary
MPBH3	29.85537	-26.0306	66	-	3.7	n/a	Alternating layers of sandstone, carbonaceous shale and coal
WVBH2	29.8508	-26.0569	41	-	3.59	n/a	Alternating layers of sandstone, mudstone, carbonaceous shale and coal with dolerite at the base
WVBH3	29.85541	-26.0543	46	-	-	n/a	Alternating layers of sandstone, carbonaceous shale and coal

11.10.3 Hydrocensus

Forty-three (43) boreholes were identified during the hydrocensus refer to Figure 11-42 below.

11.10.3.1 Groundwater Use

The following conclusions were drawn from the hydrocensus:

- The main source of drinking water supply in and around the proposed mining area is community privately owned boreholes equipped with windmill pumps supplemented by high yielding boreholes equipped with electrical submersible pumps which are mainly used for domestic and agricultural purposes;
- The pH values (Field parameters) measured during the survey varied from 6.2 at WVBH1B to 8.4 at MPBH1 with an average pH of 6.9. A pH between 6.2 and 8.4 is indicative of a slightly circum-neautral waters;
- Conductivity values varied from 0.17 µS/m at MPBH2B to 0.66 µS/m at MPBH1 and thus, indicative of moderate low to slightly high conductivity (saline water) values;
- Groundwater level elevations were measured at seven boreholes only as most of the boreholes were equipped with windmill pumps. Based on the seven measurements depth-to-groundwater ranges between 0 mbgl and 24.7 mbgl (average of 7.34 mbgl), with groundwater level elevations ranging between 1 630 mamsl at WVBH1 and 1 691 mamsl at LPBH1; and
- The areas that have no sampling points were areas where access was not granted for the study.

11.10.3.2 Groundwater Levels

Groundwater levels were measured in seven (7) hydrocensus boreholes and two (2) of the newly drilled boreholes. The groundwater levels ranged between 0 mbgl and 24.2 mbgl, with an average of 6 mbgl. The groundwater levels are therefore relatively shallow and can provide a source of water to perennial pans and wetlands in the area. Groundwater levels were compared to surface elevations and a good correlation between surface elevation and groundwater level was found with a correlation coefficient of 0.93, indicating groundwater flow directions will mainly follow topography and the main surface water drainage directions.

There are two boreholes with groundwater levels deeper than 20 mbgl. One of the boreholes is equipped and the lower water level could be because of abstraction. The other borehole is not equipped but may be influenced by dewatering from a neighboring mining project.

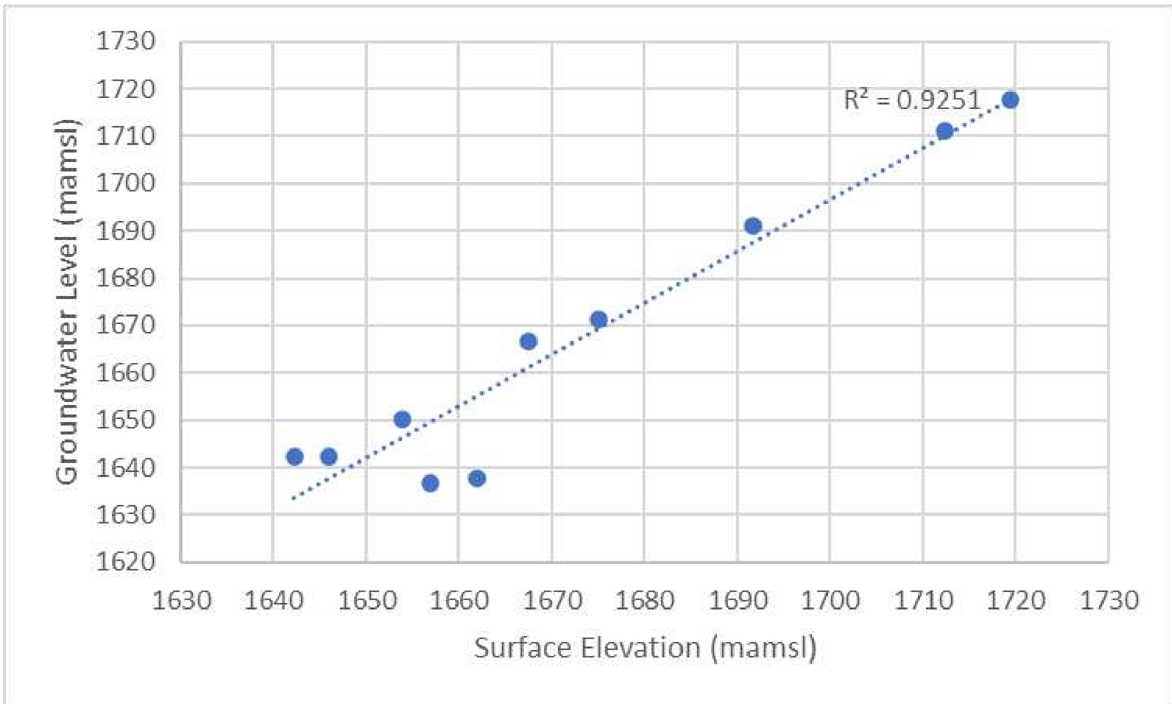


Figure 11-41: Bayesian Correlation between Surface Elevation and Groundwater Levels

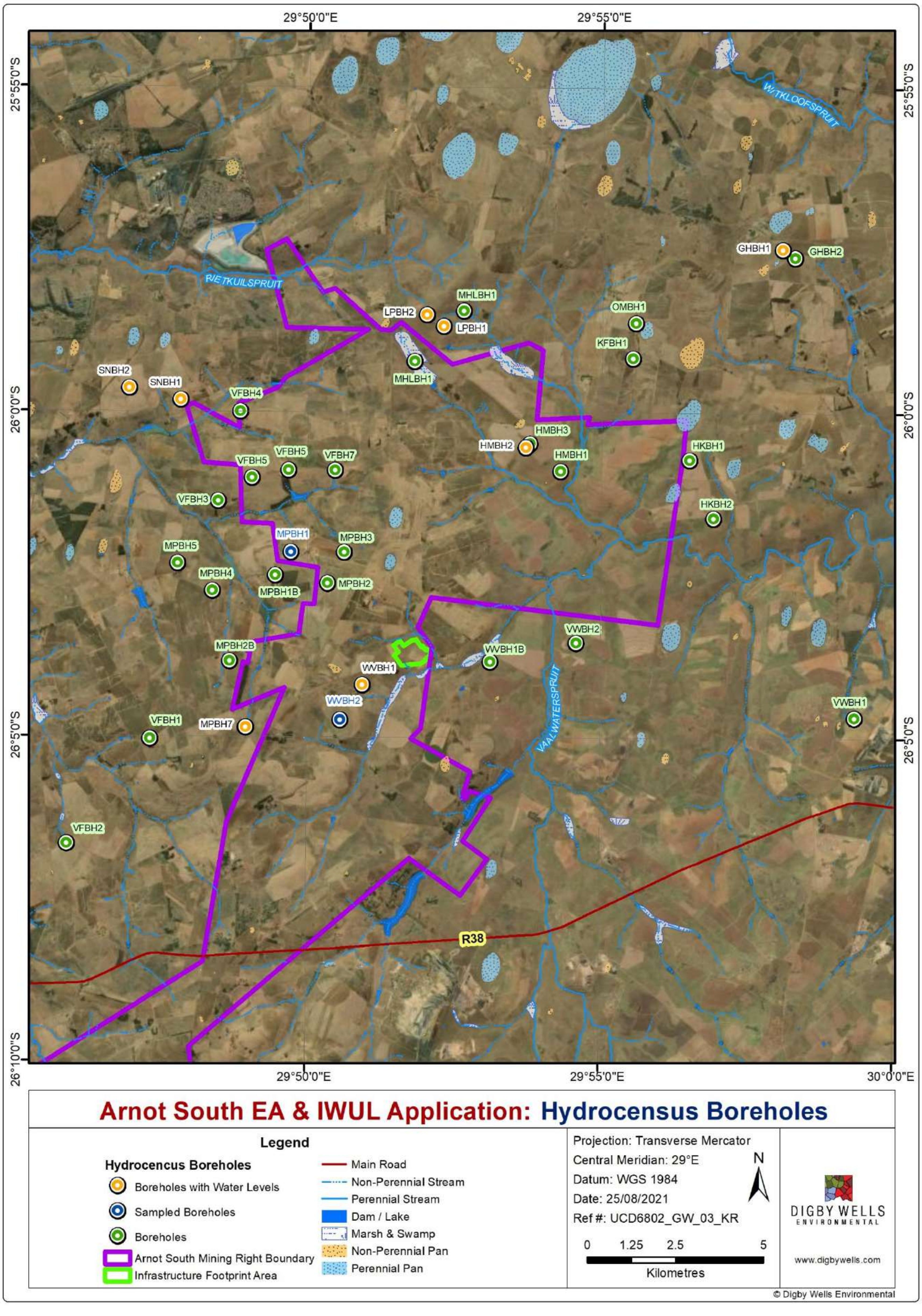


Figure 11-42: Hydrocensus Boreholes

11.10.3.3 Hydrochemistry

The Piper Diagrams (Figure 11-43) and Expanded Durov (Figure 11-44) graphs have been used to describe the hydrochemistry for the sampled boreholes.

The Piper Diagram is particularly useful for identifying groundwater facies which groups groundwater of similar chemistry into one section. The Expanded Durov diagram improves on the Piper Diagram by displaying important hydrochemical processes, such as ion exchange, simple dissolution and mixing of waters of different qualities.

The Piper Diagram (Figure 11-43) shows that there is no dominant cation and bicarbonate as the dominant anion. The Expanded Durov Diagram (Figure 11-44) shows magnesium-bicarbonate type water. Based on these two diagrams it can be noted that the water on site is fresh recently recharged water.

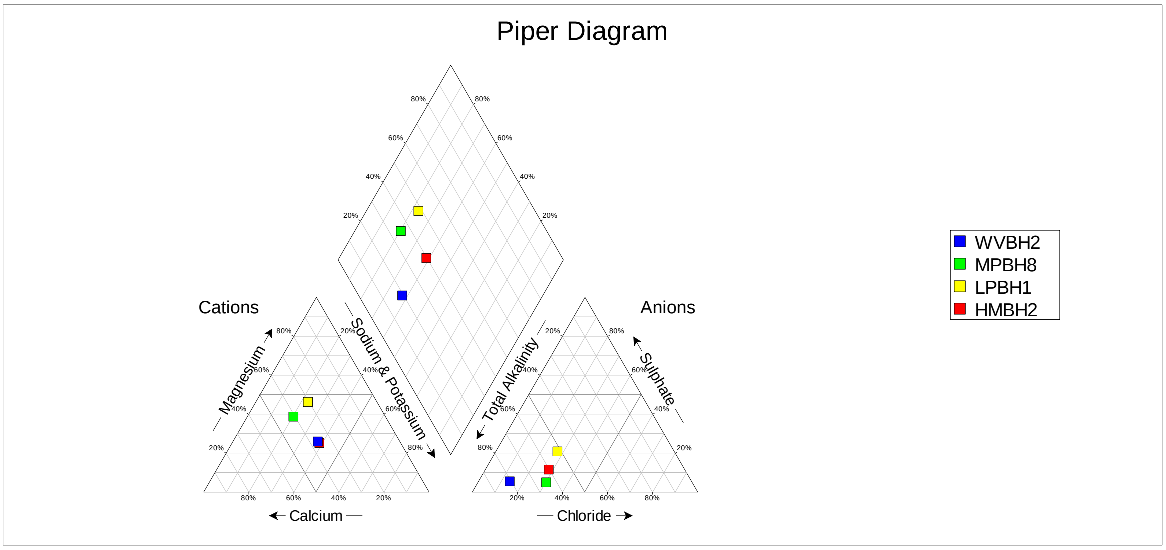


Figure 11-43: Piper Diagram

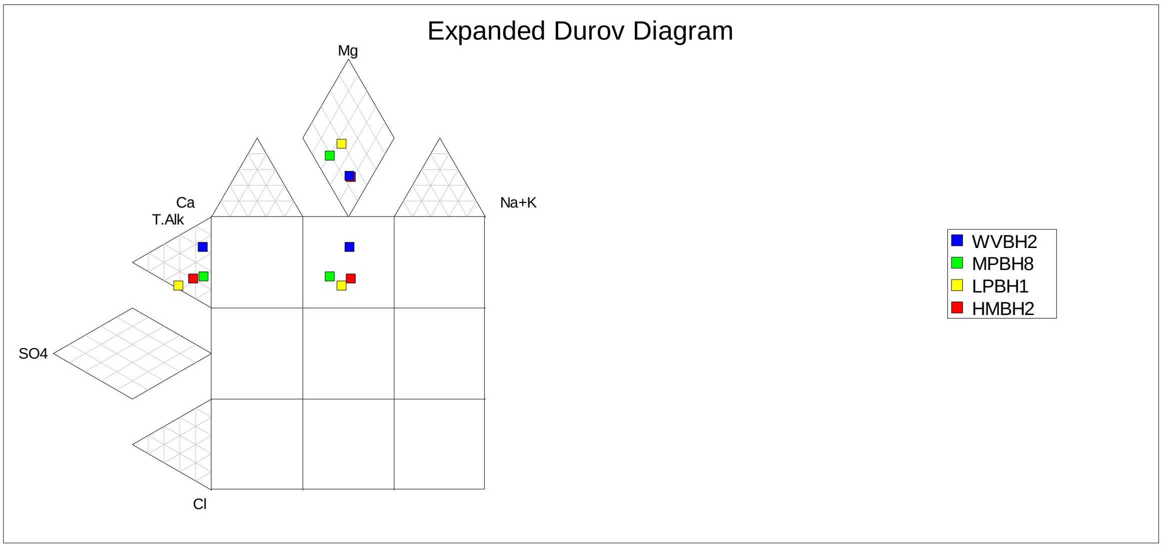


Figure 11-44: Expanded Durov Diagram

11.10.3.4 Groundwater Quality

The groundwater quality results were compared to the South African Water Quality Guidelines (SAWQG): for Drinking Water to provide an indication of the baseline water quality for the project. A total of ten samples were collected and only four were sent to a laboratory for water quality analysis (the additional six samples were to be collected in areas where landowners did not allow access, and therefore four samples were sent for analysis). Samples collected were sent to M and L laboratories (a SANAS accredited lab) for analysis. The results are summarized in Table 11-31. An additional three water samples were collected from the newly drilled boreholes, however, these results are still outstanding.

The groundwater quality in the project area shows relatively good quality of the groundwater in the area, with a few exceedances. The most notable exceedances are for pH at LPBH1 which was not within the acceptable limit. Nitrate at WVBH2 and MPBH8 was above the ideal limit but withing the acceptable limit, this exceedance can be associated with the widespread use of fertilizer in the area. Additionally, manganese was above the ideal limit at LPBH1 which is associated with the surrounding geology

Table 11-31: Baseline Water Quality

Site Name	Sample Date	pH	EC mS/m	TDS mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO4 mg/L	NO3-N mg/L	F mg/L	Al mg/L	Fe mg/L	Mn mg/L	NH4 mg/L
Ideal			70	450	32	30	100	50	100	200	6	1	0.15	0.1	0.05	0.1
Acceptable			150	1000	80	50	200	100	200	400	10	1.5	0.5	0.3	0.1	2
Unacceptable		<6 or >9	>150		>80	>50	>200	>100	>200	>400	>10	>1.5	>0.5	>0.3	>0.1	>2
WVBH2	2020/04/07	7.26	20.41	136	15.5	6.64	15.05	6.2	8.2	<4	6.2	<0.1	<0.017	0.004	<0.001	<1.00
HMBH2	2020/04/07	6.38	11.4	98	7.7	3.23	4.76	8.29	9.43	5	2.8	<0.1	<0.017	0.04	0.004	<1.00
MPBH8	2020/04/07	6.67	26.03	216	22.1	12.64	9.9	5.33	19.59	<4	9.6	<0.1	<0.017	0.007	<0.001	<1.00
LPBH1	2021/04/07	5.92	22.22	144	14.6	13.34	11.5	2.48	21	21	1.3	<0.1	<0.017	0.006	0.078	<1.00

11.10.4 Aquifer Testing

The slug test data was analysed using Aqtesolv software. The Bouwer-Rice and Hvorslev methods for unconfined conditions were used to determine the hydraulic conductivity for the aquifer system. The results are summarised in Table 11-32.

The hydraulic conductivities range between 0.003 m/d and 0.6 m/d which are typical for Karoo aquifers. Project experience around Hendrina indicates typical hydraulic conductivities of between 0.25 m/d and 0.06 m/d for the weathered to shallow aquifer and between 0.005 m/d 0.0002 m/d for the deeper fractured aquifer.

Table 11-32: Aquifer Test Summary

BH ID	Blow yield (l/s)	Pump yield (l/s)	Test	Total Displacement (m)	Test duration (min)	Recovery %	Hydraulic Conductivity (m/day)			Transmissivity (m2/day)
							Bouwer-Rice	Hvorslev	Average	
MPBH3	-	-	Slug (In) Early	0.27	12	26	0.47	0.59	0.53	33.0
MPBH3	-	-	Slug (In) Late				0.006	0.006	0.006	0.4
WVBH2	-	-	Slug (In)	0.25	6	52	0.17	0.20	0.18	6.9
WVBH2	-	-	Slug (Out)	0.25	9.5	91	0.28	0.37	0.32	12.1
WVBH3	-	-	Recovery	33.1	2963	-	0.003	0.004	0.004	0.1
Average									0.21	10.5
Geometric mean									0.06	2.6
Harmonic mean									0.01	0.4

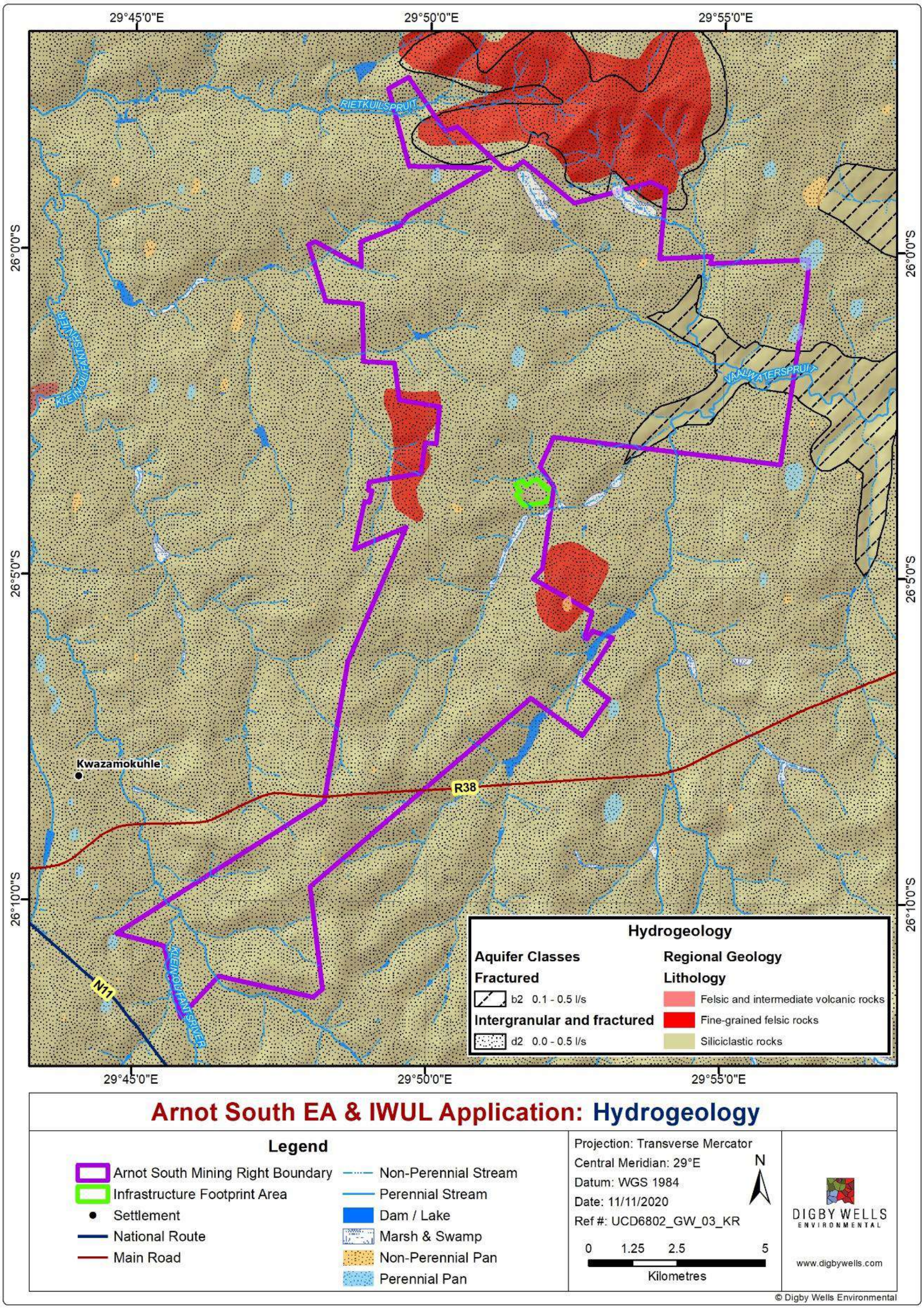


Figure 11-45: General Site Aquifer

11.11 Air Quality

The Air Quality Impact Assessment undertaken during the EIA Phase appended to this report as Appendix K.

11.11.1 Predicted Concentration of $PM_{2.5}$

The predicted Ground Level Concentrations (GLC) of $PM_{2.5}$ over a 24-hour averaging period for the operational phase returned simulation isopleths that are shown in Figure 11-46 ($PM_{2.5}$ daily) and Figure 11-47 ($PM_{2.5}$ annual).The model simulations show the worst-case scenario (assuming no mitigation measures were put in place). The model simulation did not return areas with exceedances of the 24-hour standard (40 µg/m³). The maximum GLC predicted was 29.6 µg/m³. The predicted GLC at the sensitive receptors (SR1) and SR2 were lower than the daily standard. The annual GLC of $PM_{2.5}$ predicted will not exceed the regulatory standard onsite and at selected receptors.

11.11.2 Predicted Concentration of PM_{10}

The predicted GLC of PM_{10} over a 24-hour averaging period returned simulation isopleths shown in Figure 11-48 (PM_{10} daily) and Figure 11-49 (PM_{10} annual).

The areas where the 24-hour standard of 75 µg/m³ are predicted to be exceeded are along the dirt road from the plant to the edge of the western boundary (dirt road that runs south to R38). The predicted daily GLC at the nearest sensitive receptors SR1 and SR2 were lower than the daily standard (Table 11-33). The predicted annual isopleth showed that exceedances will occur along the dirt road to the edge of the western boundary without mitigation. The predicted annual GLC at the nearest sensitive receptors SR1 and SR2 were below the annual standard

11.11.3 Predicted Dustfall Rates

The predicted dustfall rates are shown in Appendix K (without mitigation and with mitigation). The predicted dustfall rates confirmed that the non-residential limit of 1,200 mg/m²/d will be exceeded onsite and along the dirt road leading to the western boundary. The exceedances will be confined within the project area. With mitigation in place, the areas with exceedance shrunk onsite and along the dirt road. The predicted dustfall rates at the selected receptors without and with mitigation were lower than the limit (Table 11-33).

11.11.4 Predicted Concentrations of SO_2

Model predictions confirm that the SOx (as SO_2) 24-hr GLC will be very low and unlikely to exceed the South African standard of 200 µg/m³.

11.11.5 Predicted Concentrations of NO_2

The predicted NOx (as NO_2) 1-hr GLC shows exceedances of the South African standard of 200 µg/m³ onsite and outside and beyond the western boundary. Being a gas, this pollutant will dissipate quickly to negligible levels further away from the project area. The NOx (annual) were very low, hence could not plot.

11.11.6 Predicted Concentrations of CO

Model simulations returned predicted CO 1-hr and CO 8-hr GLCs that were below the South African standard of 30 mg/m^3 and 10 mg/m^3 onsite and at the surrounding sensitive receptors. During the operational phase, the exceedance of the regulatory limit is not anticipated due to the low GLC predicted.

Table 11-33: Predicted Concentrations of PM_{10}, $PM_{2.5}$ and Dust Deposition Rates at Selected Sensitive Receptors

Pollutants	Averaging Period	South Africa Air Quality Standard (µg/m³)	Predicted Ground Level Concentration (µg/m³)	
			SR1	SR2
$PM_{2.5}$ (No Mitigation)	Daily	40[1]	3.9	2.7
	Annual	20[1]	0.2	0.3
PM_{10} (No Mitigation)	Daily	75[1]	25	10
	Annual	40[1]	1.5	0.9
Dust Deposition Rates (mg/m²/day)				
Dust (No Mitigation)	Monthly	Residential (600[2]) Non-residential (1200[2])	37	60
Dust (With Mitigation)			18	42

1. South African National Ambient Air Quality Standards, 2009;2012
2. South African National Dust Control Regulation, 2013 (NDCR)

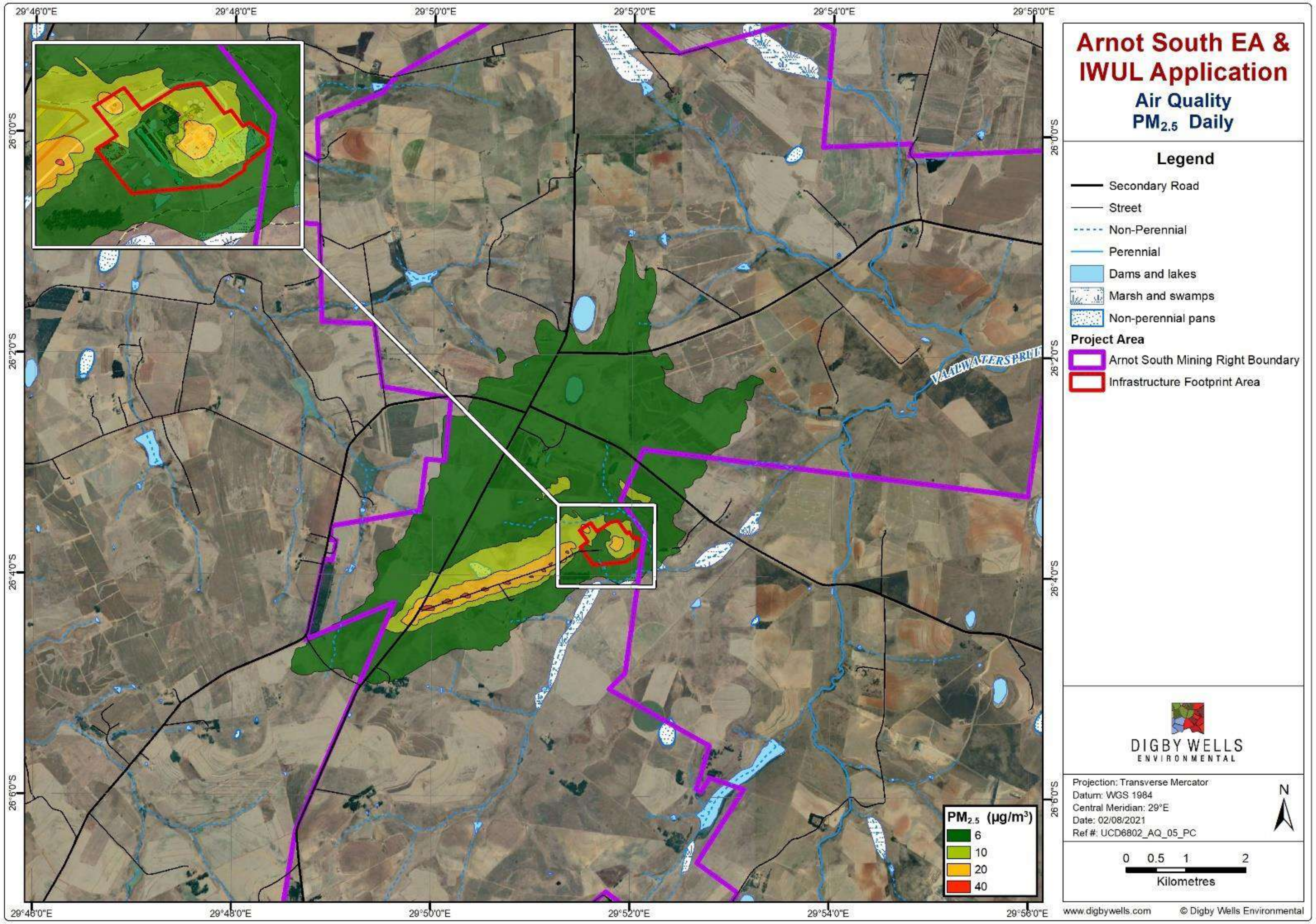


Figure 11-46: : Predicted 4th highest (99th percentile) daily $PM_{2.5}$ Concentrations (µg/m³)

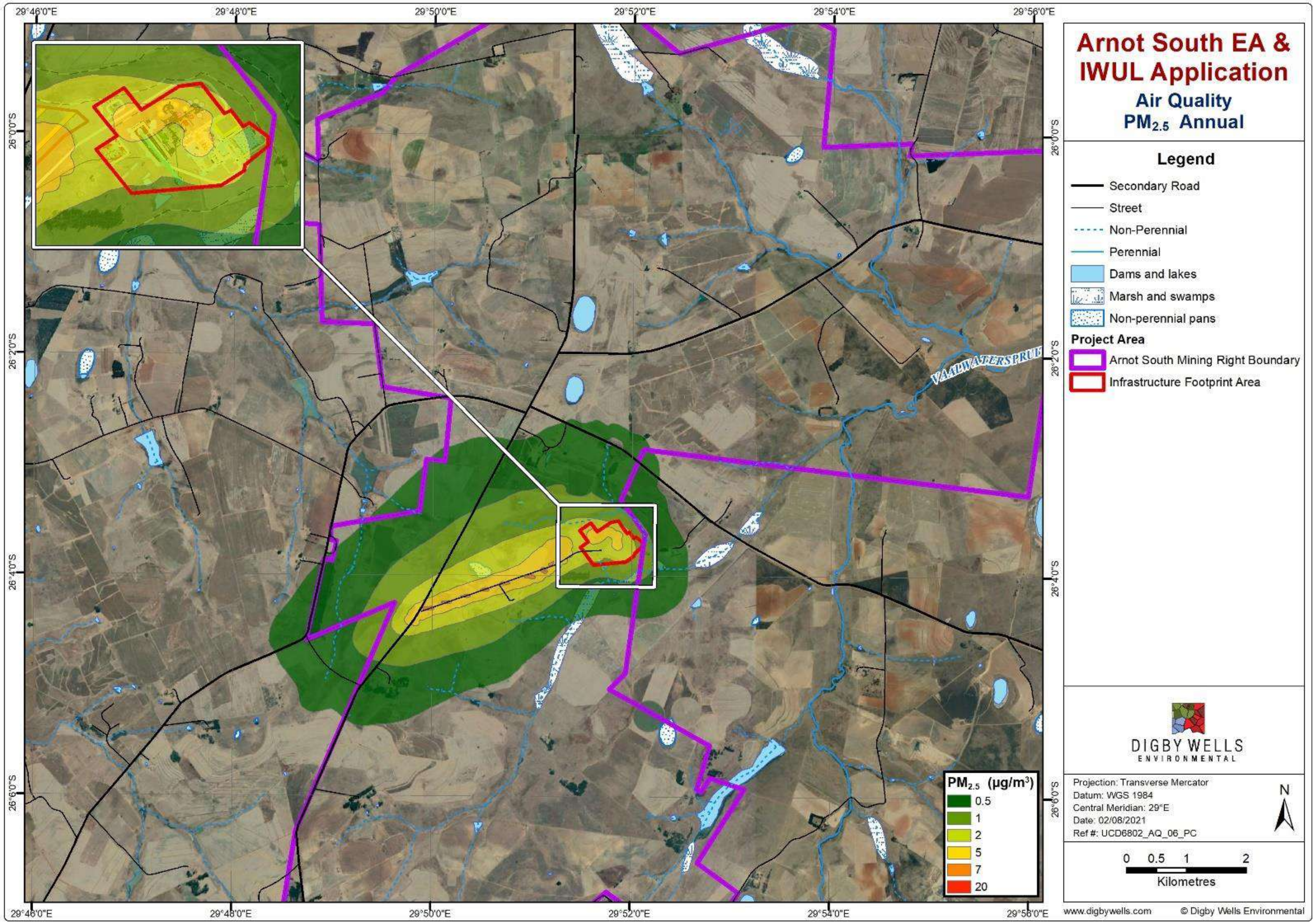


Figure 11-47: Predicted 1st highest (100th percentile) Annual PM2.5 Annual Concentrations (µg/m³)

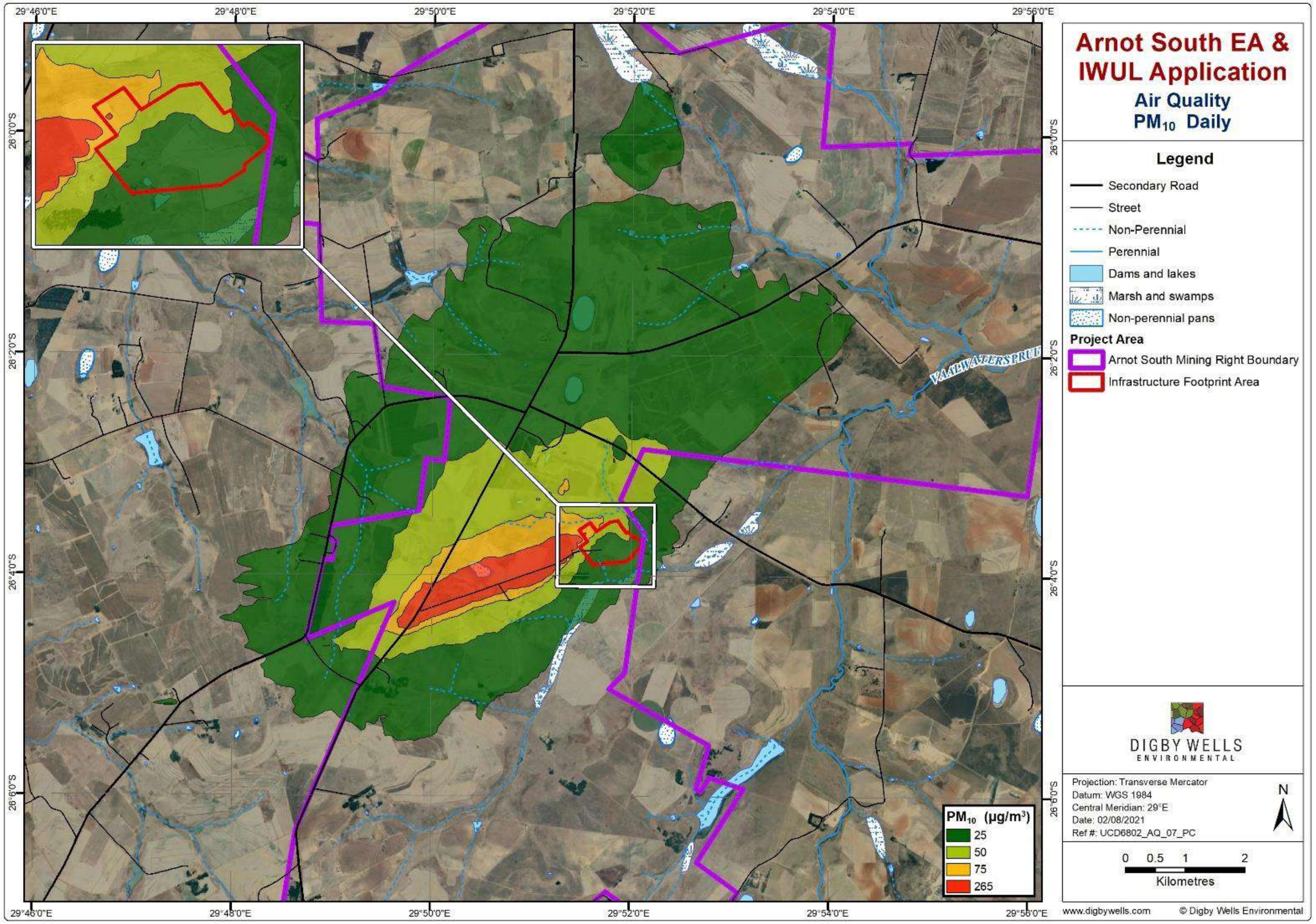


Figure 11-48: Predicted 4th highest (99th percentile) daily PM_{10} Concentrations (µg/m³)

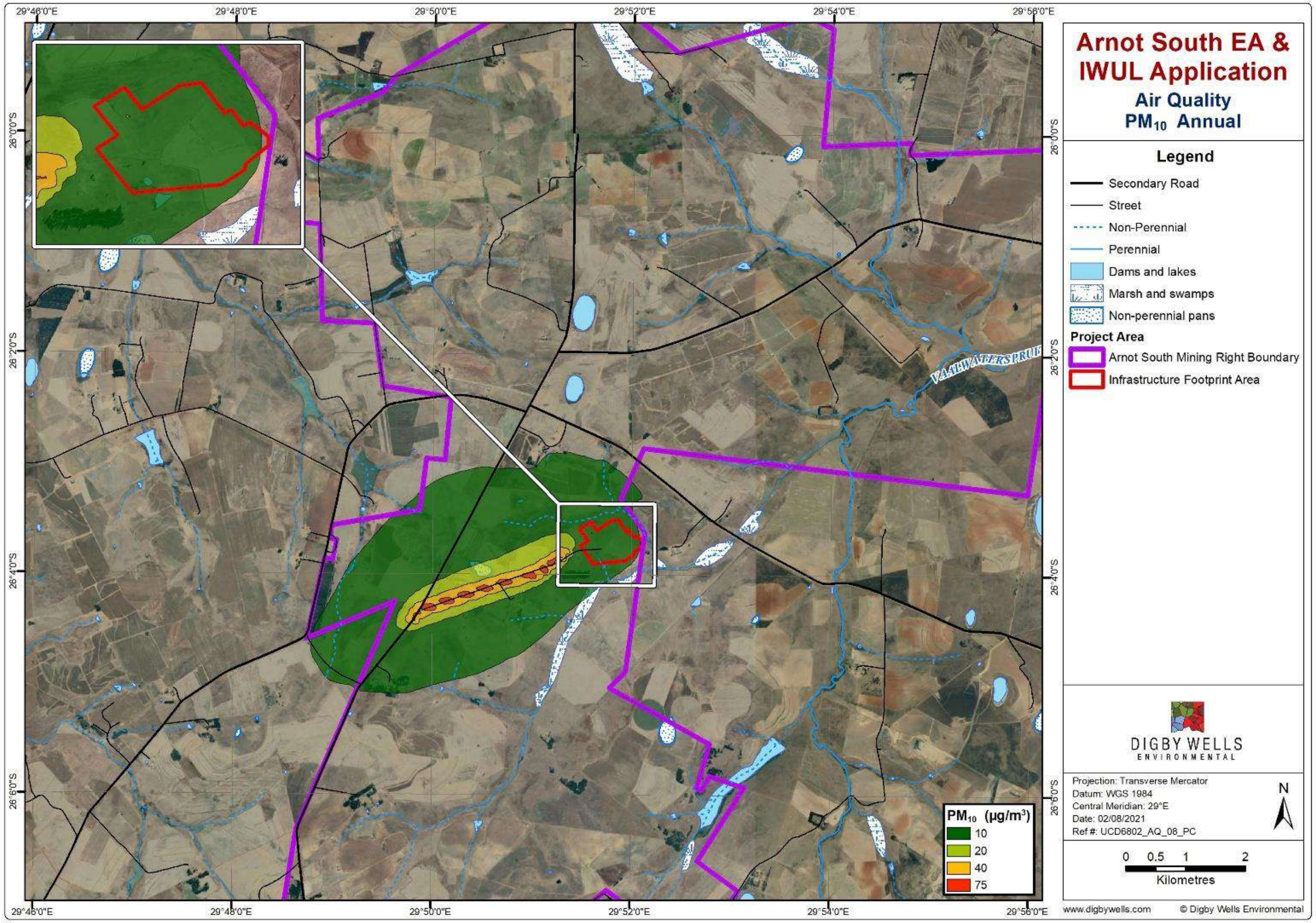


Figure 11-49: Predicted 1st highest (100th percentile) Annual PM_{10} Concentrations (µg/m^3)

11.12 Noise

The Noise Impact Assessment undertaken during the EIA Phase is appended to this report as Appendix L.

11.12.1 Sensitive Receivers

Due to the low population density of the receiving environment, sensitive receivers are limited and are at a distance from the proposed Project area, refer to Figure 11-50. The only nearby sensitive receivers closer the operation was a farm homestead, within 5 km of the proposed noise generating infrastructure locations.

11.12.2 Ambient Noise Levels

The results of the noise monitoring survey are presented in Table 11-34 and discussed in the sections below. The ambient noise levels recorded on-site, the rating limits according to the SANS 10103:2008 guidelines, are presented side by side. The SPL is given in the A-weighted scale, which is used to filter the sound levels according to the human ear's varying response to different frequencies.

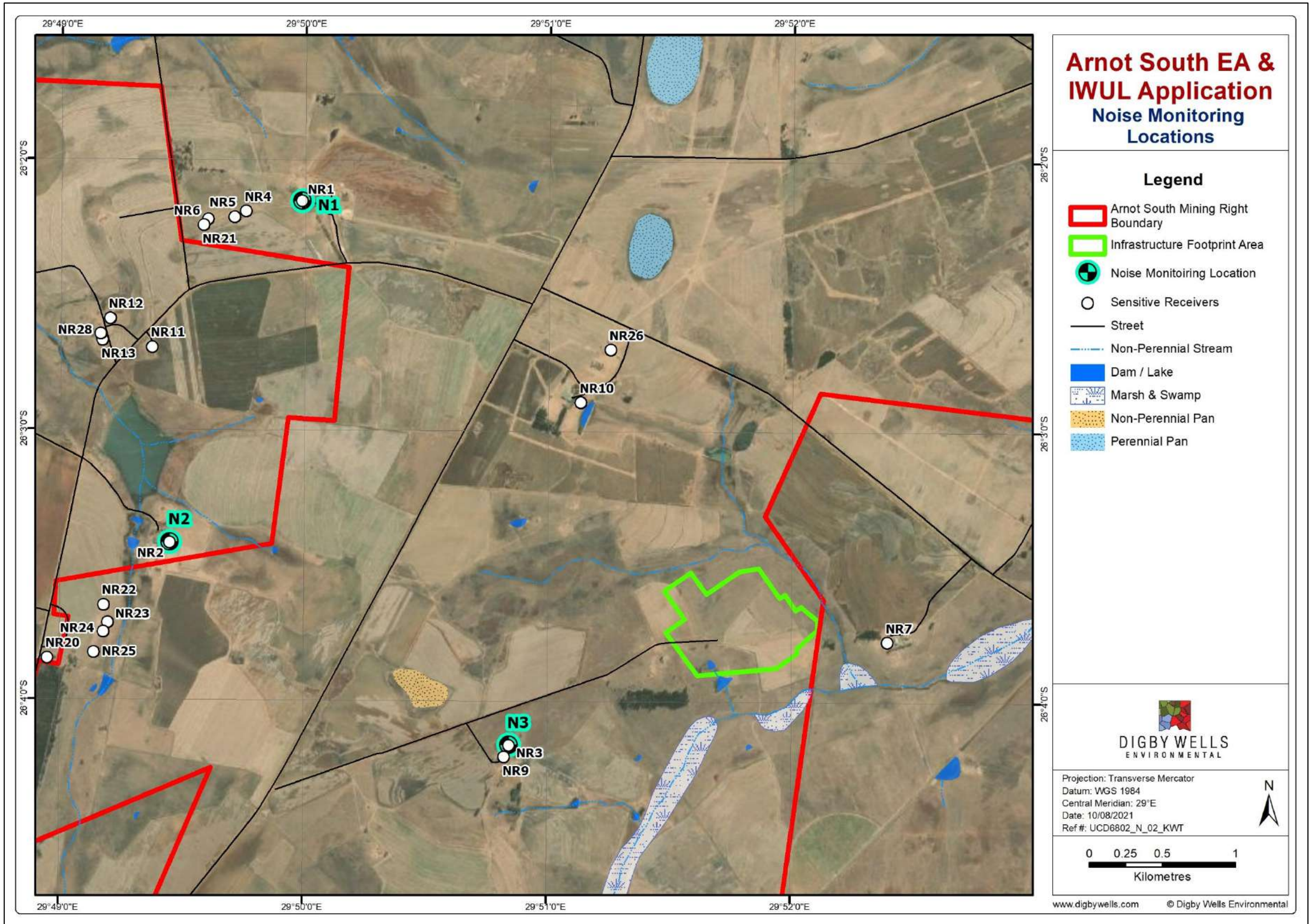


Figure 11-50: Noise Measurement and Sensitive Receivers Locations

Table 11-34: Baseline Noise Measurements

Sample ID	SANS 10103:2008 rating limit					
	Type of district	**Period**	**Acceptable Rating Level dBA**	**$L_{Aeq,T}$ dBA (Field Measurement)**	**Maximum / Minimum dBA**	**Date**
N1	Rural	Daytime	45	43	88 / 22	07/06/2021– 08/06/2021
		Night-time	35	26	71 / 24	
N2	Rural	Daytime	45	41	83 / 11	09/06/2021 – 11/06/2021
		Night-time	35	29	71 / 26	
N3	Rural	Daytime	45	46	82 / 28	04/06/2021 – 05/06/2021
		Night-time	35	38	65 / 27	
	Indicates current $L_{Aeq,T}$ levels above either the daytime rating limit or the night-time rating limit					

11.13 Heritage

The Heritage Impact Assessment undertaken during the EIA Phase is appended to this report as Appendix M.

11.13.1 Cultural Heritage Baseline Description

Table 11-35 presents an overview of the broad timeframes for the major periods of the past in the Mpumalanga Province. Figure 11-51 presents a summary of the heritage resources identified within the larger study area. The figure presents the relative abundance of these heritage resources as grouped by the periods listed in Table 11-35.

Table 11-35: Archaeological Periods in Mpumalanga

The Stone Age	Earlier Stone Age (ESA)	2 mya to 250 thousand years ago (kya)
	Middle Stone Age (MSA)	250 kya to 20 kya
	Later Stone Age (LSA)	20 kya to 500 CE (Common Era[3])
There appears to be a gap in the record in Mpumalanga between approximately 7000 and 2000 BCE.		
Farming Communities	Early Farming communities (EFC)	500 to 1400 CE
	Late Farming Communities (LFC)	1100 to 1800 CE
Historical Period[4]	-	1500 CE to 1850 (Behrens & Swanepoel, 2008)

Adapted from Esterhuysen & Smith (Stories in stone, 2007)

[3] Common Era (CE) refers to the same period as *Anno Domini* ("In the year of our Lord", referred to as AD): i.e. the time after the accepted year of the birth of Jesus Christ and which forms the basis of the Julian and Gregorian calendars. Years before this time are referred to as 'Before Christ' (BC) or, here, BCE (Before Common Era).

[4] The author acknowledges that in southern Africa, especially in Mpumalanga, the last 500 years represents a formative period that is marked by enormous internal economic invention and political experimentation that shaped the cultural contours and categories of modern identities outside of European contact. This period is currently not well documented and is being explored through the 500 Year Initiative (Swanepoel, et al., 2008).

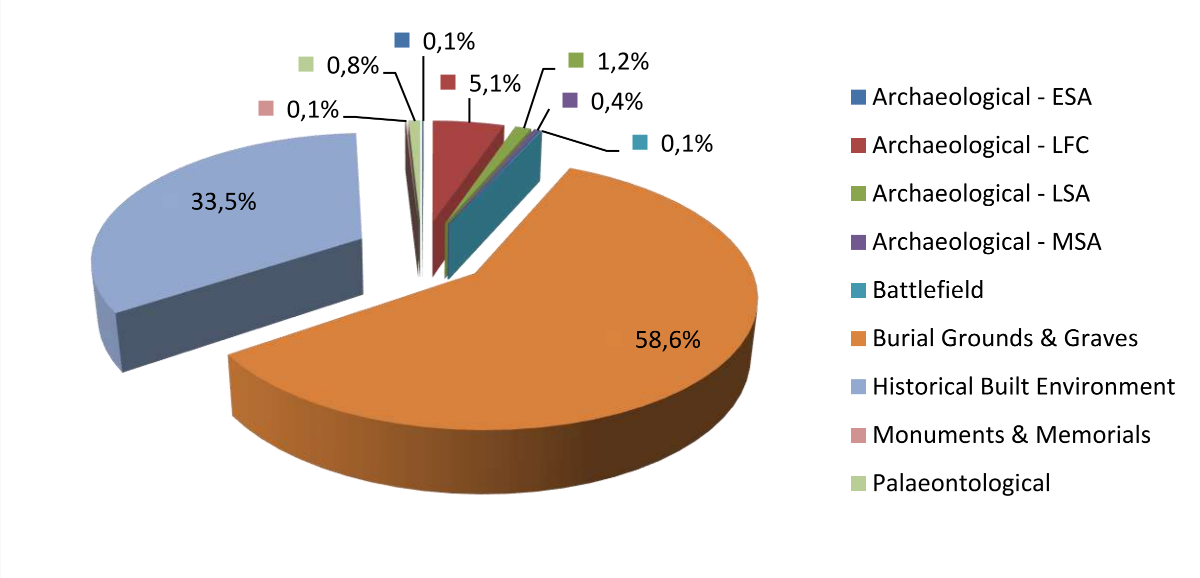


Figure 11-51: Heritage Resources identified within the Greater Study Area

In total 948 heritage resources were identified within the regional, local and site-specific study areas. The predominant tangible heritage resources recorded in the area under consideration demonstrate affiliations with the historical period, including the historical built environment and burial grounds and graves. This notwithstanding, expressions of the Stone Age, the Farming Community Period, battlegrounds and monuments and memorials have also been recorded in the regional study area.

11.13.2 Existing Environment

The natural vegetation of the site-specific study area has been disturbed in varying degrees by human activities. Table 11-36 presents a summary description of the natural environment within which the Project is situated. Figure 11-52 below presents an overview of the environment at the time of the pre-disturbance survey.

The environment at the time of the verification survey was disturbed through anthropogenic and animal activities. There is evidence that cattle graze on the land and burrowing animals were present within the Project area. Where noted, burrows were inspected for the presence of any archaeological materials.

Anthropogenic disturbances included farming activities including cultivated and cleared fields and associated infrastructure, such as formal and informal roads. Ornamental exotic plants were noted within the Project area.

Table 11-36: Summary of the Vegetation Setting of the Project

Biome	Bio-region	Vegetation Type
Grassland	Mesic Highveld Grassland	Eastern Highveld Grasslands (Gm12) This vegetation type is characterised by short dense grassland dominated by the usual highveld grasses with small, scattered rocky outcrops with wiry sour grasses and some woody species. This unit occurs on slightly to moderately undulating plains and includes some low hills and pan depressions. This vegetation type is associated with the Vryheid Formation of the Karoo Supergroup. This vegetation type is considered endangered and approximately 44% of the type has been transformed. Cultivation may have had the most extensive impact on this vegetation type and plantations, mines, urbanisation and dams are the other primary contributors to this transformation. Erosion in this type is very low.

Adapted from Mucina & Rutherford (The Vegetation of South Africa, Lesotho and Swaziland, 2010)

Figure 11-52: State of the Environment during the Pre-disturbance Survey

11.13.3 Newly Identified Heritage Resources

During the pre-disturbance survey undertaken for the current HRM process, two heritage resources were identified. Table 11-37 includes a summary of this heritage resource and Figure 11-53 includes photographs.

Table 11-37: Heritage Resources identified during the Survey

Heritage Resource	Description
Wf-01	Structure with one visible internal division. There is no roof and no fittings. The windows and doors are identifiable through the deliberate gaps in the structure. The doors have heavy wood lintels intact. This is likely to be a farmhouse or residential structure. The materials from which the structure is constructed suggest there have been multiple phases of construction or refurbishment. The exterior is largely sandstone, and the visible interior wall was made of mudbrick. In proximity to the structure is a windmill, reservoir and large animal kraal made of ferricrete and rock. The kraal is in good condition. Also near to the house is a small outbuilding made of ferricrete and red brick which has been plastered over. This werf may potentially include a mix of historical (i.e., older than 60 years) and more modern structures. Ornamental exotic plants were identified near this site. *These structures are not visible on the historical layering. However, there are lines of trees visible on the historical imagery at this point. Such features are typically associated with historical structures. As such, this structure is assumed to be older than 60 years and must be assumed to have General Protection under Section 34 of the NHRA.*
Wf-02	Structure with an exterior made of sandstone blocks and interior walls of red brick. The walls are in various states of collapse, from none to total collapse. The number of internal divisions is not clear, but there is at least one. Part of the standing red brick wall was plastered and one side had been painted red. This suggests that the different rooms had been used for specific purposes. This was most likely a farmhouse or residential structure. One doorway is visible and other has been blocked by red brick. The doorways include stone lintels. The roof is missing and no fittings were present. In proximity to the house, a square stone foundation and reservoir are present. Some distance away from the house[5] lies an additional square foundation. Walls occur around the foundation but range from near collapse to a maximum height of two courses. These walls are made of sandstone and ferricrete. The purpose of the structure is not obvious from the remains but are considered here as part of Wf-02. *These structures are not visible on the historical layering. However, there are lines of trees visible on the historical imagery at this point. Such features are typically associated with historical structures. As such, this structure is assumed to be older than 60 years and must be assumed to have General Protection under Section 34 of the NHRA.*

[5] At the point indicated Wf-02b in Appendix M.

Structures present at Wf-001

Structures present at Wf-002

Figure 11-53: Results of the Pre-disturbance Survey showing Newly Identified Heritage Resources

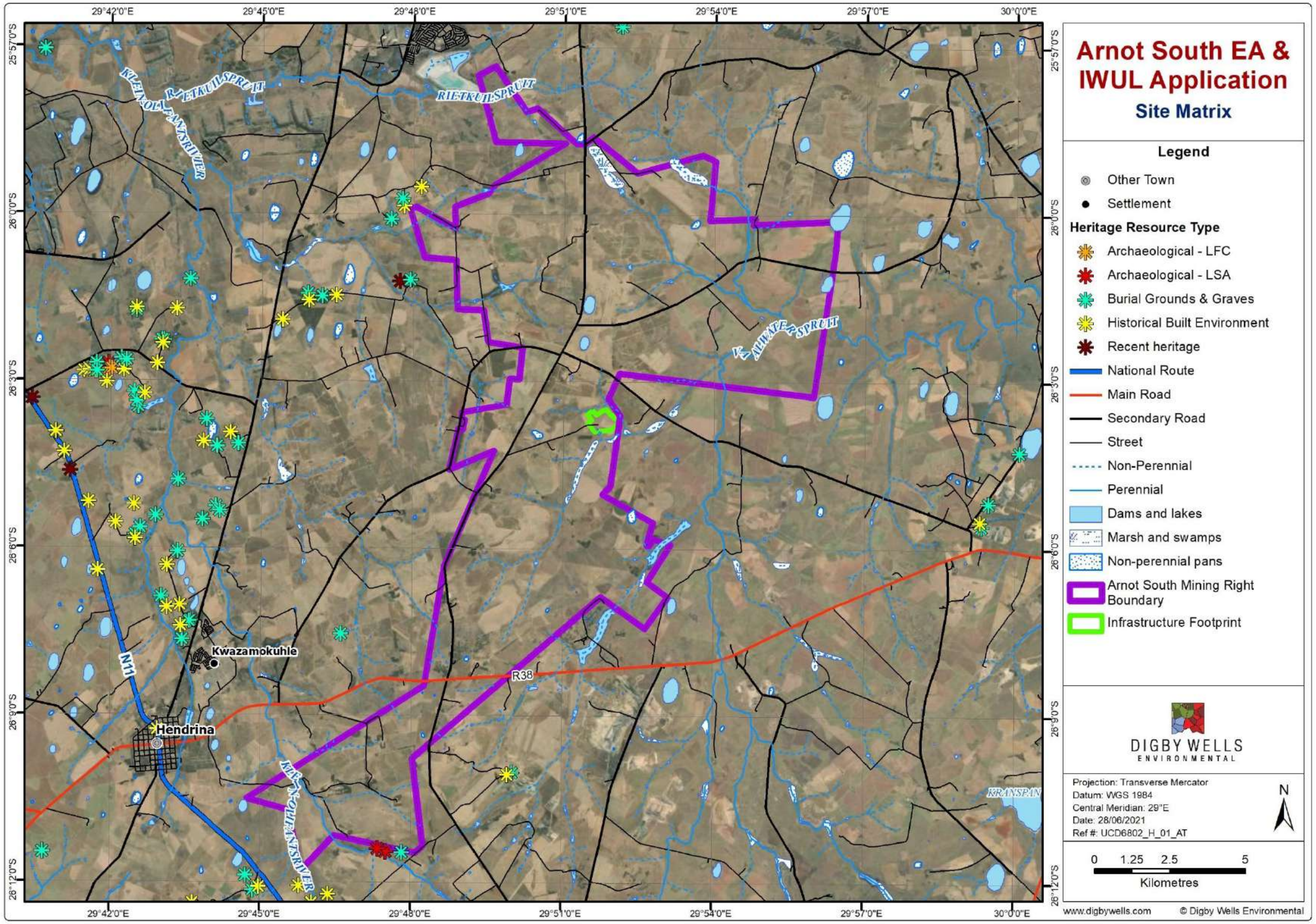


Figure 11-54: Site Matrix

11.14 Visual

A Visual Impact Assessment (VIA) undertaken during the EIA Phase is appended to this report as Appendix N.

11.14.1 Visual Environment

The expected visual impact of the Project was categorised based on the type of receiving environment and the type of development as detailed in Table 11-38 (Oberholzer, 2005). The table provides an indication of the visual impacts that can be expected for different types of developments in relation to the nature of the receiving environment. Following this classification system, the Project is classed as a **Category 5 development**. The receiving environment is best described as an **area of medium scenic, cultural or historical significance**. It is therefore expected that the Project will potentially have a **high visual impact** on the receiving environment as shown in Table 11-39.

Table 11-38: Key to Categorisation of Development (adapted from Oberholzer, 2005)

Type of Development	Examples of Development
Category 1	Nature reserves, nature related recreation, camping, picnicking, trails and minimal visitor facilities.
Category 2	Low-key recreation/resort/residential type development, small-scale agriculture/nurseries, narrow roads and small-scale infrastructure.
Category 3	Low density resort/residential type development, golf or polo estates, low to medium-scale infrastructure.
Category 4	Medium density residential development, sports facilities, small-scale commercial facilities/office parks, one-stop petrol stations, light industry, medium-scale infrastructure.
Category 5	High density township/residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll roads, large-scale infrastructure generally. Large-scale development of agricultural land and commercial tree plantations. Quarrying and mining activities with related processing plants.

Table 11-39: Categorisation of Expected Visual Impact (adapted from Oberholzer, 2005)

Type of Environment	Type of Development (Low to High Intensity)				
	Category 1 Development	Category 2 Development	Category 3 Development	Category 4 Development	Category 5 Development
Protected/wild areas of international, national or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high, scenic, cultural or historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected
Areas or routes of medium scenic, cultural or historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural or historical significance	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected
Disturbed or degraded sites/run down urban areas/wasteland	Little or no visual impact expected. Possible benefits	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

For projects where a high or very high visual impact is expected, Oberholzer (2005) recommends that a Level 4 visual assessment be conducted. A Level 4 visual assessment includes the following:

- Identification of issues raised in the scoping phase, and site visit;
- Description of the receiving environment and the proposed project;
- Establishment of view catchment area, view corridors, viewpoints and receptors;
- Indication of potential visual impacts using established criteria;
- Description of alternatives, mitigation measures and monitoring programmes; and

- Complete 3D modelling and simulations, with and without mitigation.

11.14.2 Receptor Identification

An analysis of the various datasets used for the receptor identification indicates the following categories of receptors shown in Table 11-40.

Table 11-40: Receptor categorisation

Identified Receptor Category	Description	Distance from proposed development
Disperse settlements	The project area is characterized by disperse settlements which are located throughout the surrounding farms.	Ranging from immediate vicinity to 20 km.
Town Settlements	Jonkerville (Kwazamakuhle)	14.45 km
	Hendrina	17.23 km
	Rietkuil	13.2 km
	Arnot	16.26 km
	Nazareth	15.46 km
Nature Reserve	Nooitgedacht Dam Nature Reserve	17.00 km
Motorists	N11	17.50 km
	R38	8.4 km
Surrounding Coal Mine Operations	Various active and inactive coal mines around the region	Ranging from 8.8 km to 20 km.

Figure 11-55 provides a spatial representation of the various potential sensitive receptors that have been identified.

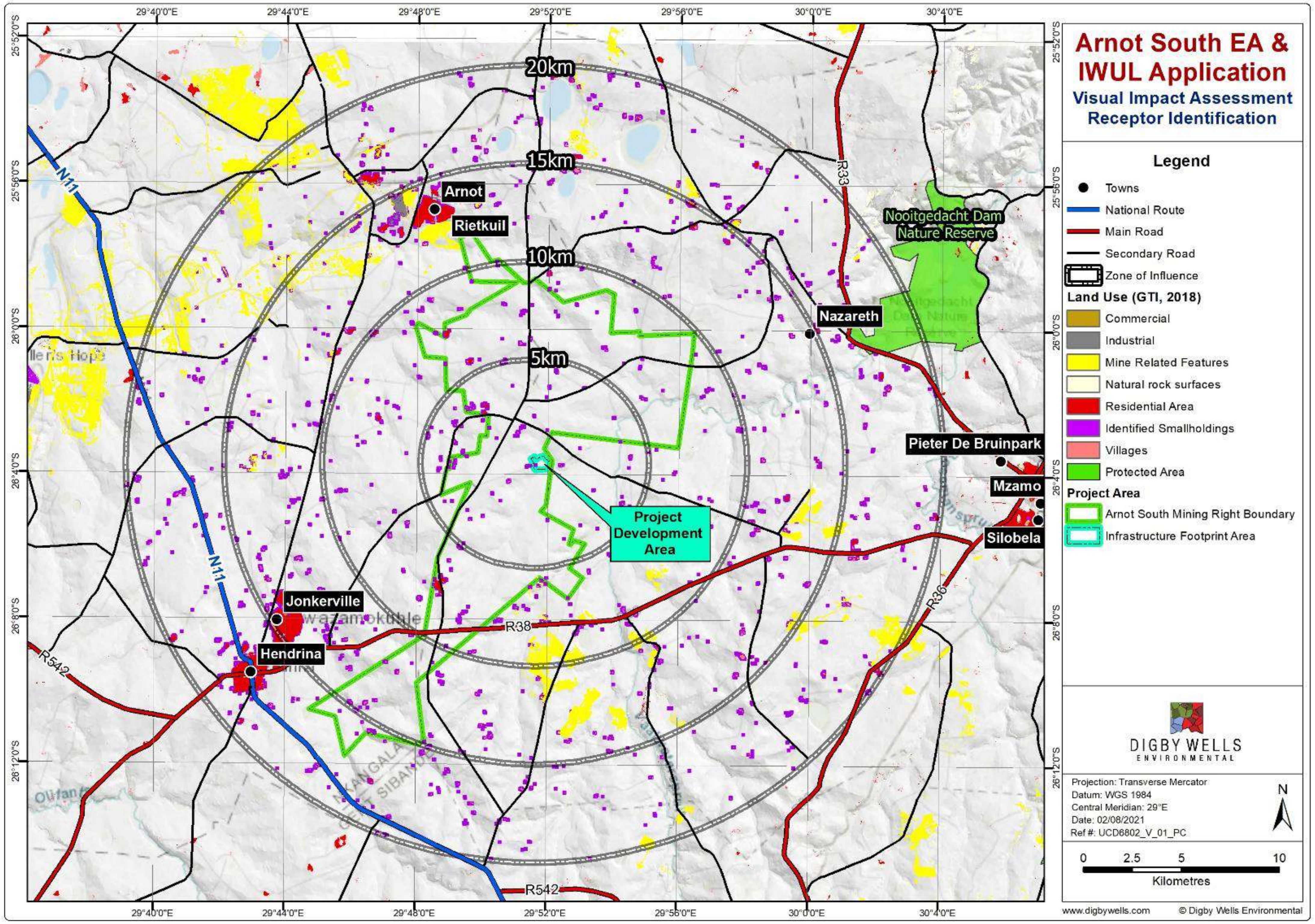


Figure 11-55: Receptor identification and distribution

11.14.3 Viewshed Assessment

The results from the viewshed modelling process are presented in this section, where individual viewsheds were run to model the potential impact of the most significant infrastructure features as detailed in Visual Report appended to this report as Appendix N.

11.14.3.1 Discard dump viewshed results

The results indicate that the discard dump will have the largest potential for visual impact based on the area of visibility. Very high visual exposure is limited to the region within five kilometres of the development area. The results also show that the majority of the visual impact is anticipated to occur to the Eastern side of the project area, owing to the visual screening from the topographical variation. Sections along the R38 main road are affected by moderate levels of visual exposure. The Visual Report shows the extent of the viewshed modelling results from the discard dump. The large contribution is due to the vertical offset of 30-meters, which is anticipated to be the highest feature from the operational phase of the mine.

11.14.4 Box-cut and berm viewshed results

The results from the box-cut and surrounding berm’s viewshed analysis indicate that most of the visual exposure is expected to be restricted to the immediate region, within ten kilometres of the proposed development area. The highest degrees of visual exposure are anticipated to occur to the immediate north-west of the project development area, within a four-kilometre area. Extensions of moderate level exposure are seen towards the south-west of the project development area, which will likely be screened by the placement of the overburden dump. A potential moderate visibility location is identified along the R38. The Visual Report shows the extent of the viewshed modelling results from the box-cut and its associated two-meter-high berm.

11.14.5 Overburden dump viewshed results

The results from the overburden dump share a similar viewshed distribution to the discard dump, but with a smaller area of visual impact to the west of the project development area due to the topographical screening (the overburden dump being ten-meters lower than the discard dump). The majority of high to very high visual exposure is anticipated to occur within the five-kilometre radius from the project development area. The Visual Report shows the extent of the viewshed modelling results from the overburden dump.

11.14.6 Vent shaft

The results from the vent shaft viewshed analysis indicate that most of the visual exposure from the overhead gear is expected to be restricted to the immediate region, within ten kilometres of the proposed development area. The highest degrees of visual exposure are anticipated to occur to the immediate north-west of the project development area, within a two-kilometre area. The Visual Report shows the extent of the viewshed modelling results from the vent shaft.

11.14.7 Product stockpiles and plant

The results from the product stockpiles and adjacent plant's viewshed analysis indicate that most of the visual exposure is expected to be restricted to the immediate region, within ten kilometres of the proposed development area. Extensions of moderate level exposure are seen towards the south-west of the project development area, which will likely be screened by the placement of the overburden dump. The highest degrees of visual exposure are anticipated to occur to the immediate north-west of the project development area, within a two-kilometre area. The Visual Report shows the extent of the viewshed modelling results from the product stockpiles and plant.

11.14.8 Workshops, offices and PCD area

The results from the ancillary structures (workshops, offices, etc) and PCD's viewshed analysis indicate that most of the visual exposure is expected to be restricted to the immediate region, within ten kilometres of the proposed development area. Extensions of moderate level exposure are seen towards the south-west of the project development area, which will likely be screened by the placement of the overburden dump. The highest degrees of visual exposure are anticipated to occur to the immediate north-west of the project development area, within a two-kilometre area. The Visual Report shows the extent of the viewshed modelling results from the product stockpiles and plant.

11.15 Traffic

The Traffic Impact Assessment (TIA) was conducted by EDL Engineers (Pty) Ltd (EDL) and is attached to this report as Appendix O. The study was undertaken to investigate the passing and new traffic that will be generated by the colliery, and to quantify, as well as evaluate its impact on the existing road network.

11.15.1 Surrounding Road Network

The following roads are relevant to the study area:

- **R38:** This road functions as a Rural Major Arterial (Class R2) and falls under the jurisdiction of The South African National Roads Agency Limited (SANRAL). As it runs across the southern portion of the planned mining area, in an east / west direction between Hendrina and Carolina with an observed speed limit of 120km/h, this road is a single carriageway road with no median and one lane in each direction.

  Traffic counts indicate that this road carries traffic volumes of between 45vph and 130vph per direction during the weekday morning (AM) and afternoon (PM) peak hours.

- **D383:** This road is classified as a District Collector (Class 4) and falls under the jurisdiction of the Mpumalanga Department of Public Works, Roads and Transport (MDPWRT). This is a gravel road which is in a relatively good condition with ample space for one vehicle travelling per direction, for most of its length (upgrades are proposed in Chapter 8). This road runs in a north / south direction and intersects the R38 by means of a four (4) legged, 2-way stop intersection, with the R38 having the right-of-way. This gravel road measures 9.5m to 10m wide in the vicinity of where the access to the development is proposed.

  Traffic counts indicate that this road carries traffic volumes of less than 15vph per direction during the weekday morning (AM) and afternoon (PM) peak hours past the study site's access road.

- **D1555:** This road is classified as a District Collector (Class 4) and falls under the jurisdiction of the Mpumalanga Department of Public Works, Roads and Transport (MDPWRT). This is a surfaced, single carriageway road with one lane per direction, running in an east / west direction between the D383 and Rietkuil. This road intersects the D383 by means of a T-junction intersection, which is in a poor condition (upgrades proposed in Chapter 8).

  Traffic counts indicate that this road carries traffic volumes of between 20vph and 60vph per direction during the weekday morning (AM) and afternoon (PM) peak hours.

- **D2225**: This road is classified as a District Collector (Class 4) and falls under the jurisdiction of the Mpumalanga Department of Public Works, Roads and Transport (MDPWRT). This road runs in a southerly direction, into Rietkuil and Arnot, past the Arnot power station, as a surfaced single carriageway road with no median and one lane per direction.

  Traffic counts indicate that this road carries traffic volumes of between 25vph and 60vph per direction during the weekday morning (AM) and afternoon (PM) peak hours.

11.15.2 Future Road Network

There are no new roads / streets planned within the immediate vicinity of the proposed colliery which might impact the proposed colliery, nor its operations. For any other upgrades, as proposed by EDL, please refer to Chapter 5 and 8 of the Traffic Impact Assessment Report appended hereto as Appendix O.

11.15.3 Existing Traffic Flows

As a result of the existing surrounding roads, and proposed coal mine, as well as the number of vehicle trips it is expected to generate per hour, during weekdays, the proposed Project area was defined to include three (3) key intersections, which were analysed using SIDRA 9™. Weekday Morning and Weekday Afternoon Traffic Counts were therefore carried out during the Weekday Morning (AM) and Weekday Afternoon (PM) commuter peak periods, after 26 July of 2021, during the adjusted level 3 lockdown rules, after all the schools were opened at the following identified intersections (Figure 11-56):

- R38 & D383
- D383 & D1555
- D1555 & D2225

Note on COVID-19: Please note that the traffic counts were done, during normal peak hour traffic conditions on a weekday, in the adjusted level 3 of lockdown, when all the schools were open, and therefore no adjustments to the traffic volumes were deemed necessary.

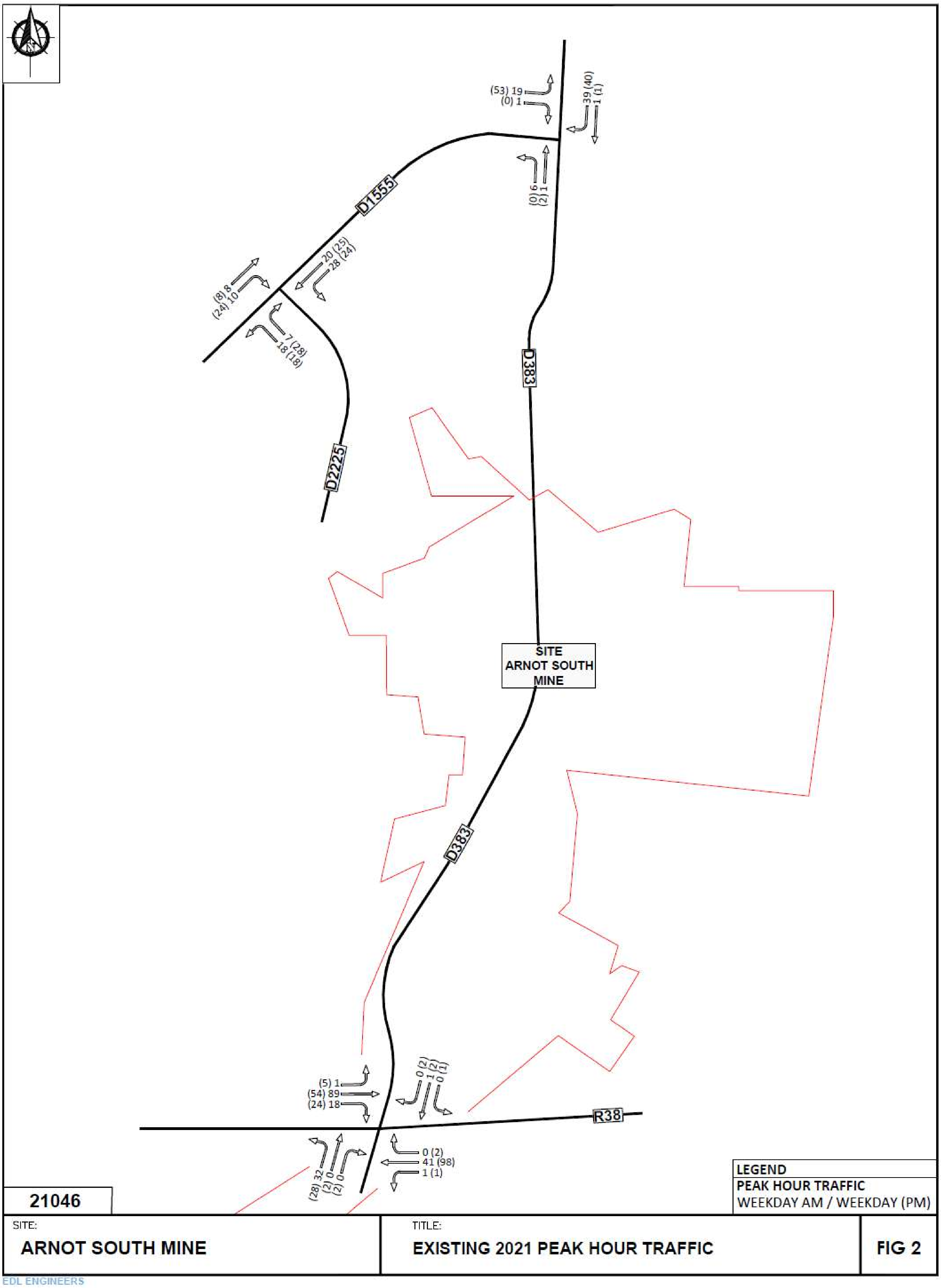


Figure 11-56: Existing Traffic Flows

11.15.4 Proposed Site Access Road

A **'Full'** access extending from an access road which intersects the **D383**, about 3.0 km to the west of where the main infrastructure is proposed, will be the proposed access for the mine development.

11.16 Blast and Vibration

The Blast and Vibration Impact Assessment was undertaken by Blast Management and Consulting and a site visit was conducted on the 05 August 2021. The purpose of the site visit was to get an understanding of the location and the structures and installations surrounding the proposed new box cut area. The Blast and Vibration Report is appended as Appendix P of this report.

11.16.1 Structure Profile

Surface structures present within a 1,500 m radius from the proposed box cut area were identified using Google Earth imagery. A list of structure locations was required to determine the allowable ground vibration limits and air blast limits.

Figure 11-57 shows an aerial view of the planned box cut area and surroundings with POIs. The type of Points of Interest (POIs) identified is grouped into different classes. These classes are indicated as "Classification" in Table 11-41.

During the site visit, 14 structures were observed or identified and the initial POI list verified and finalised on site. Structures ranged from well-built structures to informal building styles.

Table 11-41: POI Classification Used

Classes	Description
1	Rural Building and structures of poor construction
2	Private Houses and people sensitive areas
3	Office, High-rise buildings and Industrial buildings / Infrastructure
4	Ruins
5	Animal related installations and animal sensitive areas
6	Industrial Installations
7	Earth like structures – no surface structure
8	Heritage sites (buildings, infrastructure, activity)
9	Graves
10	Water Borehole
11	Water Resources Surface
12	Pipelines Buried

Classes	Description
13	Powerlines / Telephone Lines / Towers
14	Road Infrastructure

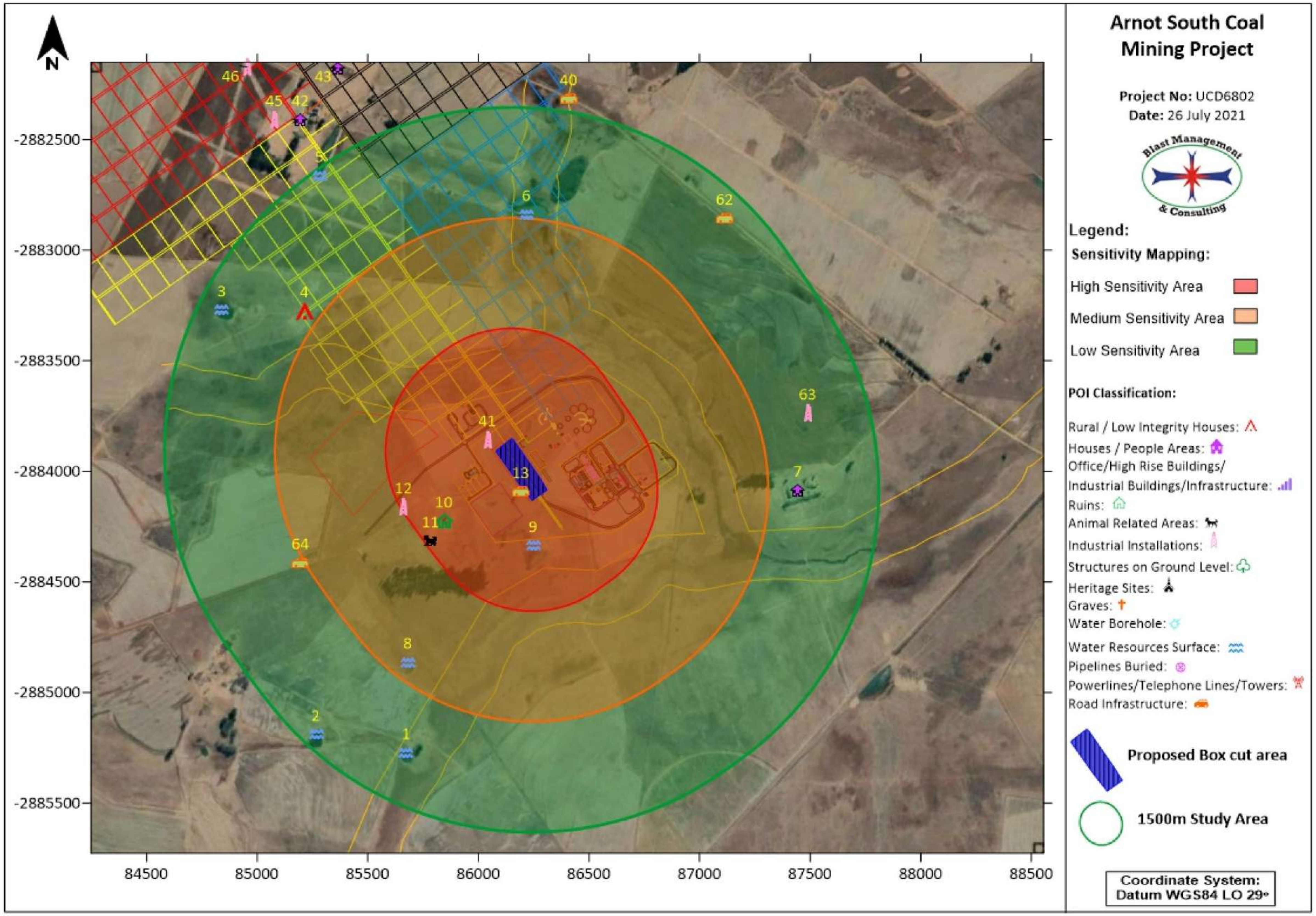


Figure 11-57: Identified sensitive areas for Box Cut

11.16.2 Blasting Operations

The underground operations will be mined mechanically using continuous miners. The box-cut will be established using conventional drilling and blasting operations. Blast design forms the basis of all calculations done for impact assessment. The current planned designs as supplied was applied for impact evaluation. Table 11-42 below provides a technical information summary of the blast designs provided.

Table 11-42: Blast Design Technical Information

Blast Geometry	
Blast Type	Box Cut
Design	Design 01
Bench Height (m)	20.0
Blast Depth Min. (m)	5.0
Blast Depth Max. (m)	20.0
Include Sub Drill (Yes/No)	Np
Sub-drill (m)	0.00
Explosive Type	Emulsion
Explo. Density (gr/cm3)	1.15
Diameter (mm)	140
Burden (m):	4.00
Spacing (m):	4.00
Pattern	Staggered1
Average Depth (m)	12.5
Explosives Per B/H (incl. Sub drill) (kg)	159.3
Average Column Length (incl. Sub drill.)	9.0
Linear Charge (kg/m)	17.70
Stemming Length (m):	3.5
Stemming Ratio	25.0
Powder Factor (kg/m3)	0.80

The information provided in Table 11-42 above is applied for predicting the ground vibration, air blast and fly rock. Evaluation of the blasting operations considered a minimum charge and a maximum charge. The minimum charge was derived from the 140 mm diameter single blast hole and the maximum charge was extracted from the blast simulation in JKSimblast. The maximum charge relates to the total number of blast holes that detonates simultaneously based on the blast layout and initiation timing of the blast. Thus, the maximum mass of explosives detonating at once. The minimum charge relates to 292 kg and the maximum charge relates to 3,761 kg. These values were applied in all predictions for ground vibration and air blast.

11.16.2.1 Ground Vibration

Based on the designs presented on expected drilling and charging design, the following Table 11-43 shows expected ground vibration levels (PPV) for various distances calculated at the two different charge masses. The charge masses are 292 kg and 3,761 kg for the box cut area.

Table 11-43: Expected Ground Vibration at Various Distances from Charges Applied in this Study

No.	Distance (m)	Expected PPV (mm/s) for 292 kg Charge	Expected PPV (mm/s) for 3,761 kg Charge
1	50.0	194.4	1600.9
2	100.0	99.6	820.0
3	150.0	31.7	261.3
4	200.0	19.7	162.5
5	250.0	13.7	112.5
6	300.0	10.1	83.3
7	400.0	6.3	51.8
8	500.0	4.4	35.8
9	600.0	3.2	26.5
10	700.0	2.5	20.6
11	800.0	2.0	16.5
12	900.0	1.7	13.6
13	1000.0	1.4	11.4
14	1250.0	1.0	7.9
15	1500.0	0.7	5.8
16	1750.0	0.6	4.5
17	2000.0	0.4	3.6
18	2500.0	0.3	2.5
19	3000.0	0.2	1.9

No.	Distance (m)	Expected PPV (mm/s) for 292 kg Charge	Expected PPV (mm/s) for 3,761 kg Charge
29	3500.0	0.2	1.4

11.16.2.2 Air Blast

The prediction of air blast as a pre-operational effect is difficult to define exactly. There are many variables that have influence on the outcome of air blast. Air blast is the direct result from the blast process, although influenced by meteorological conditions, wind strength and direction, the final blast layout, timing, stemming, accessories used, covered or not covered etc. all has an influence on the outcome of the result. Air blast is also an aspect that can be controlled to a great degree by applying basic rules.

In most cases mainly an indication of typical levels can be obtained. The indication of levels or the prediction of air blast in this report is used to predefine possible indicators of concern.

11.17 Socio- economic

The Social Impact Assessment (SIA) undertaken during the EIA Phase is appended to this report (Appendix Q). The baseline profile of the receiving socio-economic environment is presented in this section.

11.17.1 Population Demographics

In terms of population size, the Mpumalanga Province is comprised of 4,335,963 people who reside in 1,238,861 households. The average household size in the province is 3.5 persons per households. Less than one percent of the households within the province were reportedly headed by children, displaying a total of 10,369 households headed by children in the province.

The two project affected districts (i.e., GSDM and NDM) are both the largest in terms of population size and the smallest and largest, in terms of their land sizes, respectively. GSDM is divided into seven local municipalities; of which CALLM is the second smallest in terms of population size, with 187,830 residents. In turn, NDM is divided into six local municipalities of which Steve Tshwete Local Municipality (STLM) is the third largest in terms of population size with 278,749 residents. The STLM is further divided into 29 wards.

Furthermore, NDM had the largest population density compared to the provincial level owing to the availability of minerals, natural resources, and the Maputo Corridor which has translated to the district's economic growth and strength[6]. This was followed by STLM, having the second

[6] Nkangala District Profile, 2020

highest population density likely due coal mining activities within the broader local municipal area which attracts a sizeable number of job and business seekers.

Most of the population (94%) within the province are Black African, and the predominantly spoken languages are IsiZulu, which is followed by siSwati.

A similar pattern in terms of ethnicity and languages as at a provincial level are observed within districts and local municipalities. At a local municipal level, the most noticeable differences are with regards to the languages spoken in each namely: IsiZulu is most spoken within STLM, and siSwati is predominant within CALLM.

Within the primary study area, notable characteristics of Ward 21 are as follows:

- The ward has the largest proportion of the population compared to Wards 3 and 7;
- The largest land area (1995.7 km²) compared to Wards 3 and 7; and
- The highest number of child-headed households amongst the three Wards.

The average household size across the primary study area is 3.7 persons per household. Furthermore, the predominant ethnic groups are Black Africans and Whites.

11.17.1.1 Education

Figure 11-58 illustrates that 36% have completed high school (i.e., matric or Grade 12), whilst 32% of the population within the Mpumalanga Province have completed some secondary education. Education trends within the NDM depicted an increase in the number of people who completed matric or Grade 12 - from 161,000 in 2006 to 271,000 in 2016 (about 68%). Overall, data trends also indicate that a relatively low percentage of the population across the study areas completed higher education.

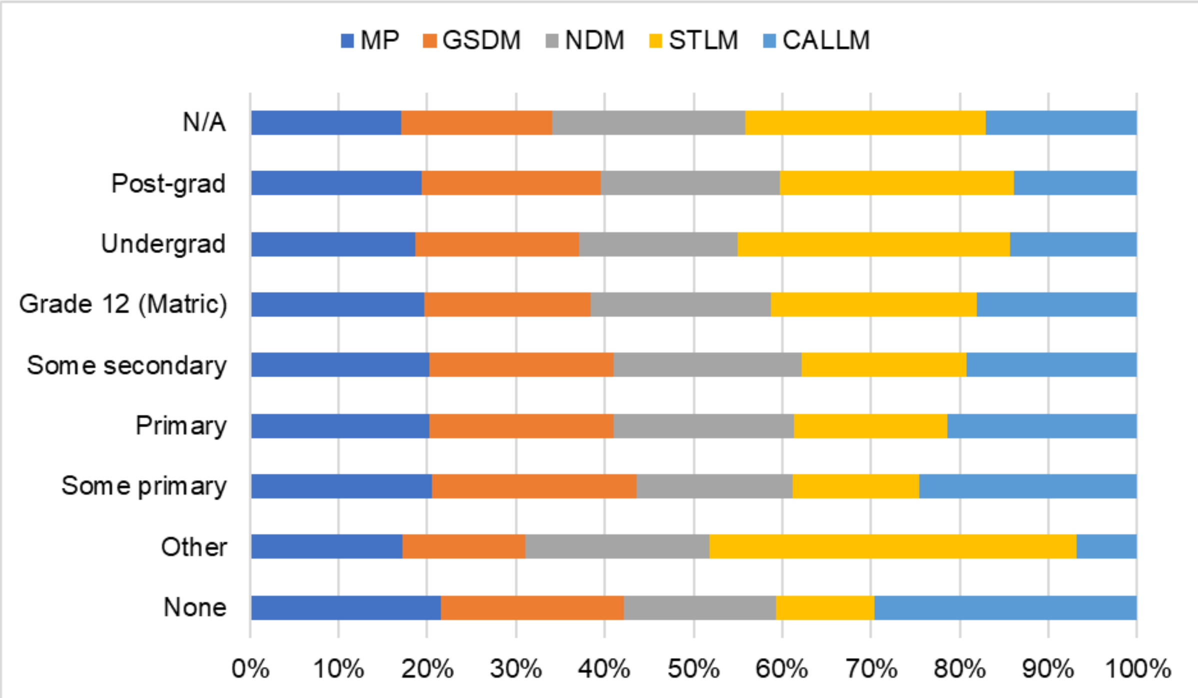


Figure 11-58: Levels of education Completed within the Regional Study Areas[7]

Figure 11-59 displays that (38%) of the population has attained Grade 12 (matric) within Ward 7 when compared to the population of Ward 3 (36%) and Ward 21 (27%). A relatively low percentage of the population across all three Wards have attained higher education. According to the interviewees, most of the commercial farmers in the primary study area the majority (40%) have only completed Grade 12 level education except for two farmers who have attained a bachelor's degree. Most stated that they do not need higher education to operate a farm as this is a skill passed onto them from multiple generations of farmers in the family.

[7] Adapted from Wazimap, 2017

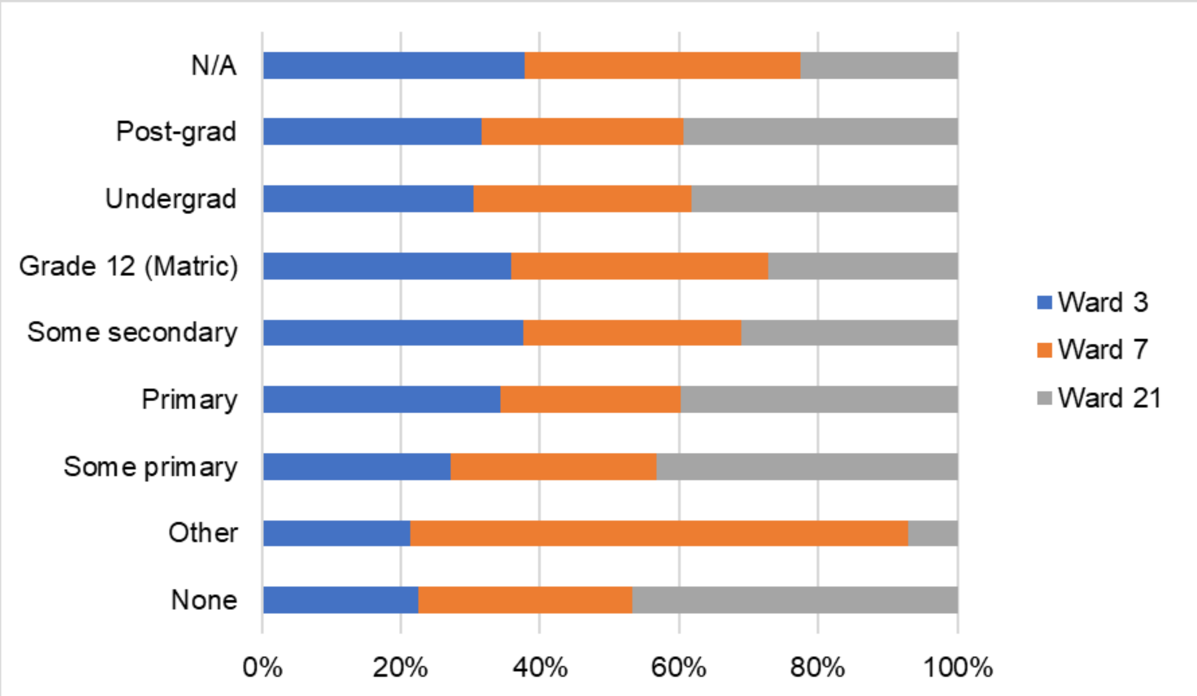


Figure 11-59: Levels of education completed within the Secondary Study Area[8]

11.17.2 Economic and Livelihoods Overview

The provincial economy is dominated by the mining sector specifically coal mining, followed by community services, trade sector and heavy industries which support the mining sector as well as the power generation sectors (mostly Eskom power plants)[9]. The heavy industry sector does not only support mining but the commercial agricultural sector as well.

It has been reported that the Mpumalanga Province has the highest potential of arable land in South Africa due to highly fertile soil that are able to supports a range of farming operations. To this end, both the agricultural and mining sectors are the primary land users in the province; this is inclusive of land classified as moderate, to very high agricultural potential. Therefore, there is an increasing competition between the two sectors as most land where mineral resources are found often has high agricultural value in terms of the soil quality. Similar trends are also observed in GSDM and NDM. Other sectors of the economy are depicted in Figure 11-60 below.

[8] Adapted from Wazimap, 2017

[9] Provincial Review, 2016

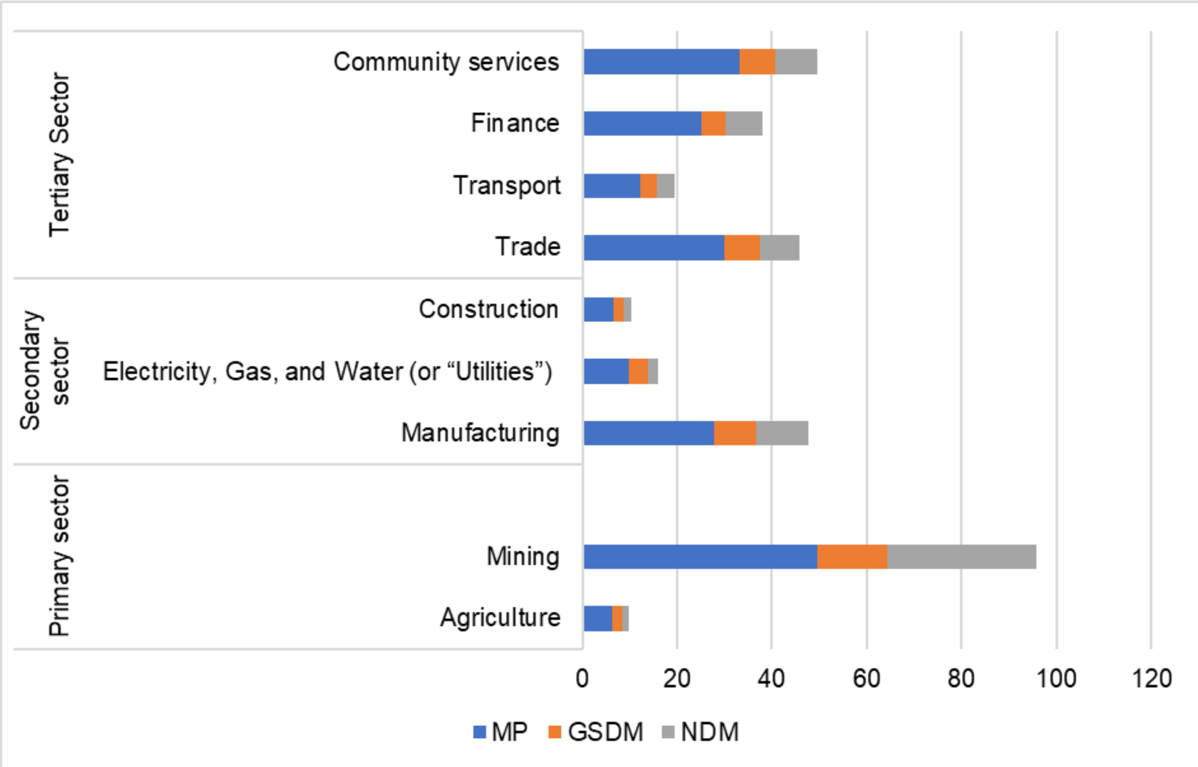


Figure 11-60: Economic sectors with the regional study area[10]

Within the primary study areas, agriculture is the most predominant economic, livelihood and income source for the households. For most of the interviewees (63%), agricultural activities serve as the primary source of their income, whilst for 31%it serves as both a source of income and subsistence. Finally, six percent (6%) of the interviews agricultural activities are solely for subsistence purposes.

The sector is characterised by both crop farming and livestock production (specifically sheep and cattle). Most of the farms in the area are on privately owned land that has been owned by multiple generations of farmers; whilst others are being leased to farmers by mining companies. Table 11-44 depicts farm portions which are being leased within the primary study area (specifically project site).

Table 11-44: Leased Agricultural Land within the Primary Study Area

Farm Name	Portion size	Details
Groblersrecht (Portion 4 leased from Exxaro)	undisclosed	Leased portion used for grazing and farming maize
Klipfontein 495 JS	192 hectares	Used for cattle, Farming crops (maize and soybeans)

[10] Adapted from: Mpumalanga Spatial Development Framework, 2019

Farm Name	Portion size	Details
Boschmanspoort 159 IS (Portion leased from Son)	28 hectares	Livestock
Hendrina farm name not disclosed)	60 hectares	Farming crops (maize and soybeans)
Schoonoord 164 IS (Sarel van Der Merwe leases from father)	undisclosed	Farming crops (maize and soybeans)
Op Goeden Hoop 205 IS	undisclosed	
Rietkuil 491 JS (portion 14) Leased from Morne Ferrari	60 hectares	

11.17.3 Crop Production

Crop production within the primary study area is for subsistence and commercial purposes. The main crops sold commercially are maize and soyabeans. The main buyers of maize include agro-processing and bulk-grain traders such as Ingrain[11], Rand Agri[12], African Products (Tongaat Hullett site), Lindwater Mills, and Carolina Mill. In turn, Soybeans are supplied to Rand Agri Kegel farmers, and local markets. A supplementary commercial crop grown is hay which is mostly sold to local farmers and other users. Produce such as fruit, vegetables, dairy, and eggs are mostly produced at a small scale and for household consumption only.

Table 11-45 shows the various crops grown within the primary study area.

Table 11-45: Types of Crops Produced in the Primary Study Area by Type and Purpose

<table>
<tr><th colspan="5">Commercial farming products</th></tr>
<tr><th>Grains</th><th>Grazing pasture</th><th colspan="2">Livestock</th><th>Poultry</th></tr>
<tr><td>• Maize
• Soybeans</td><td>• Field hay/cattle feed</td><td colspan="2">• Sheep
• Cattle</td><td>• Chickens</td></tr>
<tr><th colspan="5">Non-commercial products (Subsistence)</th></tr>
<tr><th>Fruit</th><th>Vegetables</th><th>Meat</th><th>Dairy</th><th>Other</th></tr>
<tr><td>• Apples
• Pears
• Citrus</td><td>• Cabbage
• Potatoes
• Spinach</td><td>• Beef
• Sheep</td><td>• Milk</td><td>• Eggs
• Bee Harvesting</td></tr>
</table>

[11] Ingrain is Africa's largest producer of modified starch, glucose and other related products. The maize supplied by the farmers are used by Ingrain to produce high quality products which is supplied to customers across the African continent (IngrainSA, 2020).

[12] Rand Agri is a bulk grain trader, which means that farmers supply them directly and Rand Agri supplies this to consumers across southern Africa.

• Peaches	• Pumpkin • Onions • Green Chillies • Green Peppers			

The estimated market price of these crops vary throughout the season based on market supply and demand. The estimated prices for these crops are presented in Table 11-46.

Table 11-46: Estimated Market Price of Crop Produce

Type of crop	Prices
Maize	R 2,700 to R3,800/ ton
Soybeans	R 3,000 to R4,000/ ton
Hay	R 500 to R 600/ bale

11.17.4 Livestock Production

Livestock keeping is undertaken mostly for subsistence purposes and comprise mainly of cattle and sheep. The cattle are mostly sold in auctions and abattoirs. The prominent auctions are mainly held in Witbank (BKB Van Wyk Auctions) and Belfast (Badenhorst Auctioneers). Livestock auctions reportedly play a dual role i.e., income generation and for farmers to benchmark themselves against others by producing high quality livestock that fetches the highest price at the market. Livestock prices are shown in Table 11-46.

Table 11-47: Livestock Market Price

Livestock	Prices
Cattle (young)	R 9,000
Pregnant Cow	R 15,000
Sheep	R 1,300 to R 1,800
Pregnant sheep	R3,400

Commercial farmers reported that their operations were not affected by Covid-19 related restriction in 2020 nor in 2021.

11.17.5 Community Challenges

Figure 11-61 depicts socio-economic challenges identified by interviewees which they believe will be exacerbated if the mine is established in the primary study area. These challenges relate mostly to community health, safety, and security risks.

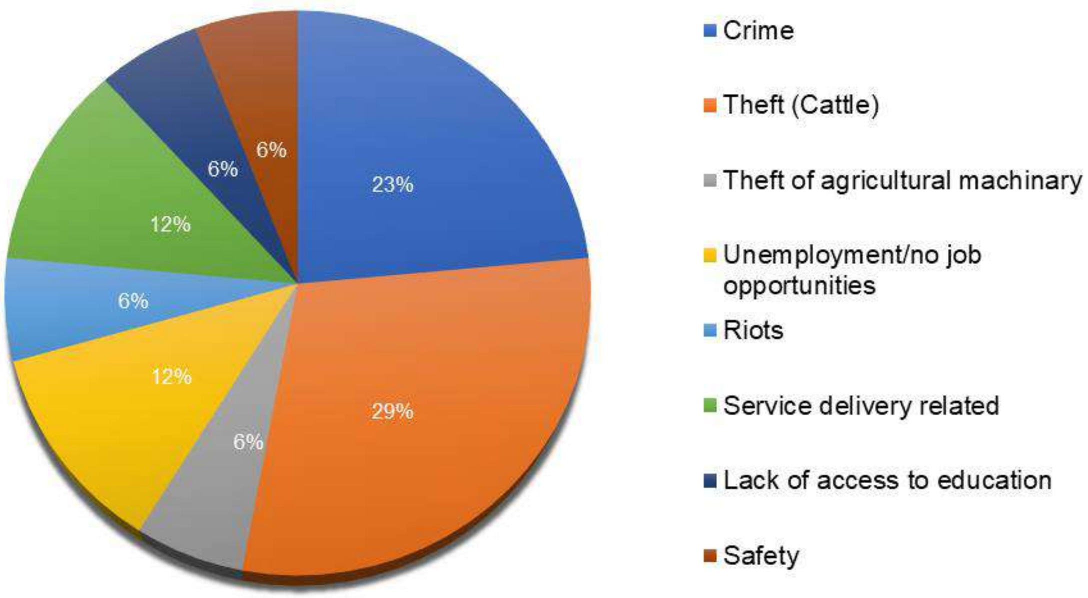


Figure 11-61: Predominant socio-economic challenges

11.17.6 Labour Force and Employment

Table 11-48 provides a summary of the employment indicators for the regional and secondary study areas. Notably, over half of the population within STLM were reportedly employed, which is higher than the provincial and the project affected districts as well as CALLM. CALLM also showed the lowest number of people who are employed compared to the other study areas as well as the percentage of economically inactive people due to age (ranges between zero- to 19-year-olds). On average, 69% of the population is employed within the formal sectors of the economy. This is attributed to the mining, agriculture, energy generation, and industrial sectors of the economy.

Table 11-48: Employment Indicators for the Regional and Secondary Study Areas[13]

Indicators	Mpumalanga	GSDM	NDM	STLM	CALLM
Employed	36%	39%	41%	53%	27%
Unemployed	17%	16%	18%	13%	15%
Discouraged job seekers	6%	5%	5%	3%	9%
Not economically active	39%	39%	37%	31%	50%
% Employed in the formal sector	69%	71%	69%	73%	65%

[13] Adapted from Wazimap, 2017

11.17.7 Annual Household Income

Within the regional and secondary study areas, most of the households earn between R10,000 and R 40,000 per annum. This is indicative of a monthly salary that ranges between R 833 to R 3,333. This means that most households are living in extreme food poverty line which is R 585 per person per household[14]. Whilst an average of 14% of the households live within the lower-bound food poverty line as they earn an estimated R 75,000 per month and can afford food for R 840 per person per month.

Table 11-49: Annual Household Income: Regional Study Area[15]

Indicators	Mpumalanga	NDM	GSDM	STLM	CALLM
R0	15%	14%	15%	13%	15%
Under R4800	5%	4%	5%	3%	7%
R 5K - R 10K	9%	7%	8%	4%	12%
R10K - R20K	19%	16%	18%	11%	23%
R 20K - R40K	20%	20%	20%	16%	20%
R 40K - R 75K	13%	16%	14%	17%	10%
R 75K - R 150K	9%	11%	9%	14%	7%
R 150K - R 300K	6%	7%	7%	11%	4%
R 300K - R 600K	3%	4%	4%	7%	1%
R 600K - R 1.2 m	1%	1%	1%	2%	0%
R 1.2M - R 2.5 m	0%	0%	0%	1%	0%
Over R 2.5m	0%	0%	0%	0%	0%

Of the project affected Wards, households residing with Ward 7 reportedly earned slightly high income per annum (R 75,000 to R 150,000). This means that most of the households reside within the upper-bound food poverty line and have a budget of around R 1,268[16] per person per month. However, the population of Ward 3 and 21 mimics the trends identified within the regional and secondary study areas and worse as shown in Table 11-50.

Table 11-50: Annual Household Income within the Secondary Study Area

[14] Food poverty line – R585 (in April 2020 prices) per person per month. This refers to the amount of money that an individual will need to afford the minimum required daily energy intake. This is also commonly referred to as the “extreme” poverty line.

[15] Adapted from Wazimap, 2017

[16] Upper-bound poverty line – R1 268 (in April 2020 prices) per person per month. This refers to the food poverty line plus the average amount derived from non-food items of households whose food expenditure is equal to the food poverty line.

Indicators	Ward 3	Ward 7	Ward 21
R0	12.1%	6.9%	7.8%
Under R 4800	2%	2.2%	3.7%
R5k-R10K	4.3%	3.5%	4.5%
R10k-R20K	10.6%	8.6%	22.9%
R20k-R40K	16.5%	12%	22.5%
R40-R75K	17.7%	19.5%	15.3%
R75k-R150K	16.3%	20.9%	9.8%
R150k-R300K	12.2%	17.5%	7%
R300k-R600K	5.8%	7.3%	4%
R600k-R1.2m	1.6%	1.2%	1.4%
R1.2m-R2.5m	0.7%	0.3%	0.6%
Over R2.5m	0.3%	0.3%	0.6%

11.17.8 Household Access to Basic Services

Figure 11-62 below shows the households access to basic services at the regional and secondary study areas. Notable findings include:

- On average 87% of the households have access to **water** from a regional or local service provider;
- An average 69% of households have access to prepaid **electricity**;
- An average of 51% have access to flush / chemical **toilets,** with CALLM households have access to flush or chemical toilets while 43% uses ventilated pit latrines; and
- An average of 58% of households have access to formal **waste disposal** by local municipality except for households in CALLM whereby 70% have no access to formal waste disposal system.

Mpumalanga Province	NDM	GSDM	STLM	CALLM
Water: 86% of HHs getting water from a regional or local service provider	**Water:** 88% of HHs getting water from a regional or local service provider	**Water**: 89% of HHs are getting water from a regional or local service provider	**Water:** 94% of HHs are getting water from a regional or local service provider	**Water:** 76% of HHs are getting water from a regional supplier or service provider
Electricity: 81% of HHs have in-house prepaid meter	**Electricity: 76%** of HHs have in-house prepaid meter	**Electricity:** 76% of HHs have in-house prepaid meter	**Electricity**: 70% of HHs have in-house prepaid meter	**Electricity**: HH information not available.
Toilet facilities: 45% of HHs have access to flush / chemical toilets	**Toilet facilities**: 54% of HHs **h**ave access to flush or chemical toilets	**Toilet facilities**: 67% of HHs have access to flush/ chemical toilets	**Toilet facilities**: 82% of HHs have access to flush/ chemical toilets	**Toilet facilities:** 8% of HHs have access to flush/ chemical toilets. 43% with VIP toilets
Refuse disposal: 40% of HHs have access to formal waste disposal by local municipality	**Refuse disposal**: 50% of HHs have access to formal waste disposal by local municipality	**Refuse disposal**: 57% of HHs have access to formal waste disposal by local municipality	**Refuse disposal**: 81% of HHs have access to formal waste disposal by local municipality	**Refuse disposal**: 70% uses their own waste dumps

Figure 11-62: A Summary of Households' Access to Basic Services

11.18 Greenhouse Gas Emissions

The Greenhouse Gas Emissions Impact Assessment undertaken for the EIA Phase is appended to this report as Appendix R. This Greenhouse Gas (GHG) Emissions Assessment provides the GHG Inventory (also called a 'Carbon Footprint') for the proposed Arnot South underground coal mine and development of supporting infrastructure. It also determines the impact significance of the calculated emissions and provides recommendations to reduce the most significant GHG emissions associated with the project.

12 Item 3(k): Impacts and Risks Identified Including the Nature, Significance, Consequence, Extent, Duration and Probability of the Impacts

This section aims to rate the significance of the identified potential impacts pre-mitigation and post-mitigation. The potential impacts identified in this section are a result of both the environment in which the Project activity takes place, as well as the activity itself. The identification of potential impacts is performed by determining the potential source, possible pathways and receptors. In essence, the potential for any change to a resource or receptor (i.e. environmental aspect) brought about by the presence of a Project component or by a Project-related activity has been identified as a potential impact.

The potential impacts are discussed per environmental feature/ aspect and according to each phase of the Project i.e. the Construction, Operational and Decommissioning/ Post Closure Phases. The significance, probability and duration of these potential impacts have been assessed based on the detailed specialist studies undertaken on the sensitivity of the receiving environment. The main Project activities to take place during the construction, operational and decommissioning phases may pose potential impacts on the receiving environment and are described in Table 5-1 above.

12.1 Impacts and Mitigations per Project Phase

The potential impacts that were identified for the construction, operational and decommissioning phases, are discussed in Table 12-2. The impact matrix abbreviations used in Table 12-2 are provided in Table 12-1 below.

Table 12-1: Impact Matrix Abbreviations

Abbreviation	Definition
D	Duration
E	Extent
I	Intensity
P	Probability

Table 12-2: Impact Assessment associated with the Construction, Operational and Decommissioning Phases

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
Construction	Site/vegetation clearance (52.28 ha)	Soil, Land Use, and Land Capability	• Loss of usable soil (high land capability soils); • Soil erosion and sedimentation; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Soil contamination and deterioration; and • Increased runoff from hardened surfaces (soil compaction).	6	2	7	7	Moderate (negative)- 105	• If the destruction of soils with a High land capability is unavoidable, disturbance must be minimised and appropriately rehabilitated; • Environmental Practitioner to be present during soil stripping to prevent mixing of soils and ensure correct stockpiling methods, and top soil and sub-soil must be stockpiled separately(i.e., stockpile height, separate stockpiling for topsoil, subsoil and waste rock); • Long term soil stockpiles must be vegetated and allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction; • Monitor infrastructure, stockpiles and dumps to ensure no runoff, erosion and sedimentation and decreased land capability; • Monitor PCD, STP, raw water, processed water and washing plant, if spills have occurred, clean up immediately and implement a monitoring program for at least three months after the spill has occurred; • If any erosion occurs on site and adjacent of the Project area, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; • Restrict extent of disturbance within the Project area and minimise activity within designated areas of disturbance; • Minimise the period of exposure of soil surfaces through dedicated planning; • Ensure proper storm water management designs are in place; and • Spill containment (hazardous) and clean up kits should be available onsite and clean-up from any spill must be in place and executed at the time of a spillage with appropriate disposal as necessary.	6	2	6	7	Moderate (negative) - 98
Construction	Construction of diesel storage and explosives magazine	Soil, Land Use, and Land Capability		6	3	6	6	Moderate (negative)- 90		5	2	4	4	Minor (negative) - 44
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office.	Soil, Land Use, and Land Capability		6	3	6	7	Moderate (negative)- 105		5	3	4	5	Minor (negative) - 60
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long.	Soil, Land Use, and Land Capability		7	5	6	6	Moderate (negative)- 108		5	3	4	5	Minor (negative) - 60
Construction	Construction of Pollution control dam (PCD) (1.61 ha), Raw water pipeline, Process water, Sewage treatment plant (STP).	Soil, Land Use, and Land Capability		7	4	7	7	Major (negative)- 126		6	3	5	6	Moderate (negative) - 84
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Soil, Land Use, and Land Capability		5	3	7	7	Moderate (negative) - 105		5	2	5	5	Minor (negative) - 60
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	Fauna and Flora	• Loss of plant communities and sensitive landscapes including, Grassland	6	3	4	6	Moderate (negative) -78	• Keep site clearing to a minimal, and restrict vehicle movement to dedicated areas;	5	3	3	6	Minor (negative) - 66

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
			and Wetland habitats; • Loss of biodiversity and SCC; • Increased erosion; • Potential for AIP proliferation; • Loss of faunal habitat including faunal SCC.						• AIP Eradication strategy should be implemented; • Make use of existing roads to encourage minimal impacts/footprint; • Avoid sensitive areas such as Rocky Outcrops, Primary Grasslands and Wetlands; • Environmental Practitioner or Botanist to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct input area; • The footprint of the mine should be as compact as possible from a design point of view; and • Adhere to recommended protective buffers around wetlands as stipulated in the Wetland Report, refer to Appendix F					
Construction	Stockpile of soils, rock dump and discard dump establishment	Fauna and Flora	• Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal; • Natural vegetation will be removed, damaged and fragmented promoting edge effects and AIP proliferation; • Change in habitat and potential change in species composition; and • Increased soil compaction, runoff and erosion into surrounding sensitive landscapes.	6	4	5	7	Moderate (negative) -105	• Construction must be kept within the infrastructure footprint area, to reduce fragmentation as much as possible; • Bare land surfaces must be vegetated to limit soil erosion from surface runoff associated with stockpiles and dumps. Revegetate disturbed areas immediately after construction; • Monitor stockpiles to ensure no erosion, runoff, and sedimentation into surrounding areas; • No establishment of rubble piles; • AIPs should be continuously monitored and controlled throughout the life of the mine and thereafter with the establishment of an AIP Eradication Plan; and • Corridors (infrastructure and ecological) set aside within the mine area would mitigate fragmentation substantially, especially if this could be managed with the community over an extended period of time.	4	3	3	6	Minor (negative) - 66
Construction	Access and haul road construction	Fauna and Flora	• Removal of vegetation and basal layer;	6	3	4	6	Moderate (negative) -91	• Keep site clearing to a minimum;	5	3	3	5	Minor (negative) - 66

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
			• Increased proliferation of AIPs; • Increased faunal casualties; and • Increased dust pollution.						• If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; • Staff, contractors and other visitors of the mine must adhere to policies within the operation of the mine, such as adhering to designated speed limits; • Restoration and rehabilitation of any removed vegetation and SCC should occur during the rehab phase; • Identify migratory crossing links between watercourses for herpetofauna, install correct signage to make all staff personnel aware and create safe underpasses for fauna at risk; and • AIPs should be continuously monitored and controlled throughout the life of the mine; and thereafter, with the establishment of an AIP Eradication Plan.					
Construction	Construction of infrastructure, and ventilation Shafts	Fauna and Flora	• Increased faunal casualties and vegetation removal; • Increased risk of AIP proliferation and edge effects; and • Changes to the landscape and undulating topographies.	5	3	3	4	Minor (negative) -44	• AIPs should be continuously monitored and controlled throughout the life of the mine; and thereafter, with the establishment of an AIP Eradication Plan; • Keep areas of infrastructure to the absolute minimum and stay within the demarcated footprint; • Minimise the areas that are to be stripped of vegetation; • Seal ventilation shaft hole with a concrete to avoid plugging of any 'open shaft or excavation' that may lead to the underground workings; No harvesting of floral or poaching of faunal species may take place by the construction employees; and • No contaminated water may be disposed of in the immediate environment.	3	2	3	3	Negligible (negative) -24
Construction	Site/vegetation clearance (52.28 ha)	Wetlands	• Direct loss of 79.76 ha wetlands; • Loss of habitat and biodiversity; • Erosions and sedimentation of adjacent wetlands and water courses; • Erosion and sedimentation from	7	3	7	7	Major (negative) - 119	• If the destruction of wetlands is unavoidable, disturbance must be minimised and suitably rehabilitated; • At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing; • Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area;	6	3	5	7	Moderate (Negative) - 98
Construction	Construction of diesel storage and explosives magazine	Wetlands		6	4	6	6	Moderate (negative) - 96		5	3	4	4	Minor (negative) - 48
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m)	Wetlands		7	5	7	7	Major (negative) - 133		6	3	5	7	Moderate (negative) - 98

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
	Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office		stockpiles, rock dump and discard dump; • Water and soil contamination and deterioration; • Increased runoff from hardened surfaces; • Decreased water supply to the wetlands systems; and • Change in habitat and potential change in species composition.						• Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction, • Monitor infrastructure, stockpiles and dumps to ensure no runoff, erosion and sedimentation into the adjacent areas, especially the wetlands and freshwater systems; • Monitor PCD, STP, raw water, processed water and washing plant, if spills have occurred, clean up immediately and implement a monitoring program for at least three months after the spill has occurred; • Stockpiles must be vegetated and allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; and • Locate stockpiles and dumps outside wetlands and at least a 500 m buffer.					
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long	Wetlands		7	5	7	7	Major (negative) - 133		5	4	4	4	Minor (negative) - 52
Construction	Construction of Pollution control dam (PCD) (1.6078 ha), Raw water pipeline, Process water, Sewage treatment plant (STP)	Wetlands		7	5	7	7	Major(negative) - 133		6	3	5	5	Minor (negative) - 70
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Wetlands		6	4	6	6	Moderate (negative) - 96		5	3	4	5	Minor (negative) - 60
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing in proximity to the watercourses.	5	3	-5	5	Minor (negative) – 60	General mitigation actions provided in the wetlands and surface water studies conducted by Digby Wells should be used to guide the effective management of aquatic resources potentially affected by the proposed Project. However, more specific management actions for the Construction Phase are listed below: • Limit vegetation removal to the infrastructure footprint are only. Where removed or damaged, vegetation areas (riparian or aquatic related) should be revegetated as soon as possible; • Bare land surfaces downstream of construction activities must be vegetated to limit erosion from the expected increase in surface runoff from infrastructure; • Environmentally friendly barrier systems, such as silt nets or, in severe cases, use trenches downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; trenches should be used as a ‘temporary’ management action during the construction phase, thus water (likely rainwater and dust suppression water) trapped in the trenches is expected to evaporate. However they should be closely inspected during the rainy season; • Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;	5	2	-2	2	Negligible (negative) – 18

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses; • Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; • All vehicles must be frequently inspected for leaks; • No material may be dumped or stockpiled within any rivers, drainage lines in the vicinity of the proposed project; • All waste must be removed and transported to appropriate waste facilities; and • High rainfall periods (usually November to March) should be avoided during construction to possibly avoid increased surface runoff in attempt to limit erosion and the entering of external material (i.e. contaminants and/or dissolved solids) into associated aquatic systems.					
Construction	Removal of vegetation / topsoil for establishment of mining infrastructure such as the haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas.	Hydropedology	Sedimentation and siltation of watercourses through overland flow leading to reduced water quality.	5	5	5	6	Moderate (Negative)-90	• Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised to minimise creation of new ones; • If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments and hazardous substances from construction vehicles used during site clearing; • Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust mobilisation which contribute to sedimentation of watercourses; • Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath; and • Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors.	5	2	2	2	Negligible (negative)-18
Construction	Moving vehicles and machinery during construction of infrastructure including haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas. Handling of hydrocarbon residues and spills during construction operations.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	5	4	3	5	Minor (negative) -60		5	2	2	2	Negligible (negative) -18

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
Construction	Removal of vegetation/topsoil for establishment of mining and linear infrastructure. Stockpiling of soils, rock dump and discard dump establishment.	Surface water	Sedimentation and siltation of water resources reducing flow regime within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	5	5	6	6	Moderate (Negative) -96	The recommended mitigation/management measures: • Limit vegetation clearing and limit disturbing the soil to the project/building footprint; • Control fluvial erosion and sedimentation by establishing a stormwater management plan; • Control through use of spill kits and accredited vendors for waste disposal; • Control by training of personnel in proper hydrocarbon and chemical handling methods; and • Control by bunding hydrocarbon and other waste storage facilities.	3	2	2	4	Negligible (negative) -28
Construction	Handling of hydrocarbons and general waste. Diesel storage and explosives magazine	Surface water	Surface water contamination leading to deteriorated water quality within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	6	5	5	6	Moderate (negative) -96		3	2	2	2	Negligible (negative) -14
Construction	Construction of infrastructure, and ventilation fans	Surface water	Interception of rainfall, runoff and subsurface flow leading to reduced downstream runoff yield	5	6	5	6	Moderate (negative) -96		5	3	2	4	Minor (Negative) -40
Construction	Site Clearing, Construction of Infrastructure, Access Road, Stockpiling of Topsoil and Establishment of Rock and Discard Dumps	Air Quality	Reduction in ambient air quality	1	2	2	6	Negligible (negative) – 30	• Application of a dust suppressant on the haul roads and exposed areas; • Limit activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on haul roads and have these limits enforced; • The area of disturbance must be kept to a minimum at all times and no unnecessary clearing, digging or scraping must occur, especially on windy days; and • The drop heights when loading onto trucks and at tipping points should be minimised to reduce dust generation.	1	1	1	4	Negligible (negative) – 12
Construction	Removal of vegetation/topsoil for the establishment of mining and linear infrastructure	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.	2	3	2	3	Negligible (negative) – 21	• Construction activities should be restricted to daylight hours; • Construction activities should be carried out in phases; • Construction machinery and vehicles should be switched off when not in use; • Construction vehicles should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound;	2	2	1	3	Negligible (negative) – 15
Construction	Establishing the box cut	Noise												
Construction	Construction of infrastructure, and ventilation Shafts.	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.											
Construction	Construction of access road and haul roads	Noise												
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Noise												

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.					
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	Visual	Removal of all vegetation within the localised infrastructure area alters the aesthetics of the immediate area and creates a contrast between the stripped area and the surrounding vegetation.	6	3	5	6	Moderate -84	• Keep site clearing to a minimal, and restrict vehicle movement to dedicated areas; • Make use of existing roads to encourage minimal impacts/footprint; and • The footprint of the mine should be as compact as possible from a design point of view.	5	2	4	6	Minor -66
Construction	Stockpiling of soils, rock dump and discard dump establishment	Visual	• Alteration to the baseline visual environment by creating sharp topographic variation over a relatively moderately undulating terrain; and • Includes removal of natural vegetation which creates a sharp contrast.	5	3	4	7	Moderate -84	• Stockpiles should be created with a rehabilitation design which details a favorable slope; and • Bare land surfaces must be vegetated to limit soil erosion from surface runoff associated with stockpiles and dumps. Revegetate disturbed areas immediately after construction.	5	2	4	7	Moderate-77
Construction	All construction activities	Socio-economic	Creation of employment opportunities	2	4	3	5	Minor - positive +45	• As per the legal requirements update, disclose, and implement the Social and Labour Plan. • Develop and implement the site-specific Employment Policy in compliance with the South African legal framework and company standards. As part of the Policy: ▪ Set employment targets aimed at increasing local employment; ▪ Set monitoring indicators for local employment; ▪ Integrate local employment targets into all procurement contracts to which the appointed contractors must adhere to; ▪ To accommodate those that do not have access to android phones or internet, widely advertise	2	4	5	5	Minor - positive + 55

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									employment opportunities using community newspapers, notice boards, etc; • All employment opportunities must be advertised in predominantly spoken languages within the primary study area; and • Ensure that no recruitment take place at the entrance to the site (to avoid people congregating at the work site). Only formal channels for employment will be used. • Develop and implement a grievance mechanism. The mechanism must be widely communication to stakeholders within the primary study area, and a grievance register must be kept up-to-date.					
Construction	• Establishment of infrastructure; • Construction of access and haulage road; • Site/vegetation clearance; • Infrastructure construction; • Diesel storage and explosive magazine ; • Sewage treatment plant ; and • Sewage treatment plant, pollution control dam.	Socio-economic	Creation of Opportunities Within the Supply Chain	5	4	6	4	Minor - positive +60	• Implement the SLP commitments as they relate to the local business development; • Development a Local Procurement Strategy with local business development targets aligned to the commitments set-up in the SLP for the project; • Effectively communicate the benefits of local procurement to external stakeholders; • Considerations for local procurement should support groups, such as women, visible minorities, and youths; • Strengthen the capacity of local businesses to ensure that they are in a better position to supply the services required by the project, through holding workshops and seminars geared towards explain the tender requirements; • Consider unbundling of contracts into small work programs to ensure that small and locally based businesses can benefit; • Propose and promote joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development; • Establish a time-bound commitments to increase local procurement; Such commitments could include annual or mid-term targets for local procurement spending, supplier development programmes, local procurement plans, local procurement key performance indicators (KPIs) for procurement staff, and other local procurement objectives;	4	4	5	6	Moderate - positive +78

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• All tender process must follow existing Exxaro's SMME development strategies and programs; • Host workshops to provide training for current and potential suppliers to build up skills that were commonly identified as lacking in the supplier audits (e.g.;, business plan creation, tender preparation, etc;); and • Implement the grievance mechanism.					
Construction	All project related activities associated with construction and operation	Socio-economic	Increased Incidences of Livestock Theft	6	5	5	6	Moderate - negative -96	• Ensure that no employment take place at the entrance to the site; • Within the limits of the law, livestock owners should consider adopting an appropriate animal identification system in accordance with the Draft Document for Livestock Identification and Traceability System South Africa (LITS SA)[17]; • Livestock owners are encouraged to regularly count their livestock to ensure that all are still accounted for. In case of missing livestock, the incident must be reported to the nearest police station; • Where site access requires that Project personnel use farm parameter fences or gates – these must be closed immediately upon entry or exit; • Livestock owners are encouraged to regularly monitor, and mend broken fences; • Livestock should be kept away from fences or roads to reduce exposure to pedestrians; • Once the relevant environmental and mine authorisations are in place, the applicant will commence with negotiations with affected landowners to discuss suitable compensation methods to address livestock theft; and • Implement the grievance mechanism.	5	3	4	4	Minor - negative - 60
Construction	All project related activities associated with construction and operation	Socio-economic	Impacts Associated with Community Health, Safety and Security	6	4	6	5	Moderate - negative -80	• Design and implement measures to minimise the risk of hazardous substances entering the environment, including development of an Emergency Prevention, Preparedness and Response Plan for accidents involving release of hazardous substances to the environment.	6	4	5	4	Minor - negative - 60

[17] Draft Document for Livestock Identification and Traceability System South Africa (LITS SA) which allows an integrated platform for livestock keeping such as animal registration.

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• Secure storage and labelling of hazardous substances in line with the manufacturer's recommendations and measures to prevent contact with untrained personnel, birds, and animals. • Secondary containment using impervious, chemically resistant material and designed to prevent contact between incompatible materials in the event of a release. • Develop information, education and communication campaigns around diseases and health practices including communicable diseases such as HIV/AIDS, TB, and Covid-19; etc. Regularly review and update as necessary its existing communicable diseases management strategy. • During the project lifecycle, the risks and impacts to health and safety of affected landowners and communities should be evaluated and preventative measures should be taken early in the project. • Integration of organisational policies, programs, and practices, including those relevant to the control of hazards and exposures, the organisation of work, compensation, and benefits, built environment supports, leadership, changing workforce demographics, policy issues, and community supports, that will contribute to safety, health, and wellbeing. • Road safety interventions may need to range beyond their fleets of company vehicles and their workers' commutes and should consider the driving, walking, and riding practices of community members in the locality.					
Construction	All Construction Activities	Socio-economic	Loss of Agricultural Land	6	2	-6	7	Moderate - negative -98	• The Project shall purchase the land required from the directly affected landowners at the current market value to be determined by a qualified and registered land valuer. This will allow landowners who want to continue their farming activities to purchase replacement farmland elsewhere. • The Project shall identify farm portions which will not be immediately mined or used and where possible, lease such to the directly affected farmers to enable them to continue with their crop production. • All Project land purchase agreements with the landowners shall include special provisions for farmworkers and / or farm dwellers. Should the landowner plan to sell he / she must do the following:	6	3	1	5	Minor - positive +50

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• Inform all farm workers and farm dwellers of the change in ownership of the land; • Explain in detail the consequences of the sale of land as it relates to the farmworkers and farm dwellers; • In case where the farmers will no longer continue with farming, he or she must pay the farmworkers severance packages from the sale of the farm; and • In discussions with the municipality and the department of rural development and land reforms, ensure that all farm dwellers are accommodated elsewhere within eleven months after the sale of the farm. • Implement the grievance mechanism.					
Construction	All project related activities associated with construction and operations.	Socio-economic	Potential Physical Displacement of Farm Dweller Households	7	1	-7	6	Moderate negative -105	• Develop and implement a Resettlement Action Plan (RAP) to best practice guidelines; • Provide transitional support to displaced farm dweller households to support livelihoods during the transitional period; • Establish a consultative structure to comply with the RAP's requirements for informed participation and consultation of affected households and relevant government representatives and departments; and • Ensure that RAP implantation is monitored across time to ensure that displaced households' livelihoods are restored or improved and that they have obtained security of tenure at resettlement site. Note: Once all relevant environmental authorisations and licences are attained, the applicant will commence negotiations with the relevant affected landowners to determine suitable compensation.	7	1	-2	7	Minor - negative - 70
Construction	All project related activities associated with construction and operations.	Socio-economic	Change Sense of Place	6	2	-5	6	Moderate - negative -78	• Implement mitigation measures proposed in the Visual Impact Assessment Study. Implement induction programmes for all employees and contractors to increase sensitivity to local norms and customs; • Project Contractors shall implement a 'no fraternization' policy at the worker's camp to minimise relations with prostitutes and unsafe sexual interaction with residents; • Implement traffic safety measures, particularly speed control and driver awareness training for all drivers;	4	3	-3	5	Minor - negative -50

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• Minimise the construction footprint in forested areas and ensure that disturbed areas are rehabilitated with indigenous trees and other plants; • Adequate plan for rehabilitation; • Offset negative experience of altered sense of place by maximising local employment/ economic benefits; and • Implementation of the grievance procedure.					
Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Soil, Land Use, and Land Capability	Infrastructure area: • Soil quality contamination and deterioration; • Loss of usable soil for agriculture; • Soil erosions and sedimentation; and • Increased runoff and flow from hardened surfaces (soil compaction). Underground mined areas: • Subsidence; • Dewatering; • Groundwater and soil contamination; and • Decreased land capability and agricultural potential	7	4	7	6	Moderate (negative) - 108	• All vehicle maintenance and refuelling must occur within designated areas and inspected regularly for leaks; • All spills must be cleaned up immediately to prevent contaminants to enter the soils and groundwater. Monitoring must take place at least for three months after the spill have occurred to determine any contamination; • Culverts, roads, conveyors, powerlines and river crossings must be maintained, cleared and monitored; • All vehicles must remain on demarcated roads and within the operational footprint; • Stockpiles should be monitored and vegetated to ensure no runoff, erosion, sedimentation and loss of soil fertility; • Stockpiles must be allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; • A Storm Water Management Plan (SWMP) should already be implemented. This should consider all wetlands and other watercourses adjacent and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey contaminated water to silt traps to limit erosion and subsequent contaminants into soils and groundwater; • Monitoring of subsidence, dewatering and contamination must take place regularly to access possible impacts to soils; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible;	6	3	6	5	Moderate (negative) - 75
Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Soil, Land Use, and Land Capability		7	4	7	7	Major (negative) - 126		7	3	6	6	Moderate (negative) - 96
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Soil, Land Use, and Land Capability		6	4	7	6	Moderate (negative) - 102		5	2	5	5	Minor (negative) - 60
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	Soil, Land Use, and Land Capability		5	3	5	6	Moderate (negative) - 78		5	2	4	5	Minor (negative) - 55

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
Operational	Continue with exploration activities	Soil, Land Use, and Land Capability		5	3	5	6	Moderate (negative) - 78	• Chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; • Re-vegetate cleared areas and stockpiles to avoid wind and water erosion; • Preserve looseness of stockpiled soil by executing fertilisation and seeding operations by hand; • If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; • A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition to allow successful mine rehabilitation (Statham, 2014); • Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise AIPs, maintain soil organic matter levels, maintain soil structure, and microbial activity; and • Compacted areas are to be ripped to loosen the soil structure.	4	2	3	4	Minor (negative) - 36
Operational	Underground blasting and operation of the underground workings.	Fauna and Flora	• Increased risk of post-mining land subsidence; • Loss of topsoil; • Impacts on the hydrological systems (water table) impacting the habitat ecology and ecosystem services; and • Potential contamination of underground water with hydrocarbons, polluting sensitive habitats for sensitive faunal and floral species.	6	3	5	5	Minor (negative) -70	• Adhere to all management and mitigation measures as prescribed within other specialist reports. • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the mining personal; and • Prevent impacts from reaching downstream water resources and hydrophilic environments (wetlands) by ensuring installation and proper functioning of stormwater systems and drains to prevent contaminated water entering the natural environment. This will be prudent in this development, since petroleum and other hydrocarbons associated with the trucks and vehicle-based activities are likely to be spilled in the environment if not managed well. As referenced by the Digby Wells Hydropedology Report (2021), implementation of a proposed water stormwater management plan is important to reduce sedimentation and siltation of nearby watercourses.	5	3	4	5	Minor (negative) - 60

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste.	Fauna and Flora	Contamination of soil, water and surrounding areas / habitats (pan and wetland vegetation) from hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	5	3	5	6	Moderate (negative) -78	• All spills should be cleaned up immediately, and treated accordingly; and • Re-fuelling must take place on a sealed surface area away from sensitive habitats such as the pan vegetation to prevent the ingress of hydrocarbons into the topsoil.	5	3	2	3	Negligible(negative) -30
Operational	Continue with exploration activities	Fauna and Flora	• Continuous disturbances to the fauna and flora by explorative activities; • Increased vehicle activity; and • Continuous anthropogenic influence stemming from staff, residents and visitors that infiltrate the unexplored natural veld areas will damage and impact on species communities within certain areas. This could disturb unidentified SCC.	5	3	4	4	Minor (negative) -48	• All footprint areas should remain as small as possible; • If any SCC are encountered within the Project area the future, the following should be ensured: • If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas or within designated open space on the subject property; • All rescue and relocation plans should be overseen by a suitably qualified specialist; and • Obtain relevant permits/consent, if applicable, for each protected or endangered floral species identified within the proposed development area that will be destroyed. • Human and vehicle movement should be restricted from taking place in sensitive habitats.	2	2	2	3	Negligible (negative)-18
Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Wetlands	• Infrastructure area: • Water and soil quality contamination and deterioration; • Loss of habitat and biodiversity; • Erosion and sedimentation; • Increased runoff and flow from hardened surfaces; and • Change in habitat and potential change in species composition.	7	6	7	6	Major (negative) - 120	• Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present, and if so that a remedy is put in place as soon as possible; • If it is unavoidable that any of the wetlands will be affected, the disturbance must be minimised and suitably rehabilitated; • All vehicle maintenance must occur within designated areas and inspected regularly for leaks; • All spills must be cleaned up immediately to prevent contaminants to enter the wetlands. Monitoring must take place at least three months after the spill have occurred to determine any contamination; • Re-fuelling and maintenance must take place on a sealed surface area away from wetlands to prevent the ingress of hydrocarbons into topsoil;	5	4	5	5	Minor (negative) - 70
Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha).	Wetlands		7	6	7	7	Major (negative) - 140		6	4	6	7	Major (negative) - 112
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Wetlands		6	4	7	6	Moderate (negative) - 102		5	3	5	4	Minor (negative) - 52
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and	Wetlands		6	3	7	5	Moderate (negative)		5	2	4	3	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
	stormwater management infrastructure and stockpile areas		• Underground mined areas: • Subsidence; • Dewatering; and • Groundwater contamination.					- 80	• All areas of increased ecological sensitivity should be designated as "No-Go" areas and be off-limits to all unauthorised vehicles and personnel; • No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines; • Culverts, roads, conveyors, powerlines and river crossings must be maintained, cleared and monitored; • No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint; • Stockpiles should be monitored and vegetated to ensure no runoff, erosion and sedimentation into the adjacent areas, especially the wetlands and freshwater systems; • Stockpiles must be allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; • Stockpiles must be located outside wetlands and at least a 100 m buffer; • A Storm Water Management Plan (SWMP) should already be implemented. This should consider all wetlands and other watercourses adjacent and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey contaminated water to silt traps to limit erosion and the subsequent increase of suspended solids in downstream watercourses; • Monitoring of subsidence, dewatering and contamination must take place regularly to access possible impacts to wetlands; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; and • Chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions.					- 33
Operational	Continue with exploration activities	Wetlands		5	3	5	6	Moderate (negative) - 78		4	2	3	4	Minor (negative) - 36
Operational	Uncontrolled runoff of stormwater or process water from or through the surface infrastructure.	Aquatics	Water quality deterioration of watercourses receiving unnatural/contaminated runoff.	5	3	-5	5	Minor (negative) – 70	The following management actions are recommended to guide the effective management of stormwater and water generated on site: • Runoff from dirty areas should be directed to the storm water management infrastructure (drains and PCDs) and	5	1	-1	3	Negligible (negative) – 21

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									should not be allowed to flow into the nearby watercourses, unless DWS discharge authorisation and compliance with relevant discharge standards are adhered to; • If discharge of water occurs, bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants; • Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; • The Dynamic Subsidence Reclamation or DSR techniques, similar to concurrent mining and reclamation concepts used in surface mining should be applied (reader is referred to Hu et al. (2016)); and • Monitoring of the associated water courses should be done by an aquatic specialist to determine potential impacts where after new mitigation actions should be implemented as per the specialist's recommendations.					
Operational	Operation of the Box Cut as a means for secure and safe entrance and access to the decline of the underground mine	Hydropedology	Disruption of water flow paths will likely reduce the quantity of water reporting to the Vaalwaterspruit thereby affecting the availability of water for downstream water users	4	2	1	7	Minor (negative) -49	Recommended management/mitigation measures are as follows: • Implementation of the proposed stormwater management plan to reduce sedimentation and siltation of nearby watercourses. The recommended perimeter berms around the discard dump, lay down areas, box cut, overburden dump and stockpiles will ensure that clean water is diverted from the dirty areas.	There are no mitigation measures to prevent this impact from occurring, but the area to be affected by the box cut and mine shaft is relatively small making this impact of minor negative significance.				
Operational	• Overland flow and interflow from the dirty areas or catchments (coal stockpile areas, mine processing plant, workshops, lay down areas etc.). Hydrocarbon residues including oil, grease and fuel spillages from equipment, moving haulage trucks and machinery transported to watercourses.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	5	4	3	5	Minor (negative)-60	Similar to the construction phase the following should be conducted to mitigate contamination of water resources during the operation phase: • Hydrocarbon waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath; and • Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken	5	2	2	2	Negligible (negative) -18

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									at designated hard park areas. Any used oil should be disposed of by accredited contractors.					
Operational	Areas containing topsoil stockpiles, overburden, and discard dumps.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	5	5	5	6	Moderate (Negative) -90	Recommended mitigation/management measures are as follows: • Control by implementing a comprehensive storm water management plan which addresses fluvial erosion control; • Stockpiles should be placed outside 1:100-year floodlines; • Control through implementation of a SWMP for dirty water management; • Control through water quality and quantity monitoring and updating the mine-wide water balance; • Maintenance of infrastructure and mining vehicles to reduce leakages; and • Remedy through re-profiling and rehabilitation of previously disturbed landscapes	3	2	1	3	Negligible (Negative) -18
Operational	• Handling of hydrocarbons and general waste; and Spillages and leakages from maintenance of haul roads, pipelines, and machinery; • Use of water for mining operations and production of contaminated effluent/process water.	Surface water	Contamination of water resources and deterioration of water quality.	6	6	5	5	Moderate (negative) -85		3	2	1	3	Negligible (Negative) -18
Operational	Operation of the Underground Mine, Ventilation Shaft, Use and Maintenance of Haul Road, and Concurrent Rehabilitation	Air Quality	Dust generation and release of gaseous pollutants leading to poor air quality	5	3	4	6	Minor (negative) – 72	• Application of dust suppressant on the haul roads and exposed areas; • Limit dust-generating activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on dirt roads and have these limits enforced; • The drop heights when loading onto trucks and at tipping points should be minimised; and • Dust mitigation equipment for the vent shaft.	5	2	2	3	Negligible (negative) – 27
Operational	Ventilation fans and infrastructure area containing stockpile areas	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance	5	3	3	7	Major (negative) – 77	The following management measures are recommended as good practice guidelines. • Machinery and vehicles used for mining and/ maintenance work should be switched off when not in use; • Vehicles used for mining and maintenance work should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound;	5	2	1	5	Minor (negative) – 40
Operational	Underground blasting	Noise	Noise impacts are considered to be negligible therefore was not assessed further.											
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent, and	Noise	Noise emissions from equipment/machinery will increase the noise levels at											

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
	stormwater management infrastructure and stockpile areas.		sensitive receivers and may result in a noise disturbance.						• A concrete wall should be used as the perimeter fence instead of a wire fence; • Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.					
Operational	Removal of rock (blasting).	Noise	Noise impacts are considered to be negligible therefore was not assessed further.											
Operational	Establishment and upkeep of Mine related structures along with the box cut	Visual	• Alterations of the natural visual character of the region; • Long term vegetation loss; and • Land cover and land use changes.	6	3	4	7	Moderate -91	• As far as possible, preserve the natural vegetation to reduce the visual impact; • Sensitive receptors should be mitigated from the visual impact by a strategic usage of tree-lines and on site berm features which integrate with effective landform design; and • Buildings on site should be kept to a colour that does not bear a large contrast to the existing natural vegetation and landscape.	5	2	3	6	Minor -60
Operational	Establishment and operation of the stockpile and plant region during operations	Visual	Constant topographical changes to the stockpiles, which also have a sharp contrast to the natural landcover in the region	5	3	4	7	Moderate -84	Visual screens be placed in the form of tree-lines, particularly along highly sensitive areas along the R38.	5	2	4	7	Moderate -77
Operational	Lighting of mine infrastructure at night	Visual	• The mine site would contain lighting for security and operational safety purposes; and • The artificial lighting could provide a source of distraction to receptors in the region.	4	2	2	4	Negligible -40	• Focus the lights towards components of the mine that require specific lighting to avoid light dispersal; and • Consider utilizing lower lumen lighting that does now spill outside of the mine region.	4	1	2	4	Slightly Detrimental -24
Operational	All project related activities associated with construction and operation.	Socio-economic	Creation of Long-term Employment Opportunities, Skills Development and Work Experience	4	5	4	5	Minor – positive - 65	• As per the legal requirements update, disclose, and implement the Social and Labour Plan. • Develop and implement the site-specific Employment Policy in compliance with the South African legal framework and company standards. As part of the Policy:	3	4	4	4	Minor - positive - 44

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									- Set employment targets aimed at increasing local employment; - Set monitoring indicators for local employment; - Integrate local employment targets into all procurement contracts to which the appointed contractors must adhere to; - To accommodate those that do not have access to android phones or internet, widely advertise employment opportunities using community newspapers, notice boards, etc; - All employment opportunities must be advertised in predominantly spoken languages within the primary study area; and - Ensure that no employment take place at the entrance to the site (to avoid people congregating at the work site). Only formal channels for employment will be used. - Develop and implement a grievance mechanism. The mechanism must be widely communication to stakeholders within the primary study area, and a grievance register must be kept up-to-date.					
Operational	All project related activities associated with construction and operation.	Socio-economic	Opportunities and Capabilities within the Supply Chain	5	4	2	4	Minor - positive -44	- Implement the SLP commitments as they relate to the local business development; - Development a Local Procurement Strategy with local business development targets aligned to the commitments set-up in the SLP for the project; - Effectively communicate the benefits of local procurement to external stakeholders; - Considerations for local procurement should support groups, such as women, visible minorities, and youths; - Strengthen the capacity of local businesses to ensure that they are in a better position to supply the services required by the project, through holding workshops and seminars geared towards explain the tender requirements; - Consider unbundling of contracts into small work programs to ensure that small and locally based businesses can benefit;	5	5	6	6	Moderate - positive 96

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• Propose and promote joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development; • Establish a time-bound commitments to increase local procurement; Such commitments could include annual or mid-term targets for local procurement spending, supplier development programmes, local procurement plans, local procurement key performance indicators (KPIs) for procurement staff, and other local procurement objectives; • All tender process must follow existing Exxaro's SMME development strategies and programs; • Host workshops to provide training for current and potential suppliers to build up skills that were commonly identified as lacking in the supplier audits (e;g;, business plan creation, tender preparation, etc;); and • Implement the grievance mechanism.					
Operational	All project related activities associated with construction and operation.	Socio-economic	Changes to the Water Quality	4	4	5	5	Minor - negative -65	• Implement mitigation measures outline in the Surface and Ground Water Specialist Studies associated with this project; and • Implement a grievance mechanism.	3	3	3	4	Minor - negative - 36
Operational	All project related activities associated with construction and operation.	Socio-economic	Impacts Associated with Surface Subsidence	7	4	-6	5	Moderate - negative -85	• Develop a Subsidence Management Plan (SMP) prior to the establishment of the mine. The Plan should prioritise the adequate protection of important natural and built features within the Project area. Management could include avoidance of damage to particularly natural features, mitigation of damage or rehabilitation; • Possible relocation of people away from all infrastructure areas while surface subsidence occurs could be implemented in accordance with best practice guidelines for resettlement. In all cases, adequate budget must be provided for repairs to water and electrical supply systems, walls of buildings, fencing, and roadways; and • Implement a grievance mechanism.	5	4	-4	5	Minor - negative - 65
Operational	All project related activities associated with construction and operation.	Socio-economic	Occupational Health Risks to Mine Workers	6	5	-4	5	Moderate – negative -75	• Develop and implement a detailed Occupational Health and Safety Management Plan and System. The Occupational Health and Safety (OHS) management plan should include, but not limited to: ◦ Hazard identification and risk assessment procedure;	6	5	-3	4	Minor – negative -56

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									▪ A 'fitness for work' programme to ensure that all employees are physically able to undertake their work without impact to their health; ▪ Mandatory OHS training programmes provided to all employees, including contractors to ensure staff are aware of the health and safety guidelines; ▪ Specific OHS training programmes provided for workers assigned to tasks associated with H&S risks; ▪ All workers should be provided with Personal Protective Equipment (PPE) and be mandated to use it; ▪ Placement of visual warning signs in place, including those for the electrical and mechanical equipment safety warning, and chemical hazard warning; ▪ Toolbox talks or health and safety meeting daily to ensure that procedures are being adhered to, and to discuss any incidents that have occurred; ▪ Develop and implement a workforce grievance procedure where they can raise issues and concerns relating to OHS; ▪ Conduct information, education, and communication campaigns amongst Project Personnel on hygiene and sanitation; and ▪ Provide awareness, counselling, and testing (ACT) for all Project personnel, including voluntary testing for STIs and HIV/AIDS in pre-employment and on-going health screening. (Workers will not be denied employment or discriminated against in any way based on their HIV status). ● Project workers including third party Contractors to be subject to health and safety standards and policies; and ● Develop and implement a workforce grievance mechanism.					
Operational	All project related activities associated with construction and operation	Socio-economic	Economic Multiplier	7	5	2	5	Minor - positive +70	● Implement enhancement measures linked to employment creation and opportunities associated with the supply chain; ● Implement the SLP related interventions; ● Compliance with SLP commitments to make maximum use of local SMMEs and BBBEE companies; and ● Implement the grievance mechanism.	5	5	3	6	Moderate - positive +78

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
Operational	All project related activities associated with construction and operation	Socio-economic	Social Development as part of Social and Labour Plan (SLP)	6	3	5	5	Minor - positive +70	• Consultation with Project beneficiaries regarding proposed community development needs and associated initiatives; • Early identification of community members for enrolment in ABET and portable skills training to improve likelihood of employment on the mine; • Conduct baseline socio-economic survey of households located within primary study area prior to commencement of community development initiatives to enable accurate identification of eligible Local Economic Development (LED) project and skills training beneficiaries and measure impacts of development initiatives on households; • Collaboration with other developmental role players during implementation; • Establishing an external monitoring programme to monitor and evaluate community development initiatives as well as HRDP and procurement policy implemented by the mine and its contractors; • Expanding skills development and capacity building programmes to non-employees; and • Maintaining a record of training courses completed per individual and community. Where training is offered to non-employees, their contact information and qualifications can be shared with other industries	7	3	6	6	Moderate - positive (96)
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Ground Vibration	2	3	4	5	Minor (negative) -40	• Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing; and • Monitor ground vibration and air blast from blasting operations.	2	3	2	3	Negligible (negative) -16
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Air blast	2	3	2	3	Negligible (negative) -16	Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths.	2	3	2	3	Negligible (negative) -16
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Fly rock	2	2	2	1	Negligible (negative) -10	• Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect; and • Monitor fly rock situation using video camera	2	2	2	1	Negligible (negative) -10

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
Decommissioning	Demolition and removal of infrastructure.	Soil, Land Use, and Land Capability	• Soil erosion and sedimentation; • Decreased soil fertility and increased AIPs; • Soil contamination due to decanting and the groundwater contamination plume; • Subsidence; • Dewatering; and • Decreased land capability and agricultural potential.	6	3	5	6	Moderate (negative) - 84	• Rehabilitation and decommissioning should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation; • Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material, and sedimentation; • Implement and maintain a AIPs Management Plan for the duration of the rehabilitation phase and into closure; • Rehabilitation must be done as soon as any impacts are observed (decanting, subsidence and contamination); • Monitor subsidence and possible decant of Acid Mine Drainage (AMD) and implement management measures which include for example an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021); • Newly shaped and topsoiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; • Ensure proper storm water management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs; • Continue with Concurrent Rehabilitation, and implement land rehabilitation measures; • Address compacted areas by deep ripping to loosen the soil, and revegetate the area; and • The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions.	5	2	3	4	Minor (negative) -40
Decommissioning	Post-closure monitoring and rehabilitation.	Soil, Land Use, and Land Capability		5	3	5	5	Minor (negative) -65		4	2	3	3	Negligible (negative) -27
Decommissioning	Closure of the underground mine.	Soil, Land Use, and Land Capability		7	4	7	7	Major (negative) - 126		7	3	6	6	Moderate (negative) - 96
Decommissioning	Demolition and removal of infrastructure.	Fauna and Flora	• Disturbance of soils, and subsequent erosion by wind and water; • Increased vehicle movement in the area, increasing soil	5	3	3	4	Minor (negative) -44	• Continue with concurrent Rehabilitation, begin with stockpiles, bare grounds and dumps, implement rehabilitation measures; • Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible to prevent AIP sprawl;	2	2	2	4	Negligible (negative) -24

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
			erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Unexpected changes in topography and landscape as a result of subsidence.						• Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and • Only designated access routes are to be used to reduce any unnecessary compaction.					
Decommissioning	Post-closure monitoring and rehabilitation	Fauna and Flora	• Minimal negative impacts on the environment; • Activities involve the rehabilitation processes of reprofiling the soils and re-vegetation thereafter; • Impacts include the possibility of erosion and sedimentation; • Proliferation of AIPs; and • Change in the habitat and species composition.	4	1	5	5	Minor (negative) -50	• During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season (October to February) to ensure adequate plant recruitment; • Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and • Only designated access routes are to be used to reduce any unnecessary compaction.	6	3	2	6	Minor (positive)+66
Decommissioning	Closure of the underground mine.	Fauna and Flora	• Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats.	6	3	5	4	Minor (negative) -56	Ensure mitigations measures to prevent subsidence are enforced and maintained throughout the decommissioning phase.	4	3	4	3	Negligible (negative) -33

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
			• Change in the land topography and species composition.											
Decommissioning	Demolition and removal of infrastructure.	Wetlands	• Impacts to the wetlands and watercourses include: • Erosion and sedimentation; • Increased AIPs; • Change in habitat and potential change in species composition; • Soil and water contamination due to decanting and the groundwater contamination plume; • Subsidence; and • Dewatering	6	3	5	5	Minor (negative) - 70	• Rehabilitation should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation of the wetlands; • Mine-affected water should be reintroduced into the environment without treatment, if necessary, and a WUL; • Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material, and sedimentation into wetland areas; • Implement and maintain a Wetland and AIPs Management Plan for the duration of the rehabilitation phase and into closure; • No material should be dumped/stockpiled within any wetlands or watercourses; • No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffers. All vehicles must remain on demarcated roads; • Wetland monitoring must be carried out during the Rehabilitation phase into mine closure to ensure no unnecessary impact to wetlands takes place; • Rehabilitation must be done as soon as any impacts are observed (decanting, subsidence and contamination); • Monitor subsidence and possible decant of Acid Mine Drainage (AMD) and implement management measures which include for example an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021); • Newly shaped and topsoiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; and • Implement a Wetland Offset Strategy to compensate for residual impacts to the wetlands.	5	2	3	3	Negligible (negative) - 30
Decommissioning	Post-closure monitoring and rehabilitation.	Wetlands		5	3	5	5	Minor (negative) -65		4	2	2	3	Negligible (negative) -24
Decommissioning	Closure of the underground mine.	Wetlands		7	6	7	7	Major (negative) - 140		7	4	6	6	Moderate (negative) - 102
Decommissioning	Decant and runoff of contaminated water entering aquatic ecosystems.	Aquatics	Water quality deterioration of watercourses in contact with contaminated water resulting in AMD.	7	3	-6	6	Moderate (negative) – 108	The goal of mitigation should be to prevent and or limit the decant of contaminated water into associated aquatic ecosystems. The following measures may be utilised in attempt to reduce the Decommissioning and Post Closure impacts:	3	1	-1	3	Negligible (negative) – 15

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
									• The demolition of infrastructure should occur during the dry season to avoid increase runoff of contaminated water into associated watercourses; • Best practise rehabilitation should be utilised to trap and contain the deep sediments that contain the acid forming rock responsible for acid water formation; • Subsidence and decant should be monitored to prevent changes to the geomorphology of the water courses and potential contamination with AMD; and • If decant occurs post-closure, passive treatment with lime or other alkaline compounds can be applied to neutralise AMD at the decant points. Aquatic biomonitoring is also recommended to monitor any changes in the aquatic ecosystems and to provide solutions for identified, additional/unforeseen impacts for at least three years after rehabilitation.					
Decommissioning	Demolition and removal of infrastructure	Hydropedology	Sedimentation and siltation of watercourses due to increased soil erosion leading to reduced water quality.	5	5	5	6	Moderate (Negative) -90	The following mitigation/management measures are recommended: • Soil disturbances during demolition should be restricted to the relevant footprint area; • All decommissioning activities should be undertaken in a way to minimise disturbance of soils which will lead to erosion, sedimentation and siltation of the Vaalwaterspruit; • In the event of decanting, passive treatment (through application of calcium compounds) should be implemented to neutralise and treat the AMD before being discharged back into freshwater resources; • Use of constructed wetlands can also be considered as a mitigation measure against AMD; • Alternatively, when passive treatment fails to correct the situation active Water Treatment (e.g. Reverse Osmosis) should be considered; and • Post closure monitoring should be conducted for at least 5 years after decommissioning to help with the early detection of decant and prevent or reduce contamination of water resources.	5	2	2	2	Negligible (negative)-18
Decommissioning	After decommissioning, dewatering ceases and water accumulates within the mine shaft and the water reacts with the pyrite in the backfilled material, thereby becoming acidified and starts decanting at low lying positions, including the adjacent Vaalwaterspruit.	Hydropedology	Contamination of soil and water resources from potential decant of AMD and movement of contamination plume due to the re-watering of the mine shaft	7	6	4	7	Major (Negative)-119		4	3	2	7	Minor (Negative) -63

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
Decommissioning	Demolition and removal of infrastructure.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries.	6	5	5	6	Moderate (Negative) -96	Recommended mitigation/management measures: • Control through limiting disturbance of soils to where demolition will be taking place and the demolition site should be cleared as quickly as possible to avoid sediment erosion; • Maintain demolition vehicles to ensure that no leakages occur, and all chemical related waste and storages should be handled by trained personnel; • Control the quality of water through water quality monitoring; • Options to deal with AMD include the following: ○ Actively treating AMD decant to acceptable water quality levels for re-use or prior to discharge into the natural stream; and ○ Passive treatment or neutralisation of AMD effluent with calcium carbonate or lime at identified decant points to obtain water with acceptable quality. • Remedy through rehabilitation of areas previously occupied by ventilation fans and other infrastructure, post-closure; and • Remedy through re-profiling and rehabilitation of previously disturbed landscapes.	3	2	2	3	Negligible (Negative-21
Decommissioning	Spillages and leakages from vehicles and machinery during demolition of infrastructure.	Surface water	Contamination of water resources from AMD and deterioration of water quality.	6	5	5	5	Moderate (negative) -80		3	2	2	2	Negligible (Negative) -14
Decommissioning	Decant of Acid Mine Drainage (AMD).	Surface water	Water Contamination from Acid Mine Drainage into surface water resources.	7	7	4	6	Moderate (negative) -80		7	2	2	4	Minor (negative) - 4-
Decommissioning	Post-closure monitoring and rehabilitation Closure of the underground mine.	Surface water	Restoration of free drainage and runoff yield at least to a certain extent.	7	6	6	6	**Major Positive 114**		No mitigation possible.				
Decommissioning	Demolition and Removal of Infrastructure and Rehabilitation	Air Quality	Dust generation leading to poor air quality	3	2	2	4	Minor (negative) – 28	• Application of dust suppressant on the haul roads and exposed areas; • Limit activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on dirt roads and have these limits enforced; • The area of disturbance must be kept to a minimum at all times and no unnecessary clearing, digging or scraping must occur, especially on windy days; • The drop heights when loading onto trucks and at tipping points should be minimised and • Rehabilitation of disturbed land to allow for vegetation growth.	3	1	1	3	Negligible (negative) – 15
Decommissioning	Demolition and removal of infrastructure – once mining activities have been	Noise	Noise emissions from equipment/machinery will	2	2	2	3		• Restrict decommissioning activities to daylight hours;	2	1	1	3	

Phase	Project Activity	Aspect	Impacts	D	E	I	P	Significance (Pre-Mitigation)	Mitigation Measures	D	E	I	P	Significance (Post Mitigation)
	concluded infrastructure will be demolished in preparation for the final land rehabilitation		increase the noise levels at sensitive receivers and may result in a noise disturbance. However, the removal of noise generating sources will also lead to a reduction in the noise levels.					Negligible (negative) – 18	• Construction vehicles should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Regularly service machines and vehicles to ensure noise suppression mechanisms are effective e.g., installed exhaust mufflers; • Regulate speed limits on access roads; and • Switch off equipment when not in use.					Negligible (negative) – 12
Decommissioning	Rehabilitation – rehabilitation mainly consists of spreading and landscaping of the preserved subsoil and topsoil, profiling of the land, and re-vegetation.	Noise	Noise impacts are considered to be negligible therefore will not be assessed further.											
Decommissioning	Post-closure monitoring and rehabilitation.	Noise												
Decommissioning	Decommissioning	Socio-economic	Economic Boom-Bust after the Operation Phase	3	5	-5	6	Moderate - negative -78	• Develop and implement an integrated Mine Closure Plan; and • Proactively assess and manage the social and economic impacts on individuals, regions, and economies where retrenchment and/or closure of the Project are certain.	3	5	-3	6	Minor - negative -66

12.2 Cumulative Impacts

The importance of identifying and assessing cumulative impacts is that the whole is often greater than the sum of its parts. This implies that the total effect of multiple stressors or change processes acting simultaneously on a system may be greater than the sum of their effects when acting in isolation. The cumulative impacts considered by the relevant specialists are discussed per environmental aspect, below.

12.2.1 Soil, Land Use and Land Capability

The land uses within and adjacent of the Project area have contributed to losses of soil, land use and land capabilities. Historical and current land uses (i.e., agropastoral activities, infrastructure and mining) has led to major geomorphological and hydrological changes, vegetation loss, erosion, overgrazing, the contamination of soil and water resources and increased surface inflows.

The land uses have led to land degradation, changing the land capability in large areas. The alteration of vegetation and surface flow has led to the onset of erosion and may be perpetuated further by the proposed activities. In addition to mining and agropastoral activities were linear infrastructures such as roads, dams, powerlines, and fences. The impacts include the creation of preferential flow paths, erosion, sedimentation and compaction of soils.

- Activities impacting the soil resources include changes to the physio-chemical properties of the soil. Impacts include:
- Geomorphological changes to the natural soils and landscape;
- Loss of habitat, vegetation and growth medium;
- Erosion, destruction of agricultural land, loss of topsoil and organic material;
- Sedimentation and pollution of water courses (wetlands); and
- Soil contamination through agricultural fertilizers, pesticides, mine impacted water and heavy metals from adjacent mining activities.

The cumulative impacts have a significant effect on the soil resources and therefore impacting the land use and land capability of the Project Area. Contaminated soil directly impacts the water quality and quantity as well as vegetation and soil fertility.

12.2.2 Fauna and Flora

It is necessary to consider the impacts that the future development will have from a wide-ranging perspective, by considering land-use and transformation of the natural habitat in surrounding areas. Cumulative impacts are assessed by considering past, present and anticipated changes to the biodiversity. Roads, other mining activity and agricultural activity in the area contribute to this regard. The proposed project is localised in extent but could affect SSC if not managed carefully.

The further removal of habitat/vegetation types to allow construction will bring about a reduction of natural areas, and the increase of the edge effect. The loss of vegetation and flora along with associated faunal habitat and ecosystem services within the proposed infrastructure layout will be minimal as majority of the area of disturbance comprises of already disturbed habitat such as cultivated areas. Albeit the Project Area resides in the Endangered Eastern Highveld Grassland vegetation type which is currently poorly protected. The cumulative loss of the vegetation type as well as the SCC within it should be considered proactively. The primary impacts will include fragmentation and edge effects, isolating pockets of vegetation decreasing movement and corridors for wildlife and threatened species.

Secondary cumulative impacts will include increased accessibility to the site and the resulting increase in development and resource dependence. Ideally, a strategic environmental plan for the area should be developed and adhered to. This should include the conservation of important areas as well as the provision of corridors for faunal movement.

12.2.3 Wetlands

The land uses within the Project Area have contributed to losses of wetlands and continued impacts on the remaining catchment. Historical and current agropastoral (i.e., intensive cultivation, cattle grazing, infrastructure, dams and boreholes), anthropological (i.e., housing, roads, tracks, cattle, borrow pits and firewood collection), infrastructure, (i.e., national roads, dams, powerlines and pipelines) and mining activities have led to various geomorphological, vegetation and hydrological changes (e.g., vegetation loss, overgrazing and contamination of water resources and increased surface inflows) contributing to the physical impacts on the wetlands, reducing the PES, EIS and ES.

The historical and current agropastoral activities and mining within the catchment have led to losses in wetlands and alteration to the hydrological regime that may have facilitated increased water flow and also have increased the number of pollutants flowing into the water resources and created large erosion gullies. The alteration of vegetation and surface flow has led to the onset of erosion in the wetlands and adjacent areas, and this may be perpetuated further by the proposed activities.

12.2.4 Aquatic Ecology

Presently, the main cumulative impact identified for the aquatic ecosystems within the Project Area appears to be the influence of agricultural fields and mining operations (including Eskom's Hendrina and Arnot power stations, the Mbuyelo Coal Mavungwani Colliery and other mines in the area).

Agricultural fields and game farms are known to abstract water for animal consumption and for irrigation (Ginster *et al.*, 2010), and mines use significant amounts of water for mineral processing, dust suppression, slurry transport and domestic uses. The establishment of the proposed mine might result in synergistic effects which will potentially impact on the biotic and abiotic environment.

12.2.5 Hydropedology

Activities within and adjacent of the Arnot South MRA contribute to the interruption of hydropedological processes within hillslopes thereby influencing flow regimes in rivers and streams as well as affecting wetland and aquatic ecosystems. Historical and current land uses (i.e., agropastoral activities, infrastructure development and mining) has led to major geomorphological and hydropedological changes, vegetation loss, overgrazing, the contamination of soil and water resources and increased runoff and associated erosion processes.

The cumulative impacts have a significant effect on the soil-water resources and therefore impacting on hillslope processes which are essential to ensure sustainable river flow regimes and water storage in natural reservoirs including wetlands and pans. The proposed Arnot South Project will also add to these impacts when viewed at a regional scale.

12.2.6 Surface Water

In coal mines, a significant amount of water is used for mining and processing, and dust suppression, thus having huge impacts on the availability of water. Furthermore, water availability is also reduced with deteriorating water quality because of dirty runoff from mines and contamination from decant water after mine closure. Despite the efforts to recycle water in this industry, a significant amount of water is needed to ensure effective operation, therefore, water requirements and water consumption remain high.

The project area is situated on the divide of the Olifants and Inkomati WMAs, where similar mining activities are being conducted, already with reports of pollution within river systems in this part of the catchment. In fact, the Olifants catchment, in particular, is considered one of the most polluted in Southern Africa (Le Roux, Schaefer, & Genthe, 2012). Extreme caution and care should, therefore, be taken to avoid exacerbating the water challenges already being experienced prior to the proposed Arnot South Project.

Water quality should closely and rigorously be monitored within the surrounding surface water resources to ensure adherence to South African Target Water Quality Guidelines. The proposed mitigation measures will ensure overall minimum cumulative impacts on the Olifants and Crocodile Rivers.

12.2.7 Air Quality

The predicted GLCs of the pollutants shows that future impacts will not be severe outside the project boundary and at sensitive receptors.

12.2.8 Noise

The findings of this noise survey show that the predicted noise emissions will have negligible daytime and significant night-time impacts from a SANS 10103:2008 perspective on the ambient noise levels in the area. This is corroborated by the calculated cumulative noise impacts, which shows that the exceedance of the regulatory limit values for daytime will not occur. However, exceedance of the regulatory limit values will occur for night-time at sensitive receivers NR7 and NR9. Irrespective of the above mentioned, it is recommended that quarterly noise monitoring be conducted to ensure the cumulative impact stay the same throughout the LoM.

12.2.9 Heritage

Cumulative impacts occur from in-combination effects of various impacts on heritage resources acting within a host of processes that result in an incremental effect. The importance of identifying and assessing cumulative impacts is that the whole is often greater than the sum of its parts. This implies that the total effect of multiple stressors or change processes acting simultaneously on a system may be greater than the sum of their effects when acting in isolation.

This Project in conjunction with other planned developments in line with the strategic development plans for the Mpumalanga Province requires consideration to identify the possible in-combination effects of various impacts to known heritage resources. Table 12-3 presents a summary of the possible cumulative impacts of the Project.

Table 12-3: Summary of Potential Cumulative Impacts

Type	Cumulative Impact	Direction of Impact	Extent of Impact
Additive	The proposed construction and operation of the Project will add to the existing infrastructure associated with the local and broader study areas. This Project will contribute to the loss of heritage resources and the gradual sanitising of the cultural heritage landscape. The Project will subtract from the sense of place and will decrease the area in which heritage resources not identified can occur.	Negative	Local study area

12.2.10 Socio-economic

Potential cumulative impacts associated with the Project are listed in Table 12-4.

Table 12-4: Potential Cumulative Impacts Related to Proposed Project

Nature	Direction of change	Extent of impact
Improved standard of living through increased employment opportunities, local business development, and improved public and community services and facilities (the latter will be dependent on government and private-sector contributions).	Positive	Local and regional

Nature	Direction of change	Extent of impact
Urban sprawl, housing backlog and / or growth of informal settlements.	Negative	Local and regional
Added pressure on local public service delivery and infrastructure, including housing, health systems, water and sanitation facilities, schools, and police services.	Negative	Local and regional
The use of non-local labour, due to unavailability of local skilled workers, may cause tension in local communities due to expectations that the Project should provide employment to locals.	Negative	Local
The visual impact of mining infrastructure and other industrial developments, and associated changes in land use, are significant and imprint an industrial character onto the rural agricultural landscape, impacting on sense of place.	Negative	Local and regional
Increased pressure on water resources to maintain the reserves required to supply basic human and ecological needs.	Negative	Local and regional
Compounded effects of lighting, noise, traffic, water pollution, dust emission, groundwater abstraction and physical reduction in habitat impacts community health and safety.	Negative	Local and regional
Reduced land availability for agricultural use (crop and livestock production).	Negative	Local, regional and national
Economic dependency on surrounding mines will negatively impact local, regional and national economies with decommissioning and mine closure.	Negative	Local, regional and national

Isolated attempts by the Project to ameliorate the above impacts will have only limited success. It is essential that the Project collaborates with the appropriate governmental and non-governmental structures and forums as well as the mining projects listed above to address these impacts.

13 Item 3(l): Methodology Used in Determining and ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = CONSEQUENCE X PROBABILITY X NATURE

Where

Consequence = intensity + extent + duration

And

Probability = likelihood of an impact occurring

And

Nature = positive (+1) or negative (-1) impact

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 13-3. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this EIA report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 13-2, extracted from Table 13-1. The descriptions of the significance ratings are presented in Table 13-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 13-1: Impact Assessment Parameter Ratings

Rating	Intensity		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the Project.	Definite: There are sound scientific reasons to expect that the impact will occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond Project life: The impact will remain for some time after the life of the Project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	<u>Province/ Region</u> Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the Project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	<u>Municipal Area</u> Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	<u>Local</u> Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the Project, therefore there is a possibility that the impact will occur. <25% probability.
2	**Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	<u>Limited</u> Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low because of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

DIGBY WELLS ENVIRONMENTAL

Table 13-2: Probability/ Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Consequence																																					

Table 13-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the Project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the Project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the Project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the Project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

13.1 Item 3(I)(i): The Positive and Negative Impacts that the Proposed Activity and Alternatives will have on the Environment and the Community that may be Affected

Section 9.1 above provides an explanation of the site layout, alternatives and aspects that were considered during the finalisation of the layout. The Impact Assessment detailed in Section 11.18 describes all identified potential impacts associated with the preferred site layout and planned Project activities.

13.2 Item 3(I)(ii): The Possible Mitigation Measures that could be Applied and the Level of Risk

Mitigation measures for each identified impact have been proposed and are presented with the impact ratings in Section 12.1 above.

13.3 Item 3(I)(iii): Motivation where no Alternatives Sites were Considered

In terms of mining, alternative sites (i.e. locations) could not be considered since the location of the mineral resource determines the location of the mining operations. Since mining and extraction can only occur at the location of an ore body, it is not feasible to consider alternative locations. The proposed property has indicated the presence of coal.

The alternatives considered for the new proposed activities have been detailed in Section 9 above.

13.4 Item 3(I)(iv): Statement Motivating the Alternative Development Location within the Overall Site

The preferred overall site is based on the location of the identified coal seam, however, the proposed infrastructure layout for the Arnot South Project area was informed by various specialist investigations. The mine layout is being amended to avoid sensitive areas and to ensure that structures are situated away from sensitive pans and terrestrial ecology areas, as far as possible. The layout was therefore designed and revised to reduce associated impacts to the environment. The amended layout will be presented in the Water Use Licence.

The no-mining option will mean that all potential negative impacts associated with the proposed mine and its associated infrastructure would not occur.

14 Item 3(m): Full Description of the Process undertaken to Identify, Assess and Rank the Impacts and Risks the Activity will Impose on the Preferred Site (In respect of the final site layout plan) Through the Life of the Activity

The identification, assessment and ranking of potential new impacts associated with the Project were informed by the environmental and technical specialist investigations undertaken. The impacts associated with the decommissioning and rehabilitation Project are presented in Table 15-1.

15 Item 3(n): Assessment of each identified potentially significant impact and risk

Table 15-1 provides all identified impacts associated with the construction, operational, decommissioning, rehabilitation and post closure phase aspects.

Table 15-1: Assessment of each Identified Potentially Significant Impact

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Construction	Site/vegetation clearance (52.28 ha)	Soil, Land Use, and Land Capability	• Loss of usable soil (high land capability soils); • Soil erosion and sedimentation; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Soil contamination and deterioration; and • Increased runoff from hardened surfaces (soil compaction).	Moderate (negative)	• If the destruction of soils with a High land capability is unavoidable, disturbance must be minimised and appropriately rehabilitated; • Environmental Practitioner to be present during soil stripping to prevent mixing of soils and ensure correct stockpiling methods, and top soil and sub-soil must be stockpiled separately(i.e., stockpile height, separate stockpiling for topsoil, subsoil and waste rock); • Long term soil stockpiles must be vegetated and allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction, • Monitor infrastructure, stockpiles and dumps to ensure no runoff, erosion and sedimentation and decreased land capability; • Monitor PCD, STP, raw water, processed water and washing plant, if spills have occurred, clean up immediately and implement a monitoring program for at least three months after the spill has occurred;	Moderate (negative)
Construction	Construction of diesel storage and explosives magazine	Soil, Land Use, and Land Capability		Moderate (negative)		Minor (negative)
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office.	Soil, Land Use, and Land Capability		Moderate (negative)		Minor (negative)
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long.	Soil, Land Use, and Land Capability		Moderate (negative		Minor (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Construction	Construction of Pollution control dam (PCD) (1.61 ha), Raw water pipeline, Process water, Sewage treatment plant (STP).	Soil, Land Use, and Land Capability		Major (negative)	• If any erosion occurs on site and adjacent of the Project Area, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; • Restrict extent of disturbance within the Project Area and minimise activity within designated areas of disturbance; • Minimise the period of exposure of soil surfaces through dedicated planning; • Ensure proper storm water management designs are in place; and • Spill containment and clean up kits should be available onsite and clean-up from any spill must be in place and executed at the time of a spillage with appropriate disposal as necessary.	Moderate (negative)
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Soil, Land Use, and Land Capability		Moderate (negative)		Minor (negative)
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	Fauna and Flora	• Loss of plant communities and sensitive landscapes including, Grassland and Wetland habitats; • Loss of biodiversity and SCC; • Increased erosion; • Potential for AIP proliferation; • Loss of faunal habitat including faunal SCC.	Moderate (negative)	• Keep site clearing to a minimal, and restrict vehicle movement to dedicated areas; • AIP Eradication strategy should be implemented; • Make use of existing roads to encourage minimal impacts/footprint; • Avoid sensitive areas such as Rocky Outcrops, Primary Grasslands and Wetlands; • Environmental Practitioner and botanist to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct input area; • The footprint of the mine should be as compact as possible from a design point of view; and • Adhere to recommended protective buffers around wetlands as stipulated in the Wetland Report, refer to Appendix F	Minor (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Construction	Stockpile of soils, rock dump and discard dump establishment	Fauna and Flora	• Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal; • Natural vegetation will be removed, damaged and fragmented promoting edge effects and AIP proliferation; • Change in habitat and potential change in species composition; and • Increased soil compaction, runoff and erosion into surrounding sensitive landscapes.	Moderate (negative)	• Construction must be kept within the infrastructure footprint area, to reduce fragmentation as much as possible; • Bare land surfaces must be vegetated to limit soil erosion from surface runoff associated with stockpiles and dumps. Revegetate disturbed areas immediately after construction; • Monitor stockpiles to ensure no erosion, runoff, and sedimentation into surrounding areas; • No establishment of rubble piles; • AIPs should be continuously monitored and controlled throughout the life of the mine and thereafter with the establishment of an AIP Eradication Plan; and • Corridors (infrastructure and ecological) set aside within the mine area would mitigate fragmentation substantially, especially if this could be managed with the community over an extended period of time.	Minor (negative)
Construction	Access and haul road construction	Fauna and Flora	• Removal of vegetation and basal layer; • Increased proliferation of AIPs; • Increased faunal casualties; and • Increased dust pollution.	Moderate (negative)	• Keep site clearing to a minimum; • If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; • Staff of the mine must adhere to policies within the operation of the mine, such as adhering to designated speed limits; • Restoration and rehabilitation of any removed vegetation and SCC should occur during the rehab phase;	Minor (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Identify migratory crossing links between watercourses for herpetofauna, install correct signage to make all staff personnel aware and create safe underpasses for fauna at risk; and • AIPs should be continuously monitored and controlled throughout the life of the mine; and thereafter, with the establishment of an AIP Eradication Plan.	
Construction	Construction of infrastructure, and ventilation Shafts	Fauna and Flora	• Increased faunal casualties and vegetation removal; • Increased risk of AIP proliferation and edge effects; and • Changes to the landscape and undulating topographies.	Minor (negative)	• AIPs should be continuously monitored and controlled throughout the life of the mine; and thereafter, with the establishment of an AIP Eradication Plan; • Keep areas of infrastructure to the absolute minimum and stay within the demarcated footprint; • Minimise the areas that are to be stripped of vegetation; • Seal ventilation hole with a concrete to avoid plugging of any 'open shaft or excavation' that may lead to the underground workings; • No harvesting of floral or poaching of faunal species may take place by the construction employees; and • No dirty water may be disposed of in the immediate environment.	Negligible (negative)
Construction	Site/vegetation clearance (52.28 ha)	Wetlands	• Direct loss of 79.76 ha wetlands; • Loss of habitat and biodiversity; • Erosions and sedimentation of adjacent wetlands and water courses;	Major (negative)	• If the destruction of wetlands is unavoidable, disturbance must be minimised and suitably rehabilitated; • At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing;	Moderate (negative)
Construction	Construction of diesel storage and explosives magazine	Wetlands		Moderate (negative)		Minor (negative)
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) Ventilation fans, change houses, offices, ablutions, workshops, cable	Wetlands		Major (negative)		Moderate (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
	workshop, weighbridge, weighbridge control room and access control office		• Erosion and sedimentation from stockpiles, rock dump and discard dump; • Water and soil contamination and deterioration; • Increased runoff from hardened surfaces; • Decreased water supply to the wetlands systems; and Change in habitat and potential change in species composition.		• Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction, • Monitor infrastructure, stockpiles and dumps to ensure no runoff, erosion and sedimentation into the adjacent areas, especially the wetlands and freshwater systems; • Monitor PCD, STP, raw water, processed water and washing plant, if spills have occurred, clean up immediately and implement a monitoring program for at least three months after the spill has occurred; • Stockpiles must be vegetated and allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; and • Locate stockpiles and dumps outside wetlands and at least a 100 m buffer.	
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long	Wetlands		Major (negative)		Minor (negative)
Construction	Construction of Pollution control dam (PCD) (1.6078 ha), Raw water pipeline, Process water, Sewage treatment plant (STP)	Wetlands		Major (negative)		Minor (negative)
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Wetlands		Moderate (negative)		Minor (negative)
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing in proximity to the watercourses.	Minor (negative)	General mitigation actions provided in the wetlands and surface water studies conducted by Digby Wells should be used to guide the effective management of aquatic resources potentially affected by the proposed Project. However, more specific management actions for the Construction Phase are listed below: • Limit vegetation removal to the IFA only. Where removed or damaged, vegetation areas (riparian or aquatic related) should be revegetated as soon as possible; • Bare land surfaces downstream of construction activities must be vegetated to limit erosion from the expected increase in surface runoff from infrastructure;	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Environmentally friendly barrier systems, such as silt nets or, in severe cases, use trenches downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; trenches should be used as a 'temporary' management action during the construction phase, thus water (likely rainwater and dust suppression water) trapped in the trenches is expected to evaporate. However they should be closely inspected during the rainy season; • Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; • Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses; • Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; • All vehicles must be frequently inspected for leaks; • No material may be dumped or stockpiled within any rivers, drainage lines in the vicinity of the proposed project; • All waste must be removed and transported to appropriate waste facilities; and • High rainfall periods (usually November to March) should be avoided during construction to possibly avoid increased surface runoff in attempt to limit erosion and the entering of external material (i.e. contaminants and/or dissolved solids) into associated aquatic systems.	

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Construction	Removal of vegetation / topsoil for establishment of mining infrastructure such as the haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas.	Hydropedology	Sedimentation and siltation of watercourses through overland flow leading to reduced water quality.	Moderate (Negative)	The recommended management/mitigation measures are as follows: • Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised to minimise creation of new ones; • If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments and hazardous substances from construction vehicles used during site clearing; • Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust mobilisation which contribute to sedimentation of watercourses • Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath; and • Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors.	Negligible (negative)
Construction	Moving vehicles and machinery during construction of infrastructure including haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas. Handling of hydrocarbon residues and spills during construction operations.	Hydropedologv	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	Minor (negative)		Negligible (negative)
Construction	Removal of vegetation/topsoil for establishment of mining and linear infrastructure. Stockpiling of soils, rock dump and discard dump establishment.	Surface water	Sedimentation and siltation of water resources reducing flow regime within the Vaalrivierspruit, Klein-	Moderate (Negative)	The recommended mitigation/management measures: • Limit vegetation clearing and limit disturbing the soil to the project/building footprint;	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
			Olifantsrivier and their tributaries		• Control fluvial erosion and sedimentation by establishing a stormwater management plan; • Control through use of spill kits and accredited vendors for waste disposal; • Control by training of personnel in proper hydrocarbon and chemical handling methods; and • Control by bunding hydrocarbon and other waste storage facilities.	
Construction	Handling of hydrocarbons and general waste. Diesel storage and explosives magazine	Surface water	Surface water contamination leading to deteriorated water quality within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	Moderate (negative)		Negligible (negative)
Construction	Construction of infrastructure, and ventilation fans	Surface water	Interception of rainfall, runoff and subsurface flow leading to reduced downstream runoff yield	Moderate (negative)		Minor (Negative)
Construction	Site Clearing, Construction of Infrastructure, Access Road, Stockpiling of Topsoil and Establishment of Rock and Discard Dumps	Air Quality	Reduction in ambient air quality	Negligible (negative)	• Application of a dust suppressant on the haul roads and exposed areas; • Limit activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on haul roads and have these limits enforced; • The area of disturbance must be kept to a minimum at all times and no unnecessary clearing, digging or scraping must occur, especially on windy days; and • The drop heights when loading onto trucks and at tipping points should be minimised to reduce dust generation.	Negligible (negative)
Construction	Removal of vegetation/topsoil for the establishment of mining and linear infrastructure	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.	Negligible (negative)	The following management measures are recommended as good practice guidelines: • Construction activities should be restricted to daylight hours; • Construction activities should be carried out in phases;	Negligible (negative)
Construction	Establishing the box cut	Noise				
Construction	Construction of infrastructure, and ventilation Shafts.	Noise	Noise emissions from equipment/machinery will			

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Construction	Construction of access road and haul roads	Noise	increase the noise levels at sensitive receivers and may result in a noise disturbance.		• Construction machinery and vehicles should be switched off when not in use; • Construction vehicles should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.	
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Noise				
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	Visual	Removal of all vegetation within the localised infrastructure area alters the aesthetics of the immediate area and creates a contrast between the stripped area and the surrounding vegetation.	Moderate -84	• Keep site clearing to a minimal, and restrict vehicle movement to dedicated areas; • Make use of existing roads to encourage minimal impacts/footprint; and • The footprint of the mine should be as compact as possible from a design point of view.	Minor -66
Construction	Stockpiling of soils, rock dump and discard dump establishment	Visual	• Alteration to the baseline visual environment by creating sharp topographic variation over a relatively moderately undulating terrain. • Includes removal of natural vegetation which creates a sharp contrast.	Moderate -84	• Stockpiles should be created with a rehabilitation design which details a favorable slope; and • Bare land surfaces must be vegetated to limit soil erosion from surface runoff associated with stockpiles and dumps. Revegetate disturbed areas immediately after construction;	Moderate -77

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)

Construction	All construction activities	Socio-economic	Creation of employment opportunities	Minor - positive	• As per the legal requirements update, disclose, and implement the Social and Labour Plan.
					• Develop and implement the site-specific Employment Policy in compliance with the South African legal framework and company standards. As part of the Policy:
					  ▪ Set employment targets aimed at increasing local employment;
					  ▪ Set monitoring indicators for local employment;
					  ▪ Integrate local employment targets into all procurement contracts to which the appointed contractors must adhere to;
					  ▪ To accommodate those that do not have access to android phones or internet, widely advertise employment opportunities using community newspapers, notice boards, etc;
					  ▪ All employment opportunities must be advertised in predominantly spoken languages within the primary study area; and
					  ▪ Ensure that no employment take place at the entrance to the site (to avoid people congregating at the work site). Only formal channels for employment will be used.
					• Develop and implement a grievance mechanism. The mechanism must be widely communication to stakeholders within the primary study area, and a grievance register must be kept up-to-date.
						Minor - positive

Construction	• Establishment of infrastructure; • Construction of access and haulage road;	Socio-economic	Creation of Opportunities Within the Supply Chain	Minor - positive	• Implement the SLP commitments as they relate to the local business development;	Moderate - positive

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
	• Site/vegetation clearance; • Infrastructure construction; • Diesel storage and explosive magazine ; • Sewage treatment plant ; and • Sewage treatment plant, pollution control dam.				• Development a Local Procurement Strategy with local business development targets aligned to the commitments set-up in the SLP for the project; • Effectively communicate the benefits of local procurement to external stakeholders; • Considerations for local procurement should support groups, such as women, visible minorities, and youths; • Strengthen the capacity of local businesses to ensure that they are in a better position to supply the services required by the project, through holding workshops and seminars geared towards explain the tender requirements; • Consider unbundling of contracts into small work programs to ensure that small and locally based businesses can benefit; • Propose and promote joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development; • Establish a time-bound commitments to increase local procurement; Such commitments could include annual or mid-term targets for local procurement spending, supplier development programmes, local procurement plans, local procurement key performance indicators (KPIs) for procurement staff, and other local procurement objectives; • All tender process must follow existing Exxaro's SMME development strategies and programs; • Host workshops to provide training for current and potential suppliers to build up skills that were commonly identified as lacking in the supplier audits (e;g;, business plan creation, tender preparation, etc;); and • Implement the grievance mechanism.	

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Construction	All project related activities associated with construction and operation	Socio-economic	Increased Incidences of Livestock Theft	Moderate - negative	• Ensure that no employment take place at the entrance to the site; • Within the limits of the law, livestock owners should consider adopting an appropriate animal identification system in accordance with the Draft Document for Livestock Identification and Traceability System South Africa (LITS SA)[18]; • Livestock owners are encouraged to regularly count their livestock to ensure that all are still accounted for. In case of missing livestock, the incident must be reported to the nearest police station; • Where site access requires that Project personnel use farm parameter fences or gates – these must be closed immediately upon entry or exit; • Livestock owners are encouraged to regularly monitor, and mend broken fences; • Livestock should be kept away from fences or roads to reduce exposure to pedestrians; • Once the relevant environmental and mine authorisations are in place, the applicant will commence with negotiations with affected landowners to discuss suitable compensation methods to address livestock theft; and • Implement the grievance mechanism.	Minor - negative
Construction	All project related activities associated with construction and operation	Socio-economic	Impacts Associated with Community Health, Safety and Security	Moderate - negative	• Design and implement measures to minimise the risk of hazardous substances entering the environment, including development of an Emergency Prevention, Preparedness and Response Plan for accidents	Minor - negative

[18] Draft Document for Livestock Identification and Traceability System South Africa (LITS SA) which allows an integrated platform for livestock keeping such as animal registration.

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					involving release of hazardous substances to the environment. • Secure storage and labelling of hazardous substances in line with the manufacturer's recommendations and measures to prevent contact with untrained personnel, birds, and animals. • Secondary containment using impervious, chemically resistant material and designed to prevent contact between incompatible materials in the event of a release. • Develop information, education and communication campaigns around diseases and health practices including communicable diseases such as HIV/AIDS, TB, and Covid-19; etc. Regularly review and update as necessary its existing communicable diseases management strategy. • During the project lifecycle, the risks and impacts to health and safety of affected landowners and communities should be evaluated and preventative measures should be taken early in the project. • Integration of organisational policies, programs, and practices, including those relevant to the control of hazards and exposures, the organisation of work, compensation, and benefits, built environment supports, leadership, changing workforce demographics, policy issues, and community supports, that will contribute to safety, health, and wellbeing. • Road safety interventions may need to range beyond their fleets of company vehicles and their workers' commutes and should consider the driving, walking, and riding practices of community members in the locality.	
Construction	All Construction Activities	Socio-economic	Loss of Agricultural Land	Moderate - negative	• The Project shall purchase the land required from the directly affected landowners at the current market	Minor - positive

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					value to be determined by a qualified and registered land valuer. This will allow landowners who want to continue their farming activities to purchase replacement farmland elsewhere. • The Project shall identify farm portions which will not be immediately mined or used and where possible, lease such to the directly affected farmers to enable them to continue with their crop production. • All Project land purchase agreements with the landowners shall include special provisions for farmworkers and / or farm dwellers. Should the landowner plan to sell he / she must do the following: ◦ Inform all farm workers and farm dwellers of the change in ownership of the land; ◦ Explain in detail the consequences of the sale of land as it relates to the farmworkers and farm dwellers; ◦ In case where the farmers will no longer continue with farming, he or she must pay the farmworkers severance packages from the sale of the farm; and ◦ In discussions with the municipality and the department of rural development and land reforms, ensure that all farm dwellers are accommodated elsewhere within eleven months after the sale of the farm. • Implement the grievance mechanism.	
Construction	All project related activities associated with construction and operations.	Socio-economic	Potential Physical Displacement of Farm Dweller Households	Moderate negative	• Develop and implement a Resettlement Action Plan (RAP) to best practice guidelines; • Provide transitional support to displaced farm dweller households to support livelihoods during the transitional period;	Minor - negative -

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Establish a consultative structure to comply with the RAP's requirements for informed participation and consultation of affected households and relevant government representatives and departments; and • Ensure that RAP implantation is monitored across time to ensure that displaced households' livelihoods are restored or improved and that they have obtained security of tenure at resettlement site. Note: Once all relevant environmental authorisations and licences are attained, the applicant will commence negotiations with the relevant affected landowners to determine suitable compensation.	
Construction	All project related activities associated with construction and operations.	Socio-economic	Change Sense of Place	Moderate - negative	• Implement mitigation measures proposed in the Visual Impact Assessment Study. Implement induction programmes for all employees and contractors to increase sensitivity to local norms and customs; • Project Contractors shall implement a 'no fraternization' policy at the worker's camp to minimise relations with prostitutes and unsafe sexual interaction with residents; • Implement traffic safety measures, particularly speed control and driver awareness training for all drivers; • Minimise the construction footprint in forested areas and ensure that disturbed areas are rehabilitated with indigenous trees and other plants; • Adequate plan for rehabilitation; • Offset negative experience of altered sense of place by maximising local employment/ economic benefits; and • Implementation of the grievance procedure.	Minor - negative

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Soil, Land Use, and Land Capability	Infrastructure area: • Soil quality contamination and deterioration; • Loss of usable soil for agriculture; • Soil erosions and sedimentation; and • Increased runoff and flow from hardened surfaces (soil compaction). Underground mined areas: • Subsidence; • Dewatering; • Groundwater and soil contamination; and • Decreased land capability and agricultural potential	Moderate (negative)	• All vehicle maintenance and refuelling must occur within designated areas and inspected regularly for leaks; • All spills must be cleaned up immediately to prevent contaminants to enter the soils and groundwater. Monitoring must take place at least for three months after the spill have occurred to determine any contamination; • Culverts, roads, conveyors, powerlines and river crossings must be maintained, cleared and monitored; • All vehicles must remain on demarcated roads and within the operational footprint; • Stockpiles should be monitored and vegetated to ensure no runoff, erosion, sedimentation and loss of soil fertility; • Stockpiles must be allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; • A Storm Water Management Plan (SWMP) should already be implemented. This should consider all wetlands and other watercourses adjacent and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey contaminated water to silt traps to limit erosion and subsequent contaminants into soils and groundwater; • Monitoring of subsidence, dewatering and contamination must take place regularly to access possible impacts to soils; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible;	Moderate (negative)
Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Soil, Land Use, and Land Capability		Major (negative)		Moderate (negative)
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Soil, Land Use, and Land Capability		Moderate (negative)		Minor (negative)
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	Soil, Land Use, and Land Capability		Moderate (negative)		Minor (negative)
Operational	Continue with exploration activities	Soil, Land Use, and		Moderate (negative)		Minor (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
		Land Capability			• Chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; • Re-vegetate cleared areas and stockpiles to avoid wind and water erosion; • Preserve looseness of stockpiled soil by executing fertilisation and seeding operations by hand; • If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; • A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition to allow successful mine rehabilitation (Statham, 2014); • Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise AIPs, maintain soil organic matter levels, maintain soil structure, and microbial activity; and • Compacted areas are to be ripped to loosen the soil structure.	
Operational	Underground blasting and operation of the underground workings.	Fauna and Flora	• Increased risk of post-mining land subsidence; • Loss of topsoil; • Impacts on the hydrological systems (water table) impacting the habitat ecology and ecosystem services; and	Minor (negative)	• Adhere to all management and mitigation measures as prescribed within other specialist reports; • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the mining personal; and • Prevent impacts from reaching downstream water resources and hydrophilic environments (wetlands) by ensuring installation and proper functioning of stormwater systems and drains to prevent contaminated water entering the natural environment. This will be prudent in this development, since	Minor (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
			• Potential contamination of underground water with hydrocarbons, polluting sensitive habitats for sensitive faunal and floral species.		petroleum and other hydrocarbons associated with the trucks and vehicle-based activities are likely to be spilled in the environment if not managed well. As referenced by the Digby Wells Hydropedology Report (2021), implementation of a proposed water stormwater management plan is important to reduce sedimentation and siltation of nearby watercourses.	
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste.	Fauna and Flora	Contamination of soil, water and surrounding areas / habitats (pan and wetland vegetation) from hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	Moderate (negative)	• All spills should be immediately cleaned up, and treated accordingly; and • Re-fuelling must take place on a sealed surface area away from sensitive habitats such as the pan vegetation to prevent the ingress of hydrocarbons into the topsoil.	Negligible(negative)
Operational	Continue with exploration activities	Fauna and Flora	• Continuous disturbances to the fauna and flora by explorative activities;; • Increased vehicle activity; and • Continuous anthropogenic influence stemming from staff, residents and visitors that infiltrate the unexplored natural veld areas will damage and impact on species communities within certain areas. This could disturb unidentified SCC.	Minor (negative)	• All footprint areas should remain as small as possible; • If any SCC are encountered within the Project Area the future, the following should be ensured: • If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas or within designated open space on the subject property; • All rescue and relocation plans should be overseen by a suitably qualified specialist; and • Obtain relevant permits/consent, if applicable, for each protected or endangered floral species identified within the proposed development area that will be destroyed. Human and vehicle movement should be restricted from taking place in sensitive habitats.	Negligible (negative)

<table>
<tr><th>Phase</th><th>Project Activity</th><th>Aspect</th><th>Impacts</th><th>Significance
(Pre-Mitigation)</th><th>Mitigation Measures</th><th>Significance
(Post Mitigation)</th></tr>
<tr><td>Operational</td><td>Operating STP (18.32 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant</td><td>Wetlands</td><td rowspan="5">• Infrastructure area:
◦ Water and soil quality contamination and deterioration;
◦ Loss of habitat and biodiversity;
◦ Erosion and sedimentation;
◦ Increased runoff and flow from hardened surfaces; and
◦ Change in habitat and potential change in species composition.
• Underground mined areas:
◦ Subsidence;
◦ Dewatering; and
Groundwater contamination.</td><td>Major (negative)</td><td rowspan="5">• Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present, and if so that a remedy is put in place as soon as possible;
• If it is unavoidable that any of the wetlands will be affected, the disturbance must be minimised and suitably rehabilitated;
• All vehicle maintenance must occur within designated areas and inspected regularly for leaks;
• All spills must be cleaned up immediately to prevent contaminants to enter the wetlands. Monitoring must take place at least three months after the spill have occurred to determine any contamination;
• Re-fuelling and maintenance must take place on a sealed surface area away from wetlands to prevent the ingress of hydrocarbons into topsoil;
• All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off-limits to all unauthorised vehicles and personnel;
• No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines;
• Culverts, roads, conveyors, powerlines and river crossings must be maintained, cleared and monitored;
• No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint;
• Stockpiles should be monitored and vegetated to ensure no runoff, erosion and sedimentation into the adjacent areas, especially the wetlands and freshwater systems;
• Stockpiles must be allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater;</td><td>Minor (negative)</td></tr>
<tr><td>Operational</td><td>Mining of coal by underground mining (underground) (5 050.83 ha)
Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)</td><td>Wetlands</td><td>Major (negative)</td><td>Major (negative)</td></tr>
<tr><td>Operational</td><td>Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste</td><td>Wetlands</td><td>Moderate (negative)</td><td>Minor (negative)</td></tr>
<tr><td>Operational</td><td>Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.</td><td>Wetlands</td><td>Moderate (negative)</td><td>Negligible (negative)</td></tr>
<tr><td>Operational</td><td>Continue with exploration activities</td><td>Wetlands</td><td>Moderate (negative)</td><td>Minor (negative)</td></tr>
</table>

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Stockpiles must be located outside wetlands and at least a 100 m buffer; • A Storm Water Management Plan (SWMP) should already be implemented. This should consider all wetlands and other watercourses adjacent and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey contaminated water to silt traps to limit erosion and the subsequent increase of suspended solids in downstream watercourses; • Monitoring of subsidence, dewatering and contamination must take place regularly to access possible impacts to wetlands; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; and Chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions.	
Operational	Uncontrolled runoff of stormwater or process water from or through the surface infrastructure.	Aquatics	Water quality deterioration of watercourses receiving unnatural/contaminated runoff.	Minor (negative)	The following management actions are recommended to guide the effective management of stormwater and water generated on site: • Runoff from dirty areas should be directed to the storm water management infrastructure (drains and PCDs) and should not be allowed to flow into the nearby watercourses, unless DWS discharge authorisation and compliance with relevant discharge standards are adhered to; • If discharge of water occurs, bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants;	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; • The Dynamic Subsidence Reclamation or DSR techniques, similar to concurrent mining and reclamation concepts used in surface mining should be applied (reader is referred to Hu et al. (2016)); and • Monitoring of the associated water courses should be done by an aquatic specialist to determine potential impacts where after new mitigation actions should be implemented as per the specialist’s recommendations.	
Operational	Operation of the Box Cut as a means for secure and safe entrance and access to the decline of the underground mine	Hydropedology	Disruption of water flow paths will likely reduce the quantity of water reporting to the Vaalwaterspruit thereby affecting the availability of water for downstream water users	Minor (negative) (negative)	Recommended management/mitigation measures are as follows: • Implementation of the proposed stormwater management plan to reduce sedimentation and siltation of nearby watercourses. The recommended perimeter berms around the discard dump, lay down areas, box cut, overburden dump and stockpiles will ensure that clean water is diverted from the dirty areas; Similar to the construction phase the following should be conducted to mitigate contamination of water resources during the operation phase:	There are no mitigation measures to prevent this impact from occurring, but the area to be affected by the box cut and mine shaft is relatively small making this impact of minor negative significance.
Operational	• Overland flow and interflow from the dirty areas or catchments (coal stockpile areas, mine processing plant, workshops, lay down areas etc.). Hydrocarbon residues including oil, grease and fuel spillages from equipment, moving haulage trucks and machinery transported to watercourses.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	Minor (negative)	• Hydrocarbon waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath; and	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors.	
Operational	Areas containing topsoil stockpiles, overburden, and discard dumps.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	Moderate (Negative)	Recommended mitigation/management measures are as follows: • Control by implementing a comprehensive storm water management plan which addresses fluvial erosion control; • Stockpiles should be stored away from the drainage line; • Control through implementation of a SWMP for dirty water management; • Control through water quality and quantity monitoring and updating the mine-wide water balance; • Maintenance of infrastructure and mining vehicles to reduce leakages; and • Remedy through re-profiling and rehabilitation of previously disturbed landscapes	Negligible (Negative)
Operational	• Handling of hydrocarbons and general waste; and Spillages and leakages from maintenance of haul roads, pipelines, and machinery. Use of water for mining operations and production of contaminated effluent/process water.	Surface water	Contamination of water resources and deterioration of water quality.	Moderate (negative)		Negligible (Negative)
Operational	Operation of the Underground Mine, Ventilation Shaft, Use and Maintenance of Haul Road, and Concurrent Rehabilitation	Air Quality	Dust generation and release of gaseous pollutants leading to poor air quality	Minor (negative)	• Application of dust suppressant on the haul roads and exposed areas; • Limit dust-generating activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on dirt roads and have these limits enforced; • The drop heights when loading onto trucks and at tipping points should be minimised; and • Dust mitigation equipment for the vent shaft.	Negligible (negative)

<table>
<tr><th>Phase</th><th>Project Activity</th><th>Aspect</th><th>Impacts</th><th>Significance
(Pre-Mitigation)</th><th>Mitigation Measures</th><th>Significance
(Post Mitigation)</th></tr>
<tr><td>Operational</td><td>Ventilation fans and infrastructure area containing stockpile areas</td><td>Noise</td><td>Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance</td><td rowspan="4">Major
(negative)</td><td rowspan="4">The following management measures are recommended as good practice guidelines.
• Machinery and vehicles used for mining and/ maintenance work should be switched off when not in use;
• Vehicles used for mining and maintenance work should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound;
• A concrete wall should be used as the perimeter fence instead of a wire fence;
• Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and
• Regulate vehicle speeds on the main, access and haul roads.</td><td rowspan="4">Minor
(negative)</td></tr>
<tr><td>Operational</td><td>Underground blasting</td><td>Noise</td><td>Noise impacts are considered to be negligible therefore was not assessed further.</td></tr>
<tr><td>Operational</td><td>Maintenance of haul roads, pipelines, machinery, water, effluent, and stormwater management infrastructure and stockpile areas.</td><td>Noise</td><td>Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.</td></tr>
<tr><td>Operational</td><td>Removal of rock (blasting).</td><td>Noise</td><td>Noise impacts are considered to be negligible therefore was not assessed further.</td></tr>
<tr><td>Operational</td><td>Establishment and upkeep of Mine related structures along with the box cut</td><td>Visual</td><td>• Alterations of the natural visual character of the region
• Long term vegetation loss
Land cover and land use changes.</td><td>Moderate</td><td>• As far as possible, preserve the natural vegetation to reduce the visual impact;
• Sensitive receptors should be mitigated from the visual impact by a strategic usage of tree-lines and on site berm features which integrate with effective landform design; and
• Buildings on site should be kept to a colour that does not bear a large contrast to the existing natural vegetation and landscape</td><td>Minor</td></tr>
<tr><td>Operational</td><td>Establishment and operation of the stockpile and plant region during operations</td><td>Visual</td><td>Constant topographical changes to the stockpiles, which also have a sharp contrast to the natural landcover in the region;</td><td>Minor</td><td>Visual screens be placed in the form of tree-lines, particularly along highly sensitive areas along the R38.</td><td>Moderate</td></tr>
</table>

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Operational	Lighting of mine infrastructure at night	Visual	• The mine site would contain lighting for security and operational safety purposes. • The artificial lighting could provide a source of distraction to receptors in the region.	Negligible	• Focus the lights towards components of the mine that require specific lighting to avoid light dispersal; • Consider utilizing lower lumen lighting that does now spill outside of the mine region.	Slightly Detrimental

Operational	All project related activities associated with construction and operation.	Socio-economic	Creation of Long-term Employment Opportunities, Skills Development and Work Experience	Minor – positive	• As per the legal requirements update, disclose, and implement the Social and Labour Plan.
					• Develop and implement the site-specific Employment Policy in compliance with the South African legal framework and company standards. As part of the Policy:
					  • Set employment targets aimed at increasing local employment;
					  • Set monitoring indicators for local employment;
					  • Integrate local employment targets into all procurement contracts to which the appointed contractors must adhere to;
					  • To accommodate those that do not have access to android phones or internet, widely advertise employment opportunities using community newspapers, notice boards, etc;
					  • All employment opportunities must be advertised in predominantly spoken languages within the primary study area; and
					  • Ensure that no employment take place at the entrance to the site (to avoid people congregating at the work site). Only formal channels for employment will be used.
						Minor - positive

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Develop and implement a grievance mechanism. The mechanism must be widely communication to stakeholders within the primary study area, and a grievance register must be kept up-to-date.	
Operational	All project related activities associated with construction and operation.	Socio-economic	Opportunities and Capabilities within the Supply Chain	Minor - positive	• Implement the SLP commitments as they relate to the local business development; • Development a Local Procurement Strategy with local business development targets aligned to the commitments set-up in the SLP for the project; • Effectively communicate the benefits of local procurement to external stakeholders; • Considerations for local procurement should support groups, such as women, visible minorities, and youths; • Strengthen the capacity of local businesses to ensure that they are in a better position to supply the services required by the project, through holding workshops and seminars geared towards explain the tender requirements; • Consider unbundling of contracts into small work programs to ensure that small and locally based businesses can benefit; • Propose and promote joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development; • Establish a time-bound commitments to increase local procurement; Such commitments could include annual or mid-term targets for local procurement spending, supplier development programmes, local procurement plans, local procurement key performance indicators (KPIs) for procurement staff, and other local procurement objectives;	Moderate - positive

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• All tender process must follow existing Exxaro's SMME development strategies and programs; • Host workshops to provide training for current and potential suppliers to build up skills that were commonly identified as lacking in the supplier audits (e;g;, business plan creation, tender preparation, etc;); and • Implement the grievance mechanism.	
Operational	All project related activities associated with construction and operation.	Socio-economic	Changes to the Water Quality	Minor - negative	• Implement mitigation measures outline in the Surface and Ground Water Specialist Studies associated with this project; and • Implement a grievance mechanism.	Minor - negative
Operational	All project related activities associated with construction and operation.	Socio-economic	Impacts Associated with Surface Subsidence	Moderate - negative	• Develop a Subsidence Management Plan (SMP) prior to the establishment of the mine. The Plan should prioritise the adequate protection of important natural and built features within the Project area. Management could include avoidance of damage to particularly natural features, mitigation of damage or rehabilitation; • Possible relocation of people away from all infrastructure areas while surface subsidence occurs could be implemented in accordance with best practice guidelines for resettlement. In all cases, adequate budget must be provided for repairs to water and electrical supply systems, walls of buildings, fencing, and roadways; and • Implement a grievance mechanism.	Minor - negative
Operational	All project related activities associated with construction and operation.	Socio-economic	Occupational Health Risks to Mine Workers	Moderate – negative	• Develop and implement a detailed Occupational Health and Safety Management Plan and System. The Occupational Health and Safety (OHS) management plan should include, but not limited to: ◦ Hazard identification and risk assessment procedure;	Minor – negative

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• A 'fitness for work' programme to ensure that all employees are physically able to undertake their work without impact to their health; • Mandatory OHS training programmes provided to all employees, including contractors to ensure staff are aware of the health and safety guidelines; • Specific OHS training programmes provided for workers assigned to tasks associated with H&S risks; • All workers should be provided with Personal Protective Equipment (PPE) and be mandated to use it; • Placement of visual warning signs in place, including those for the electrical and mechanical equipment safety warning, and chemical hazard warning; • Toolbox talks or health and safety meeting daily to ensure that procedures are being adhered to, and to discuss any incidents that have occurred; • Develop and implement a workforce grievance procedure where they can raise issues and concerns relating to OHS; • Conduct information, education, and communication campaigns amongst Project Personnel on hygiene and sanitation; and • Provide awareness, counselling, and testing (ACT) for all Project personnel, including voluntary testing for STIs and HIV/AIDS in pre-employment and on-going health screening. (Workers will not be denied employment or discriminated against in any way based on their HIV status). • Project workers including third party Contractors to be subject to health and safety standards and policies; and	

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Develop and implement a workforce grievance mechanism.	
Operational	All project related activities associated with construction and operation	Socio-economic	Economic Multiplier	Minor - positive	• Implement enhancement measures linked to employment creation and opportunities associated with the supply chain; • Implement the SLP related interventions; • Compliance with SLP commitments to make maximum use of local SMMEs and BBBEE companies; and • Implement the grievance mechanism.	Moderate - positive
Operational	All project related activities associated with construction and operation.	Socio-economic	Social Development as part of Social and Labour Plan (SLP)	Minor - positive	• Consultation with Project beneficiaries regarding proposed community development needs and associated initiatives; • Early identification of community members for enrolment in ABET and portable skills training to improve likelihood of employment on the mine; • Conduct baseline socio-economic survey of households located within primary study area prior to commencement of community development initiatives to enable accurate identification of eligible Local Economic Development (LED) project and skills training beneficiaries and measure impacts of development initiatives on households; • Collaboration with other developmental role players during implementation; • Establishing an external monitoring programme to monitor and evaluate community development initiatives as well as HRDP and procurement policy implemented by the mine and its contractors; • Expanding skills development and capacity building programmes to non-employees; and	Moderate - positive

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Maintaining a record of training courses completed per individual and community. Where training is offered to non-employees, their contact information and qualifications can be shared with other industries	
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Ground Vibration	Minor (negative)	• Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing; and • Monitor ground vibration and air blast from blasting operations	Negligible (negative)
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Air blast	Negligible (negative)	Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths.	Negligible (negative)
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Fly rock	Negligible (negative)	• Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect; and • Monitor fly rock situation using video camera	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
Decommissioning	Demolition and removal of infrastructure.	Soil, Land Use, and Land Capability	• Soil erosion and sedimentation; • Decreased soil fertility and increased AIPs; • Soil contamination due to decanting and the groundwater contamination plume; • Subsidence; • Dewatering; and • Decreased land capability and agricultural potential.	Moderate (negative)	• Rehabilitation and decommissioning should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation; • Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material, and sedimentation; • Implement and maintain a AIPs Management Plan for the duration of the rehabilitation phase and into closure; • Rehabilitation must be done as soon as any impacts are observed (decanting, subsidence and contamination); • Monitor subsidence and possible decant of Acid Mine Drainage (AMD) and implement management measures which include for example an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021); • Newly shaped and topsoiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; • Ensure proper storm water management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs; • Continue with Concurrent Rehabilitation, and implement land rehabilitation measures; • Address compacted areas by deep ripping to loosen the soil, and revegetate the area; and	Minor (negative)
Decommissioning	Post-closure monitoring and rehabilitation.	Soil, Land Use, and Land Capability		Minor (negative)		Negligible (negative)
Decommissioning	Closure of the underground mine.	Soil, Land Use, and Land Capability		Major (negative)		Moderate (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions.	
Decommissioning	Demolition and removal of infrastructure.	Fauna and Flora	• Disturbance of soils, and subsequent erosion by wind and water; • Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Unexpected changes in topography and landscape as a result of subsidence.	Minor (negative)	• Continue with concurrent Rehabilitation, begin with stockpiles, bare grounds and dumps, implement rehabilitation measures; • Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible to prevent AIP sprawl; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and • Only designated access routes are to be used to reduce any unnecessary compaction.	Negligible (negative)
Decommissioning	Post-closure monitoring and rehabilitation	Fauna and Flora	• Minimal negative impacts on the environment; • Activities involve the rehabilitation processes of reprofiling the soils and re-vegetation thereafter;	Minor (negative)	• During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season (October to February) to ensure adequate plant recruitment; • Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and	Minor (positive)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
			• Impacts include the possibility of erosion and sedimentation; • Proliferation of AIPs; and • Change in the habitat and species composition.		• Only designated access routes are to be used to reduce any unnecessary compaction.	
Decommissioning	Closure of the underground mine.	Fauna and Flora	• Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats. • Change in the land topography and species composition.	Minor (negative)	Ensure mitigations measures to prevent subsidence are enforced and maintained throughout the decommissioning phase.	Negligible (negative) -
Decommissioning	Demolition and removal of infrastructure.	Wetlands	• Impacts to the wetlands and watercourses include: • Erosion and sedimentation; • Increased AIPs; • Change in habitat and potential change in species composition; • Soil and water contamination due to decanting and the groundwater contamination plume; • Subsidence; and	Minor (negative)	• Rehabilitation should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation of the wetlands; • Mine-affected water should be reintroduced into the environment without treatment, if necessary, and a WUL; • Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material, and sedimentation into wetland areas; • Implement and maintain a Wetland and AIPs Management Plan for the duration of the rehabilitation phase and into closure; • No material should be dumped/stockpiled within any wetlands or watercourses;	Negligible (negative)
Decommissioning	Post-closure monitoring and rehabilitation.	Wetlands		Minor(negative)		Negligible (negative)
Decommissioning	Closure of the underground mine.	Wetlands		Major (negative)		Moderate (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
			• Dewatering.		• No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffers. All vehicles must remain on demarcated roads; • Wetland monitoring must be carried out during the Rehabilitation phase into mine closure to ensure no unnecessary impact to wetlands takes place; • Rehabilitation must be done as soon as any impacts are observed (decanting, subsidence and contamination); • Monitor subsidence and possible decant of Acid Mine Drainage (AMD) and implement management measures which include for example an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021); • Newly shaped and topsoiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; and • Implement a Wetland Offset Strategy to compensate for residual impacts to the wetlands.	
Decommissioning	Decant and runoff of contaminated water entering aquatic ecosystems.	Aquatics	Water quality deterioration of watercourses in contact with contaminated water resulting in AMD.	Moderate (negative)	The goal of mitigation should be to prevent and or limit the decant of contaminated water into associated aquatic ecosystems. The following measures may be utilised in attempt to reduce the Decommissioning and Post Closure impacts: • The demolition of infrastructure should occur during the dry season to avoid increase runoff of contaminated water into associated watercourses; • Best practise rehabilitation should be utilised to trap and contain the deep sediments that contain the acid forming rock responsible for acid water formation;	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• Subsidence and decant should be monitored to prevent changes to the geomorphology of the water courses and potential contamination with AMD; and • If decant occurs post-closure, passive treatment with lime or other alkaline compounds can be applied to neutralise AMD at the decant points. Aquatic biomonitoring is also recommended to monitor any changes in the aquatic ecosystems and to provide solutions for identified, additional/unforeseen impacts for at least three years after rehabilitation.	
Decommissioning	Demolition and removal of infrastructure	Hydropedology	Sedimentation and siltation of watercourses due to increased soil erosion leading to reduced water quality.	Moderate (Negative)	The following mitigation/management measures are recommended: • Soil disturbances during demolition should be restricted to the relevant footprint area; • All decommissioning activities should be undertaken in a way to minimise disturbance of soils which will lead to erosion, sedimentation and siltation of the Vaalwaterspruit. • In the event of decanting, passive treatment (through application of calcium compounds) should be implemented to neutralise and treat the AMD before being discharged back into freshwater resources; • Use of constructed wetlands can also be considered as a mitigation measure against AMD; • Alternatively, when passive treatment fails to correct the situation active Water Treatment (e.g. Reverse Osmosis) should be considered; and • Post closure monitoring should be conducted for at least 5 years after decommissioning to help with the early detection of decant and prevent or reduce contamination of water resources.	Negligible (negative)
Decommissioning	After decommissioning, dewatering ceases and water accumulates within the mine shaft and the water reacts with the pyrite in the backfilled material, thereby becoming acidified and starts decanting at low lying positions, including the adjacent Vaalwaterspruit.	Hydropedology	Contamination of soil and water resources from potential decant of AMD and movement of contamination plume due to the re-watering of the mine shaft	Major (Negative)		Minor (Negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)

Decommissioning	Demolition and removal of infrastructure.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries.	Moderate (Negative)	Recommended mitigation/management measures:
					• Control through limiting disturbance of soils to where demolition will be taking place and the demolition site should be cleared as quickly as possible to avoid sediment erosion;
					• Maintain demolition vehicles to ensure that no leakages occur, and all chemical related waste and storages should be handled by trained personnel;
					• Control the quality of water through water quality monitoring;
					• Options to deal with AMD include the following:
					  • Actively treating AMD decant to acceptable water quality levels for re-use or prior to discharge into the natural stream; and
					  • Passive treatment or neutralisation of AMD effluent with calcium carbonate or lime at identified decant points to obtain water with acceptable quality.
					• Remedy through rehabilitation of areas previously occupied by ventilation fans and other infrastructure, post-closure; and
					• Remedy through re-profiling and rehabilitation of previously disturbed landscapes.
						Negligible (Negative)

Decommissioning	Spillages and leakages from vehicles and machinery during demolition of infrastructure.	Surface water	Contamination of water resources from AMD and deterioration of water quality.	Moderate (negative)		Negligible (Negative)
Decommissioning	Decant of Acid Mine Drainage (AMD).	Surface water	Water Contamination from Acid Mine Drainage into surface water resources.	Moderate (negative)		Minor (negative)
Decommissioning	Post-closure monitoring and rehabilitation Closure of the underground mine.	Surface water	Restoration of free drainage and runoff yield at least to a certain extent.	**Major Positive**		No mitigation possible.
Decommissioning	Demolition and Removal of Infrastructure and Rehabilitation	Air Quality	Dust generation leading to poor air quality	Minor (negative)	• Application of dust suppressant on the haul roads and exposed areas; • Limit activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on dirt roads and have these limits enforced;	Negligible (negative)

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Mitigation Measures	Significance (Post Mitigation)
					• The area of disturbance must be kept to a minimum at all times and no unnecessary clearing, digging or scraping must occur, especially on windy days; • The drop heights when loading onto trucks and at tipping points should be minimised and • Rehabilitation of disturbed land to allow for vegetation growth.	
Decommissioning	Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation for the final land rehabilitation	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance. However, the removal of noise generating sources will also lead to a reduction in the noise levels.	Negligible (negative)	• Restrict decommissioning activities to daylight hours; • Construction vehicles should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Regularly service machines and vehicles to ensure noise suppression mechanisms are effective e.g., installed exhaust mufflers; • Regulate speed limits on access roads; and • Switch off equipment when not in use.	Negligible (negative)
Decommissioning	Rehabilitation – rehabilitation mainly consists of spreading and landscaping of the preserved subsoil and topsoil, profiling of the land, and re-vegetation.	Noise	Noise impacts are considered to be negligible therefore will not be assessed further.			
Decommissioning	Post-closure monitoring and rehabilitation.	Noise				
Decommissioning	Decommissioning	Socio-economic	Economic Boom-Bust after the Operation Phase	Moderate - negative	• Develop and implement an integrated Mine Closure Plan; and • Proactively assess and manage the social and economic impacts on individuals, regions, and economies where retrenchment and/or closure of the Project are certain.	Minor - negative

16 Item 3(o): Summary of specialist reports

Numerous specialist impact assessments were undertaken for the proposed Project, as set out in Table 16-1. Separate specialist reports were compiled and have been attached as appendices to this report. The specialist input included the baseline environment, potential impacts and the recommended mitigation measures. Table 16-1 provides a summary of the key recommendations of the studies.

Table 16-1: Specialist Studies Undertaken for the Arnot South Project

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Soils, Land Use and Land Capability	• Reduce the risk of erosion, compaction, and the creation of preferential flow paths by re-vegetating exposed areas, maintaining linear infrastructure and culverts and installing sediment traps and erosion berms; • Rehabilitated areas must be fenced, and animals should be kept off the area until the vegetation is self-sustaining; • Runoff must be controlled and managed using proper stormwater management measures; • Restriction of vehicle movement over sensitive areas to reduce compaction; • Only the designated access routes are to be used to reduce any unnecessary compaction; • Deep rip compacted areas, cover with at least 500 mm of topsoil and revegetate; • If soil is polluted, treat the soil using in-situ bioremediation; • If in-situ treatment is not possible then the polluted soil must be classified according to the minimum requirements for the handling, classification, and disposal of hazardous material, and disposed at an appropriate, permitted or licensed disposal facility; and • All vehicles and machines must be parked within hard park areas, and must be checked daily for fluid leaks. • Refuelling must take place on a sealed surface area away from soils to prevent seepage of hydrocarbons into the soil; • Place drip trays where vehicles or machinery leaks are occurring; • Fuel, grease, and oil spills should be remediated using a commercially available emergency clean up kits; • Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills, and leaks, and undergo training on-site; Soil pollution monitoring after spills should be conducted at selected locations on the project site to detect any extreme levels of pollutants; and • Monitor the decant of AMD, contamination and dewatering and implement management measures which include for example, an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021). • Fence off rehabilitated areas from livestock until vegetation has established. Follow a grazing plan to prevent overgrazing, trampling and erosion. This will lead to improved soil fertility land capability; • Soil/Land Offset should form part of a biodiversity (wetland) Offset plan that will have to be developed and implemented after the residual impacts have been determined; and • Monitor the area for related impacts and report to authorities as soon as possible. If areas are unstable and hold a risk to animals and humans, the area should be fenced off.	X - All recommendations have been considered and included in this report.	Appendix D

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Fauna and Flora	• All identified faunal SCC must be located and relocated, if possible, before the construction phase; • All floral SCC must be identified and located. Protected Plant Permits from local governing authorities (DEFF) will be required for either the destruction or removal of protected flora (MNCA, 1998). • Regional relocation of protected species within development footprint must be instilled to offset the overall loss of floral SCC within the Project Area. Replanting of indigenous flora during the rehabilitation phase as a means to re-vegetate the area after decommissioning the mining activities; • Restriction of vehicle movement over sensitive areas to reduce degradation of undisturbed areas (please refer to Sensitivity Map attached to the Fauna and Flora). • Ensure a livestock management plan is enforced to prevent further degradations. • Minimise unnecessary removal of the natural vegetation cover outside the development footprint.; and • After rehabilitation the area must be fenced, and animals (cattle) should be kept off the area until the vegetation is self-sustaining and established.	X - All recommendations have been considered and included in this report.	Appendix E
Wetlands	• Avoid sensitive areas (Moderate and High) as far as possible by implementing no-go zones and buffer zones of at least 100 m • Monitor underground mine impacts to wetlands. • A 500 m buffer area around wetlands, when not possible at least a 100 m buffer around the wetlands to ensure no impacts to these wetlands. The establishment of hydrophytic plants and facultative hydrophytes that are native to the area. • Improve vegetation cover in eroded areas, areas impacted by infrastructure and low basal cover by the establishment of hydrophytic plants and facultative hydrophytes that are native to the area to prevent erosion and loss of wetland habitat. • Monitor underground mine impacts to wetlands. • Improved vegetation cover through the establishment of hydrophytic plants and facultative hydrophytes that are native to the area. Reduced risk of erosion and sedimentation. • Reduce the risk of erosion, compaction, and the creation of preferential flow paths by re-vegetating exposed areas, maintaining linear infrastructure and culverts and installing sediment traps and erosion berms. • Reduced risk of erosion and sedimentation of downstream wetland areas by re-vegetation and sediment traps. • Employment of a protective vegetated buffer zone strip around the adjacent and downstream wetland in proximity of the infrastructure area and implement an AIPs Programme. Monitor underground mine impacts to wetlands. • Limit livestock in the sensitive wetlands to prevent overgrazing, trampling and erosion. This will lead to improved wetland integrity and functionality.	X - All recommendations have been considered and included in this report.	Appendix F

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	• Monitor the decant of AMD, contamination and dewatering and implement management measures which include for example, an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021). • Execute a wetland offset calculator to establish the hectare equivalent of wetlands that have been lost or mined out which will have to be offset during the rehabilitation phase. • Monitor the area for related impacts and report to authorities as soon as possible. If areas are unstable and hold a risk to animals and humans, the area should be fenced off.		
Aquatics	• The developed Aquatic Biomonitoring Programme must be adopted on a biannual basis, prior to the commencement of the Construction Phase of the proposed Project. This programme should continue for the life of the Project and for at least three years post the Decommissioning Phase; • In light of the nonperennial nature of the watercourses associated with the proposed Project Area, diatom assessments should be conducted during the low-flow survey at least at a single site associated with each of the reaches assessed in the current study. Diatoms are highly representative of water quality and can be used to pinpoint specific changes related to water quality, such as organic pollution, eutrophication, acidification, metal pollution and changes in pH; and • The proposed Project should adopt a water and habitat quality preservation mindset throughout the life of the Project. In other words, the proposed activities should not result in the deterioration/degradation of aquatic habitat (i.e. riparian and instream habitat) and water quality within the associated aquatic ecosystem. At least 100 m buffer zone of regulation must be implemented as a no-go zone between the Vaalwaterspruit tributary and mining activities, only the Vaalwaterspruit system/tributaries appear to be in close proximity to the Infrastructure Footprint Area (IFA). Each of the tributaries lie less than 500 m from the IFA boundaries, however a 100 m buffer zone can be implemented to prevent impacts to these tributaries and watercourses lying further downstream.	X - All recommendations have been considered and included in this report.	Appendix G
Hydropedology	• Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised to minimise creation of new ones; • If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments and hazardous substances from construction vehicles used during site clearing; • Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust mobilisation which contribute to sedimentation of watercourses • Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath;	X - All recommendations have been considered and included in this report.	Appendix H

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	• Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors. • Implementation of the proposed stormwater management plan to reduce sedimentation and siltation of nearby watercourses. The recommended perimeter berms around the discard dump, lay down areas, box cut, overburden dump and stockpiles will ensure that clean water is diverted from the dirty areas; • Soil disturbances during demolition should be restricted to the relevant footprint area; • All decommissioning activities should be undertaken in a way to minimise disturbance of soils which will lead to erosion, sedimentation and siltation of the Vaalwaterspruit. • In the event of decanting, passive treatment (through application of calcium compounds) should be implemented to neutralise and treat the AMD before being discharged back into freshwater resources; • Use of constructed wetlands can also be considered as a mitigation measure against AMD; • Alternatively, when passive treatment fails to correct the situation active Water Treatment (e.g. Reverse Osmosis) should be considered; • Post closure monitoring should be conducted for at least 5 years after decommissioning to help with the early detection of decant and prevent or reduce contamination of water resources; and • Placement of infrastructure should be outside of all hydrologically sensitive areas such as the wetland zone of regulation, pans and watercourses.		
Surface Water	• Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones; • If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances from construction vehicles used during site clearing; • Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the mine's maintenance program they must be inspected daily before use to ensure there are no leakages underneath; • Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas at the existing mining operations. Any used oil should be disposed of by accredited contractors; • Implementation of the proposed stormwater management plan is recommended to reduce siltation and sedimentation in watercourses; • All operational vehicles should be maintained and washed at designated wash bays; • All mine waste should be handled and disposed of by an accredited vendor;	X - All recommendations have been considered and included in this report.	Appendix I

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	• The proposed water quality monitoring program should be consistently implemented to ensure adherence to stipulated water quality standards. This will enable early detection and management of any water quality problems arising as a result of mining operations and associated activities; • The water requirements and demands should be clearly stated and regularly reviewed through water balance updates to ensure water uses and losses are accounted for; • Soil disturbances during decommissioning should be restricted to the relevant footprint area; • All decommissioning debris must be cleared as soon as practically possible, and it is recommended that demolition of infrastructure be conducted during the dry season to minimise chances of soil erosion to watercourses; • Movement of heavy vehicles and machinery must be restricted to existing roads to avoid further disturbance of landscapes thus minimising soil erosion; • In the event of decanting, passive treatment should be applied to neutralise and treat the AMD before being discharged back into freshwater resources. If passive treatment fails, active treatment by a conventional Water Treatment Plant should be considered; and • Backfilled, top-soiled areas should be re-profiled and revegetated to allow free drainage that supports desired post-mining land use.		
Air Quality	• Commission an ambient air quality network before the construction phase; • Designate a qualified person to act as the EO, who will oversee the monitoring process and implementation of mitigation measures; • Ensure air quality information is incorporated into the environmental management information system and submit annual reports to the South African Atmospheric Emission Licensing & Inventory Portal (SAAELIP), as required by law; • Establish codes of practice for good housekeeping concerning air quality management and mitigation, including regular appropriate restrictions on vehicle movements and speeds; and • Monitor the air quality management measures and information to ensure that adopted mitigation measures are sufficient to achieve current air quality standards at the Project area and nearby receptors.	X - All recommendations have been considered and included in this report.	Appendix K
Noise	The findings from the impact assessment ranking methodology for the operational phase have indicated major impacts on the nearby sensitive receivers from Project related activities. However, the implementation of mitigation measures during the different phases of the Project is recommended and is predicted to result in minor – negligible impacts post-mitigation. The aforementioned will result in emission reduction and a further decrease in anticipated noise impacts onsite and at the receivers. The implementation of a monitoring plan would also be imperative in managing future noise sources and impacts throughout the Project's life. Based on the findings detailed in this report and the appropriate implementation of noise mitigation, management and monitoring measures, it is therefore recommended that the proposed Project be authorized from a noise impact perspective.	X - All recommendations have been considered and included in this report.	Appendix L

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Visual	It is recommended that landform design principles be implemented for the design parameters of the various dumps which is designed at both streamlining the rehabilitation approach for the operation along with maximising the slope angle to ensure that a gentle gradient is achieved which will have a lower visual influence when compared to a dump with steep edges that contrasts to the surrounding environment. It is recommended that should the final design of the project differ in location and assumed heights significantly from this assessment, an update of the viewshed modelling be performed to quantitatively assess the anticipated visual impacts.	X - All recommendations have been considered and included in this report.	Appendix N
Heritage	Considering the nature and the scope of the Project, Digby Wells recommends the following additional recommendations be implemented prior to the commencement of the Project: • Exxaro must apply for a permit issued in terms of Section 34 of the NHRA to allow for the destruction or alteration of the structures associated with Wf-01 and Wf-02; and • Exxaro must draft and implement a CFP as part of the EMPr.	X - All recommendations have been considered and included in this report.	Appendix M

Socio-economic	• The mitigation and enhancement measures listed for each impact, negative and positive, must be implemented; especially those relating to:
	  ◦ Impacts associated with surface subsidence;
	  ◦ Changes to water quality;
	  ◦ Impacts associated community health, safety and security;
	  ◦ A social management plan and social monitoring plan must be developed to manage and monitor the implementation of these measures and recommend corrective measures, where necessary; and
	  ◦ Implement mitigation measures recommended in other specialist studies, including traffic, dust, blasting, air quality, noise, ground and surface water, that are likely to have socio-economic impacts.
		X - All recommendations have been considered and included in this report.	Appendix Q

Traffic	• It is estimated that the proposed colliery will generate (as a worst case) a total of 118vph trips (total ‘In’ plus ‘Out’) during the Weekday Morning (AM) and 118vph trips (total ‘In’ plus ‘Out’) during the Weekday Afternoon (PM) peak hours. • The latent rights mining development of Opgoedenhoop was considered within this study. This mine will share a key intersection with the Arnot South Mine and its total impact was therefore considered at the intersection of the R38 and the D383. • SIDRA 9™ Intersection Capacity Analyses were carried out for the Weekday Morning and Weekday Afternoon peak periods at the key intersections and no upgrades for capacity purposed were found to be required for the development. However, other intersection upgrades and road widenings are necessary as set out within Chapter 8.	X - All recommendations have been considered and included in this report.	Appendix O

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	• The intersection of the D383 and D1555 is to be resurfaced, and the southern approach leg of the intersection of the D383 and the D1555 is proposed to be rehabilitated / resurfaced, for 100m to the south. Please refer to **Drawing No. 21046/ID/01**. • Access will be obtained via a gravel access road which intersects the D383. At the site's access gates, two (2) lanes of 5m wide are proposed to enter the site, and one (1) lane of 5m wide to exit the site. • The access road must have an unobstructed minimum stacking (queueing) space for six (6) heavy vehicles, i.e., 150m as measured from any access gate / security boom to the intersection with District Road D383. • The D383 and the access road must have a dust suppression layer which is proposed to be sprayed periodically onto the access road and the D383, for a minimum of 100m to both sides where the access road intersects the D383, and for 150m on the access road, to minimise dust on this road which may impair sight distance. • For road user safety, several road signs are proposed on each approach at the access road intersection with the D383, as also shown on **Drawing No. 21046/AL/01**. • Regarding non-motorised and public transport, no pedestrian walkways, nor public transport lay-bys are proposed along the D383, nor the access road. An internal public transport drop-off and pick-up zone is proposed for the development, with a minimum of 30m x 60m in size, as described in Appendix O.		
Rehabilitation and Closure	• A landform design is required for backfill and rehabilitation of the boxcut and discard dump areas requiring backfill; • A detailed material balance should be undertaken to ensure ethe boxcut is rehabilitated to be free draining and the discard dump is adequately capped, as per a detailed closure capping design to be implemented; • The option of using the discard material as backfill or selling the material to a contractor should be investigated, as this will decrease residual risk associated with this waste facility; • Geohydrological modelling based on the closure period must be undertaken to inform the post-closure water treatment measures required, to enable the required provisioning to be made for both the immediate and planned closure scenarios; • The above geohydrological model should be used to inform the capacity requirements of the water treatment plant to be constructed during operations; • Regular groundwater monitoring should take place to determine possible changes in groundwater flow and groundwater quality, which should feed into updating the geohydrological model for the site; • A post-mining land use plan should be developed early in the project life cycle to inform the closure measures and site relinquishment criteria;	X - All recommendations have been considered and included in this report.	Appendix S

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	• There should be regular interaction and communication with local stakeholders and local farmers, so that their requirements can be taken into consideration in the rehabilitation process, and particularly the post-mining land use plan development; • Invasive alien plants should be removed on an on-going basis; and • Monitoring and maintenance of the rehabilitated areas should take place on an annual basis for at least five years post-closure and should also be implemented during the operational period. This enables corrective rehabilitation to be implemented during operations and reduces the residual risk associated with post-closure vegetation failure.		
Greenhouse Gas Emissions	It is recommended that emissions management and mitigation efforts should start by focussing on these most significant emissions sources, and then move on to addressing the other GHG emission sources over the medium term. **1. Renewable and low carbon energy sources** It is recommended that Exxaro should investigate the technical and financial feasibility of implementing a range of emission-reduction initiatives for its purchased electricity and mobile equipment. The following recommendations could be considered and implemented for all three project phases: • Use solar and/or wind-powered electricity instead of Eskom purchased electricity and diesel-fuelled generators; • Investigate on-site processes to identify potential areas for process optimisation, energy efficiency, and improved energy management; • Implement a payload management system, or investigate options to improve the current system if such a system is already in place; • Implement a diesel energy-efficiency management programme; • Optimise the loading of haul trucks and adjust haul truck engines to ensure optimal energy efficiency; • Investigate the use of biofuel as a fuel enhancer or partial fossil fuel substitute of the Project's diesel usage. Potential sources for biofuel could be used cooking oil (if available) or other vegetable oils such as palm oil, soybean oil, rapeseed oil or jatropha oil; and • Investigate the use of ethanol blends, as will be allowable in terms of the vehicles' warranty. Ethanol is less costly to produce than biodiesel due to lower feedstock costs. The most common feedstocks for ethanol in Africa are sugarcane and molasses. **2. Mitigation of operational phase fugitive CH4 emissions**	X - All recommendations have been considered and included in this report.	Appendix R

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
	Examples of existing technologies which would contribute towards combatting CH4 emissions from coal mining operations include the following (Pandey et al, 2018): • **CH4 flaring:** CH4 collected from boreholes during mining can be flared. Through combustion, the CH4 is converted to CO2, which has a lower GWP compared to CH4; • **Methane purification:** Utilization of mine CH4 in its mixture form is not possible due to the presence of impurities such as N2, O2, CO2, and water vapor. Several processes are available which are commonly used for gas purification; • **Power generation using methane:** Coal mining is an energy-intensive process, which requires high electricity loads to run equipment. Mine CH4-fired stationary power generation technologies such gas engines, gas turbines, and fuel cells can be used in mining of coal. These not only promote the reutilization of generated CH4 but also reduce the energy consumption during the processes; • **Production of methanol and carbon black:** Coal mine CH4 can also be made available as a chemical feedstock for different chemical processes for the production of synthetic fuels and chemicals. Two potential applications in this field are methanol and carbon black production; • **Thermal flow, catalytic flow, and catalytic monolith reactor technologies:** Thermal and catalytic flow reversal reactors employ the flow reversal principle to transfer heat from combustion **3. GHG Management Plan** It is recommended that a GHG Management Plan be prepared and implemented for all the phases of the proposed project. The goal of the GHG Management Plan should be to achieve the maximum economically sustainable energy and carbon savings. Such a management plan should ideally include, but not be limited to, the following: • An energy and GHG emission management programme to assist in analysing and identifying opportunities at the operations to reduce energy consumption and GHG emissions. This should include measuring GHG emissions on an annual basis, as is also required for the operational phase in terms of the Technical Guidelines and Section 8 of the IFC Performance Standard 3; • GHG emissions reduction projects and offsetting opportunities; • Allocated responsibility to a key employee(s) that will be responsible and accountable for managing and reporting on the GHG emissions performance of the project on an annual basis; and • The GHG Management Plan should be updated regularly to ensure that the project complies with new South African policies and legislation relating to GHG emissions and climate change as it is promulgated.		

17 Item 3(p): Environmental impact statement

17.1 Item 3(p)(i): Summary if the Key Findings of the Environmental Impact Assessment

The Environmental Impact Statement is utilised to summarise all the potential environmental impacts identified during each phase of the proposed Project. The significance of the impacts associated with the relevant Project Phases, pre-mitigation and post-mitigation, is summarised in Table 15-1, above.

Negative impacts are to be expected with undertaking the proposed activities at the Arnot South Mine as they will require direct environmental disturbance. The most significant negative impacts identified are associated with site clearing during the construction phase and general operational and maintenance activities during the operational phase which may result in soil erosion, soil compaction, topsoil loss, subsequent sedimentation of watercourses leading to water quality deterioration. Th mining of coal by underground mining will result in groundwater contamination, decanting and subsidence.

A key finding is that the delineated wetlands over the mining right area cover 7,555 ha. The infrastructure area, which covers 65 ha, is currently being redesigned to avoid infrastructure placement within the zone of regulation of these wetland buffers.

No mining or development will occur within the wetland areas or the associated buffer zones. It is highly recommended that water courses (wetlands and pans) be avoided and not impacted with at least 100 m zones of regulation buffers to any infrastructure and construction activities.

17.2 Final Site Map

The infrastructure layout plan on which this impact assessment is based is provided in Figure 5-1 above and appended as Plan 4 in Appendix B.

17.3 Summary of the Positive and Negative Implications and Risks of the Proposed Activity and Identified Alternatives

The negative and positive impacts have been discussed in Section 12.1 of this report, Table 12-2. The proposed activities will have a considerable impact on the vegetation and associated habitat types present in the mining and infrastructure area. The key negative impacts include the loss of topsoil resources, soil erosion, loss of habitat, removal of protected species and subsequent sedimentation of freshwater systems from cleared areas as a result of construction site clearance as well as operational activities. A total of 362 species are indicated to potentially occur and 23 floral SCC are also expected to occur in the Project area.

The impacts associated with the wetlands were determined to be significant and will lead to irreversible impacts to some wetlands as the proposed surface infrastructure may potentially result in complete or partial loss of various wetlands. Underground mining contains the risk of subsidence, dewatering, decanting and contamination which might impact the wetlands significantly. Mitigation and management measures have been proposed for each identified impact associated with the proposed activities.

The most crucial impacts associated with the proposed Arnot South Project include but are not limited to:

4. Potential for water resource contamination;
5. Air and noise pollution;
6. Potential
7. Loss of SCC;
8. Fly rocks from the underground workings;
9. Infrastructure (houses) can potentially crack as a result of blasting activities;
10. Potential social impacts (i.e. change sense of place, impacts associated with impacts with community health, safety and security, Increased competition for water resources, impacts associated with blasting on neighbouring landowners, etc.).

The key positive impacts associated to the proposed Arnot South Project include but are not limited to:

11. Social Development as part of Social and Labour Plan, and
12. Economic boom-bust after the construction and operation phases.

18 Item 3(q): Proposed impact management objectives and the impact management outcomes for inclusion in the EMPR

Mitigation measures have discussed in Section 5, Part B of this report. Mitigation measures de

The EMP Report seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment and surrounding communities will be mitigated, controlled and monitored.

The EMP will address the environmental impacts and possible unplanned events during each phase of the Project (Construction, Operational, Decommissioning and Post-Closure). Mitigation measures contained in the EMP Section 5 and 6 of this report in Part B will be implemented for each phase. Due regard must be given to environmental protection during the entire Project; a number of environmental recommendations are made to achieve environmental protection. These recommendations are aimed at ensuring that the Applicant and contractors maintain adequate control over the Project to:

13. Minimise the extent of an impact during the life of the Project;
14. Ensure appropriate restoration of areas affected by the Project; and
15. Prevent long term environmental degradation.

19 Item 3 9(r): Final Proposed Alternatives

The location of the Project has been decided upon based on the location of the identified coal seams. Alternatives were therefore assessed for the layout of the Project with consideration given to the environmental and technical assessments undertaken, these are detailed in Section 8 and 9.1 above. As a result of investigations undertaken during the EIA Phase, it was found that the infrastructure footprint is within 500 m of a wetland, and the recommendation of the Wetland Specialist is to relocate the infrastructure outside of the zone of regulation. The design is being updated and will be presented in the Integrated Water and Waste Management Plan report.

The No. 2 coal seam is the most economically exploitable coal seam of the Coalfield and contains hard, dull to lustrous coal with several bright coal bands and occasional stone partings. The No. 2 coal seam shall be accessed via a boxcut located at the south-eastern end of the planned mining layout. Access to the Arnot South Project shall be by an existing gravel road that runs from the paved road that links the N4 highway to Hendrina town. The distance along the existing gravel road is 13 km with a short new 3.0 km road that shall be constructed from the existing gravel road.

20 Item 3(s): Aspects for Inclusion as Conditions of Authorisation

The studies and impact assessment has been based on the proposed mine layout. Should there be any changes to the proposed project description, the adequacy and accuracy of the work may be affected, and additional work may be required to fill in the gaps.

The EAP and Specialist team will be required to review the mine infrastructure layout and provided opportunity to amend the respective impact assessments. The Applicant will amend the layout based on the outcomes of this impact assessment process. The full extent of the proposed Mining Right area has been assessed to establish the environmental baseline. All the recommendation and outcomes of the specialist studies discussed in this report must be understood by the client and implemented.

21 Item (t): Description of any Assumptions, Uncertainties and Gaps in Knowledge

This section highlights the assumptions, uncertainties, limitations and knowledge gaps relevant to the assessment and mitigation measures of the various specialist studies undertaken. Refer to Table 21-1 below.

Table 21-1: Specialist Studies Assumptions, Uncertainties, and Gaps

Specialist Study	Assumptions, Uncertainties and Gaps
Soil, Land Use, and Land Capability	Due to the size of the Project Area, cost and time limitations: **16.** Site assessment was mostly focused on the proposed surface infrastructure areas as well as the area of high extraction; **17.** Soil samples were limited to these areas; **18.** Access to the entire MR area was not granted; **19.** Land suited for crop production (high agricultural capability) was assumed also to be suitable for other, less intensive uses such as pasture, natural grazing, forestry and wildlife; **20.** Soils are contiguous hence differentiation is not abrupt, and the transition zone cannot be completely captured during any given soil survey; **21.** The soils within the capability classes are similar only with respect to the degree of limitations in soil use for agricultural purposes or with respect to the impact on the soils when they are so used; and **22.** Due to historical and current land use activities (dominantly intensive agropastoral activities) some areas have been highly impacted, specifically the naturally occurring vegetation, hydrology and geomorphology.
Fauna and Flora	**23.** The fauna and flora study forms part of a larger EIA and should be read in conjunction with the EIA and other related specialist studies; **24.** The Fauna and Flora Impact Assessment was conducted during April 2021 having some access restrictions to parts of the Project Area, including farm portions in the Tweefontein 203 IS and Morgenster 204 IS. Furthermore, timing and brevity of the survey was not ideal and conducted at the end of the flowering season, hence some species may have been missed. Land access delayed the timing of the survey; and **25.** No form of this report may be amended or extended without the prior written consent of the author and/or a relevant reference to the report by the inclusion of an appropriately detailed citation. Any recommendations, statements, or conclusions drawn from or based on this report must cite or reference this report. Whenever such recommendations, statements or conclusions form part of the main report relating to the current investigation, this report must be included in its entirety.

Specialist Study	Assumptions, Uncertainties and Gaps
Wetlands	**26.** Wetlands within a 500 m zone of regulation outside the Project Area were assessed to account for potential catchment-based impacts. These wetlands were assessed on a desktop level with only limited ground-truthing; **27.** The wetland study forms part of a larger EIA and should be read in conjunction with the EIA and other related specialist studies; **28.** No form of this report may be amended or extended without the prior written consent of the author and/or a relevant reference to the report by the inclusion of an appropriately detailed citation. Any recommendations, statements, or conclusions drawn from or based on this report must cite or reference this report. Whenever such recommendations, statements or conclusions form part of the main report relating to the current investigation, this report must be included in its entirety; **29.** The Wetland Assessment was conducted during a one-season survey in 2021; **30.** Wetlands are dynamic systems and change over time. Due to historical and current land use activities (dominantly intensive agropastoral activities) some areas have been highly impacted, changing the naturally occurring vegetation, hydrology and geomorphology; **31.** The Wetland Impact Assessment does not include a wetland offset strategy; and **32.** Due to the size of the Project Area and cost and time limitations: • Site assessment was mostly focused on the proposed surface infrastructure areas as well as areas of high extraction which are expected to be impacted to a greater extent; • HGM units were grouped according to dominant land use and catchments; and • Access to the entire MRA was not granted.
Aquatics	To obtain a comprehensive understanding of the dynamics of the biota present within a watercourse (e.g. migratory pathways, seasonal prevalence, etc.), studies should include investigations conducted during different seasons, over several years and through extensive sampling efforts. Given the time constraints of the present study, such long-term research could not be conducted. Instead, conclusions provided within this report are based on data collected during a single late wet season sampling event, a literature review, and professional experience. In terms of constraints for the study, the associated watercourses predominantly flow through private property, thus sampling was mostly restricted to the nearest possible public road crosses as access to some of the properties could not be granted.

Specialist Study	Assumptions, Uncertainties and Gaps			
Surface Water	**Description of Assumptions and Constants**	**Value**	**Unit**	**Source**
	Discard Dump	1 500	m^2	Arnot South Mine Works Program Report (Exxaro, 2020)
	Pollution Control Dam	1 200	m^2	Arnot South Mine Works Program Report (Exxaro, 2020)
	Plant Footprint	68 600	m^2	Arnot South Mine Works Program Report (Exxaro, 2020)
	Potable water supply	42.6	m^3/day	Arnot South Mine Works Program Report (Exxaro, 2020)
	Mine Plant make-up water for coal washing	1200	m^3day	Arnot South Mine Works Program Report (Exxaro, 2020)
	Seepage from underground workings assumed to be 1% of inflows	0.5	%	Assumed % of total inflow
	Dust suppression assumed to be 95% of U/G pumped water	95	%	Assumed % of treated water
	Number of employees	154	number	Arnot South Mine Works Program Report (Exxaro, 2020)
	Underground dust control volume	30	%	Assumed % of inflows
	Recycled water from filter press and thickener for re-use	95	%	recycled water assumed to be 90% of plant water consumption
	Process Plant losses assumed to be 5% of inflows	5	%	Assumed % of inflows

<table>
<tr><th>Specialist Study</th><th>Assumptions, Uncertainties and Gaps</th></tr>
<tr><td></td><td>
<table>
<tr><td>Treated sewage effluent to PCD</td><td>80</td><td>%</td><td>Assumed to be 80% of inflows to STP</td></tr>
<tr><td>Seepage from Discard Dump to PCD</td><td>80</td><td>%</td><td>Assumed to be 80% of inflows rainfall input</td></tr>
<tr><td>Borehole yield at 2.5 L/s</td><td>216</td><td>m³/day</td><td>Groundwater model</td></tr>
<tr><td>Critical moisture content in lignite & anthracite is 25% and 20%, respectively</td><td>20</td><td>%</td><td>Assumed to be 20% of process water</td></tr>
<tr><td>Groundwater inflow rate</td><td>200</td><td>m³/day</td><td>Groundwater model</td></tr>
</table>
</td></tr>
<tr><td>Air Quality</td><td>33. Ambient air quality scenario
34. The uncertainty associated with dispersion models</td></tr>
<tr><td>Noise</td><td>35. The construction phase is assumed to be carried out during daytime hours only (06:00-18:00).
36. The modelling adopted a conservative worst-case scenario approach assuming that all activities for each phase are being carried out simultaneously.
37. A 1.8km segment of the main road was modelled for the impact of traffic noise. It was assumed that the remaining extent of the road would experience similar impacts.
38. Noise measurements could not have been conducted at noise receivers NR7, NR10 and NR26 due to farm access issues.
39. No audio recordings were recorded at noise monitoring location N2. It is assumed that noise sources documented (field notes) for daytime will be the same as night-time.</td></tr>
<tr><td>Visual</td><td>40. At the time of the compilation of the report, the infrastructure heights associated with the project design were unavailable. To effectively model the potential visual impact, assumptions were drawn using existing UCD facilities as a baseline.</td></tr>
</table>

Specialist Study	Assumptions, Uncertainties and Gaps
Blast and Vibrations	The following assumptions have been made: **41.** The project area is not currently an active full-scale mining operation; **42.** The anticipated levels of influence estimated in this report are calculated using standard accepted methodology according to international and local regulations; **43.** The assumption is made that the predictions are a good estimate with significant safety factors to ensure that expected levels are based on worst case scenarios. These will have to be confirmed with actual measurements once the operation is active; **44.** No baseline data exist for this project as the mine is not operational; **45.** Blasting operations will be mainly concentrated in establishing the box cut for access to the underground workings. A blast design is required for determining the extend of influences to be evaluated. In the process of the project no specific blast design is available for the box cut blasts. A blast design was done by BMC based on what could typically be use for similar operations. This design is not the final blast design for the box cut; **46.** The mine is an underground operation. Continuous miners will be used for extraction of coal; and No specific ground vibration influences are anticipated. **47.** The work done is based on the author's knowledge and information provided by the project applicant.
Rehabilitation and Closure	The compilation of this RCP is based on the following assumptions and limitations: • All infrastructure on site will be demolished unless these assets can be legally transferred to a third party and a contract is in place detailing the conditions of transfer; • Decommissioning and rehabilitation activities will follow directly after the cessation of mining; • Information, mitigation measures and recommendations provided in this report are based on the specialist studies completed by Digby Wells as part of the environmental authorisation for the proposed Arnot South Project;

Specialist Study	Assumptions, Uncertainties and Gaps
	• Vegetation monitoring and maintenance will take place for five years post-closure. Similarly, groundwater and surface water monitoring will be undertaken for five years post-closure. It is noted that these monitoring periods may need to be extended to prove that site relinquishment criteria have been met; • The recommendations contained within this report currently exclude any comments or issues raised by stakeholders and/or Interested and Affected Parties (I&APs). Comments from stakeholders or I&APs will be incorporated into subsequent annual updates of the RCP as and when received; • This report must be considered as a living document and should be updated as additional information become available and as monitoring and rehabilitation progresses, should the proposed project go ahead; and • Should the proposed project go ahead, this report should be updated and submitted annually as additional information becomes available (as stipulated in the Financial Provisioning Regulations, 2015.
Greenhouse Gas Emissions	The following assumptions apply to this GHG Inventory: • The GHG Inventory uses data and information that have been provided by Exxaro *via* Digby Wells (Digby Wells, 2021), as well as data provided by Universal Coal (Coetser, 2021). It is assumed that the data and information provided are correct; • The GHG emission's report only focusses on the proposed underground mine, and does not include existing operations at Arnot, nor a comparison of the emissions associated with the existing and proposed operations; • It is assumed that the coal production numbers provided by the client is run-of-mine; • It is assumed that CH4 gas is not planned to be flared as part of the underground mining extensions; and • Further assumptions relating to the quantification of GHGs and assumptions regarding the impact assessment are specified in GHG report.

22 Item 3(u): Reasoned Opinion as to whether the Proposed Activity Should or Should not be Authorised

22.1 Item 3(u)(i): Reasons why the Activity should be Authorised or Not

Various specialist studies were undertaken during the EIA Phase with the objective of identifying and weighing anticipated impacts and risks associated with the proposed activities. The findings of the impact assessment have shown that the Arnot South Project will have impacts on the receiving environment, namely, the loss of topsoil on cleared land, soil erosion, subsequent sedimentation of wetland and river systems and loss of habitats and protected species. The site is also characterised by ecologically sensitive areas, especially with regards to flora, fauna, and wetlands.

Numerous faunal and floral SCC were encountered within the delineated wetlands. The Ecological Management Plan will ensure long-term persistence of the SCC, including a monitoring programme for the species, facilitate natural ecological processes, minimise artificial edge effects and include an AIP eradication and monitoring plan.

The potential positive impacts of the proposed Project include the creation of jobs, generation of wealth within the community and economy and potential community development through the implementation of the SLP. However, the positive impacts do not significantly offset the negative environmental impacts. Further to this, coal is an undesirable source of energy and is not in line with the Paris Agreement, however, Eskom will be reliant on coal for power generation until feasible renewable alternatives are implemented.

Based on the assessment of the impacts associated with the Project, it is concluded that the proposed Arnot South Project can be authorised, provided that the mitigation measures proposed herein are applied diligently and the infrastructure layout is reconsidered to avoid sensitive wetland areas.

22.2 Item 3(u)(ii): Conditions that must be included in the Authorisation

All mitigation measures included in this EIA/EMP Report and the associated specialist studies should be conditions to the authorisation. All specialist recommendations have been captured in Table 16-1 Numerous specialist impact assessments were undertaken for the proposed Project, as set out in Table 16-1. Separate specialist reports were compiled and have been attached as appendices to this report. The specialist input included the baseline environment, potential impacts and the recommended mitigation measures. Table 16-1 provides a summary of the key recommendations of the studies.

Table 16-1: Specialist Studies Undertaken for the Arnot South Project

23 Item 3(u)(iii): Period for which the Environmental Authorisation is Required

The proposed LoM for the Project will require Environmental Authorisation for a period of 17 years.

24 Item 3(v): Undertaking

The undertaking required to meet the requirements of this section is provided at the end of the EMPr in Part B, Section 12.

25 Item 3(w): Financial provision

A summary of the closure costs for scheduled closure is reflected in Table 7-2. The total scheduled closure cost estimate amounts to **R 230,847,235.00** (excluding VAT) and including P&Gs and Contingencies at 15% and 10%, respectively.

Discounted residual closure cost estimates for long-term water treatment and subsidence management have also been included, and the methodology and assumptions applied in estimating these costs are included in the ERR, see Appendix S.

Table 25-1: Closure Cost Summary

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental Exxaro Coal Mpumalanga (Proprietary) Limited, Proposed Arnot South Project
Area and Description	Life of Mine 2039
Infrastructure Demolition	
Area 1: Arnot South Project	R11,306,841
Rehabilitation	
Area 1: Arnot South Project	R31,966,080
Total Demolition & Rehabilitation	R43,272,921
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water)	R4,772,259
Monitoring Costs (Vegetation)	R55,762
Maintenance Costs (Vegetation)	R1,925,315
Sub-total	R6,753,336
Residual Costs (Discounted)	

Monitoring of Subsided Areas (10 years)	R12,029,601
Water Treatment Costs (100 years)	R157,973,146
Sub-total	R170,002,747
Preliminary and General (15%)	R6,490,938
Contingency (10%)	R4,327,292
Sub-total	R10,818,230
GRAND TOTAL	R230,847,235

25.1 Item 3(w)(i): Explain how the Aforesaid Amount was Derived

The following approach was applied in the estimation of the closure costs:

- Review supporting information supplied by the mine;
- Collate infrastructure quantities using GIS attribute data, as per the current infrastructure layout supplied by the mine;
- Input infrastructure attributes into the Digby Wells closure cost model, and include mine-related disturbance into the model (including the boxcut and discard dump);
- Compute the rehabilitation costs for all mine disturbances, based on a set of assumptions applied;
- Summarise the closure cost estimation outcomes in this Section of the RCP; and
- Detail all assumptions applied to facilitate the closure cost estimate.

25.2 Battery Limits for Closure

The closure cost estimation is based on the battery limits for closure, which are detailed in the subsections below . The battery limits for mine closure are detailed in Table 25-2, and visually presented in Figure 4-2 and Figure 5-1.

Table 25-2: Battery Limits for Mine Closure

Mine aspect	Infrastructure/ facility
Mine infrastructure	• Medical facility; • Temporary guardhouse; • Site access (perimeter fencing and gates); • Possible laydown area; • Substation; • Weighbridges; • Vent shaft; • Fuel dispensary/storage;

Mine aspect	Infrastructure/ facility
	• Conveyors; • Offices; • Stores; • Brake-test ramp; • Stormwater management infrastructure; • Workshop; • Vehicle wash bay; • Laundry facility; • Pollution Control Dam (PCD); • Washing plant; • Potable water tank; • Water storage tank and booster; • Ventilation shafts (including fans); • Sewage Treatment Plant; • Change-house; • Salvage yard; • Coal Handling and Processing Plant; • Parking area; • Water Treatment Plant (WTP); and • New 3.0 km access road.
Mining areas	• Adit/ Boxcut
Stockpiles and waste	• ROM stockpiles; • Discard dump; • Topsoil stockpiles; and • Overburden stockpiles.

25.3 Closure Costing Assumptions and Qualifications

The following closure cost assumptions and qualifications were applied in the closure cost estimation. These should be reviewed and updated in future iterations of the closure cost estimate to ensure they remain appropriate.

25.3.1 Infrastructure Aspects

- Demolition/ removal of underground infrastructure is excluded from the cost assessment;
- Allowance for the disposal of inert demolition waste has not been accounted for since the volume of demolition waste expected at closure is currently unavailable;

- Conveyors leading into the boxcut and incline shaft have been accounted for (it was assumed total length is 30 m;
- Allowance for dismantling/ demolition of pipelines is excluded from this assessment; and
- Demolition of roadways into the boxcut leading to the three portals has been included, it was assumed that there will be three roads and each will be 30 metres in length and that each road is 6.5 metres wide (as per the MWP, 2020).

25.3.2 Mining Aspects

25.3.2.1 Boxcut

- It is assumed that the boxcut will be 30 m deep (depth to S2 coal seam appears to be about 30 m according to Fig. 4-2 in the MWP, 2020). The ramp angle will be built at an 8 degree slope (MWP, 2020), and the width of the boxcut is 69 m (KML polygons supplied). The estimated backfill volume was calculated based on these parameters;
- It was assumed that backfill will be undertaken using a combination of dozer (to move 20% of the backfill material) and truck and shovel (to move 80% of the backfill material). A maximum 1 km load and haul distance was applied; and
- It was assumed topsoil will be replaced to a death of 300 mm, to meet grazing land capability depth.

25.3.2.2 Discard dump

- A factor of 1.5 was applied to the discard dump footprint area to account for the side slopes and top surface area to be sloped at closure;
- It was assumed clay would be available within a 1 km radius for use in creating a compacted clay liner for the dump cover;
- Lime application was applied at 3 tonnes per ha and it is assumed this concentration will be enough to neutralise acidity resulting from acid mine drainage. This assumption will need to be confirmed through geochemical analysis of the discard dump material during operations (should the project go ahead);
- It was assumed soft overburden material will be available to cover the dump to a depth of 300 mm using this material as an additional breaker layer;
- It was assumed 800 mm of topsoil will be available for the dump cover; and
- All load and haul distances (for clay material, softs material and the topsoil) were limited to a 1 km load and haul from stockpile.
- Stockpiles.

- It was assumed that 300 mm of contaminated material will need to be excavated over the following areas: overburden footprint, stockpile footprint, waste disposal area; salvage yard footprint and the contractor's laydown area; and
- Allowance for load and haul of this material is not included in the cost assessment and should be included in future iterations of the closure estimation.

25.3.3 Dams

- It was assumed the dams are HDPE lined and that 300 mm of contaminated sediment would need to be removed from the dams at closure; and
- Allowance for appropriate disposal of the contaminated sediment has not been included in this assessment and should be included once the volume and waste characterisation of the sediment is able to be estimated more accurately.

25.3.4 Monitoring and Maintenance

- Quarterly surface water and groundwater monitoring costs were included for a period of ten years post-closure, it is currently assumed that site relinquishment criteria will be achieved in this period; and
- Vegetation monitoring and maintenance costs were included for five years post-closure It is currently assumed that site relinquishment criteria will be achieved in this period.

25.3.5 Additional Allowances

- Preliminaries and General (P&Gs) were applied at 15% and Contingencies were applied at 10%;
- P&Gs and Contingencies were applied to the total rehabilitation and the total demolition costs, these allocations were not applied to the monitoring and maintenance costs, or the residual closure cost estimations; and
- These percentage allocations should be reassessed in future closure cost updates to ensure they are market -related, should the project go ahead.

25.4 Residual/ Latent Closure Costs

The costs determined to manage residual/ latent risks are presented in the ERR, Appendix S of this report. The closure cost summary in the Section 25 indicates the discounted costs for managing subsidence and mine affected water post-closure.

25.5 Item 3(w)(ii): Confirm that this Amount can be Provided for from Operating Expenditure

Provided that the Mining Right is approved, Exxaro will provide for closure as per the legal requirements. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

26 Item 3(x): Specific Information required by the Competent Authority

The sub-sections below provide additional information which should be considered by the competent authority for the Project. The impact on the socio-economic conditions and the potential impacts and risks on heritage resources are considered below.

26.1 Item 3(x)(i): Impact on the Socio-economic Conditions of any Directly Affected Person

The potential socio-economic impacts expected to arise as a result of the Project have been investigated and assessed in the Social Impact Assessment (Appendix Q). The findings of this report take into consideration the project's proposed activities, location of the project, the status of the existing socio-economic environment, and the ultimate effect that the project will have on this environment. The pre- and post-mitigation ratings assigned to the various impacts discussed in the report are summarised in Table 26-1 below. A total of 15 socio-economic impacts were identified for the proposed Project, of which six were rated positive and nine negative. It was found that the majority of impacts fall within ratings of minor positive and moderate negative.

Mitigation measures are expected to reduce the significance of negative impacts to acceptable levels, while positive will be enhance to maximise benefits to surrounding communities such as the sustainable development of the local economy.

Table 26-1: Summary of Socio-Economic Impacts

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Construction	All construction activities	Socio-economic	Creation of employment opportunities	Minor - positive	Minor - positive
Construction	• Establishment of infrastructure; • Construction of access and haulage road; • Site/vegetation clearance; • Infrastructure construction; • Diesel storage and explosive magazine ; • Sewage treatment plant ; and • Sewage treatment plant, pollution control dam.	Socio-economic	Creation of Opportunities Within the Supply Chain	Minor - positive	Moderate - positive
Construction	All project related activities associated with construction and operation	Socio-economic	Increased Incidences of Livestock Theft	Moderate - negative	Minor - negative
Construction	All project related activities associated with construction and operation	Socio-economic	Impacts Associated with Community Health, Safety and Security	Moderate - negative	Minor - negative

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Construction	All Construction Activities	Socio-economic	Loss of Agricultural Land	Moderate - negative	Minor - positive
Construction	All project related activities associated with construction and operations.	Socio-economic	Potential Physical Displacement of Farm Dweller Households	Moderate negative	Minor - negative
Construction	All project related activities associated with construction and operations.	Socio-economic	Change Sense of Place	Moderate - negative	Minor - negative
Operational	All project related activities associated with construction and operation.	Socio-economic	Creation of Long-term Employment Opportunities, Skills Development and Work Experience	Minor – positive	Minor - positive
Operational	All project related activities associated with construction and operation.	Socio-economic	Opportunities and Capabilities within the Supply Chain	Minor - positive	Moderate - positive
Operational	All project related activities associated with construction and operation.	Socio-economic	Changes to the Water Quality	Minor - negative	Minor - negative
Operational	All project related activities associated with construction and operation.	Socio-economic	Impacts Associated with Surface Subsidence	Moderate- - negative	Minor - negative
Operational	All project related activities associated with construction and operation.	Socio-economic	Occupational Health Risks to Mine Workers	Moderate – negative	Minor – negative
Operational	All project related activities associated with construction and operation	Socio-economic	Economic Multiplier	Minor - positive	Moderate - positive

Phase	Project Activity	Aspect	Impacts	Significance (Pre-Mitigation)	Significance (Post Mitigation)
Operational	All project related activities associated with construction and operation.	Socio-economic	Social Development as part of Social and Labour Plan (SLP)	Minor - positive	Moderate - positive
Decommissioning	Decommissioning	Socio-economic	Economic Boom-Bust after the Operation Phase	Moderate - negative	Minor - negative

26.2 Item 3(x)(ii): Impact on any National Estate referred to in Section 3(2) of the National Heritage Resources Act.

The HIA (Appendix M) was completed as part of this Project. Potential impacts and risks on heritage resources were investigated and assessed, and where possible, mitigation measures were provided. Only two (2) heritage resources were identified in the Project area. It was noted that the environment was disturbed through anthropogenic and animal activities. Anthropogenic disturbances included farming activities including cultivated and cleared fields and associated infrastructure, such as formal and informal roads. Ornamental exotic plants were noted within the Project area.

The two (2) identified heritage resources include:

48. **Wf-01 -** Structure with one visible internal division. There is no roof and no fittings. The windows and doors are identifiable through the deliberate gaps in the structure. The doors have heavy wood lintels intact. This is likely to be a farmhouse or residential structure.

These structures are not visible on the historical layering. However, there are lines of trees visible on the historical imagery at this point. Such features are typically associated with historical structures. As such, this structure is assumed to be older than 60 years and must be assumed to have General Protection under Section 34 of the NHRA.

49. **Wf-02** - Structure with an exterior made of sandstone blocks and interior walls of red brick. The walls are in various states of collapse, from none to total collapse. The number of internal divisions is not clear, but there is at least one.

These structures are not visible on the historical layering. However, there are lines of trees visible on the historical imagery at this point. Such features are typically associated with historical structures. As such, this structure is assumed to be older than 60 years and must be assumed to have General Protection under Section 34 of the NHRA.

27 Item 3(y): Other Matters Required in Terms of Sections 24(4)(a) and (b) of the Act

This section is not applicable to the proposed Project.

Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

Digby Wells Environmental (Digby Wells) has been appointed as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Authorisation Application and the IWULA application processes, the associated specialist studies and the required Public Participation Process for the proposed Arnot South Project in the Mpumalanga Province of South Africa. The details of the EAP are contained in the table below and the Curriculum Vitae and Qualifications of the EAP are attached in Appendix A

Table 1-1: Contact details of the EAP

Name of Practitioner:	Xan Taylor
Telephone:	+27 11 789 9495
Fax:	+27 11 789 9495
Email:	Xan.Taylor@digbywells.com

2 Item 1(b): Description of the Aspects of the Activity

The aspects of the activity as described in Section 5 of Part A are covered by the EMP.

3 Item 1(c): Composite Map

A composite map is shown in Figure 3-1, which depicts the mining associated infrastructure and environmental aspects assessed which informed the impact assessment.

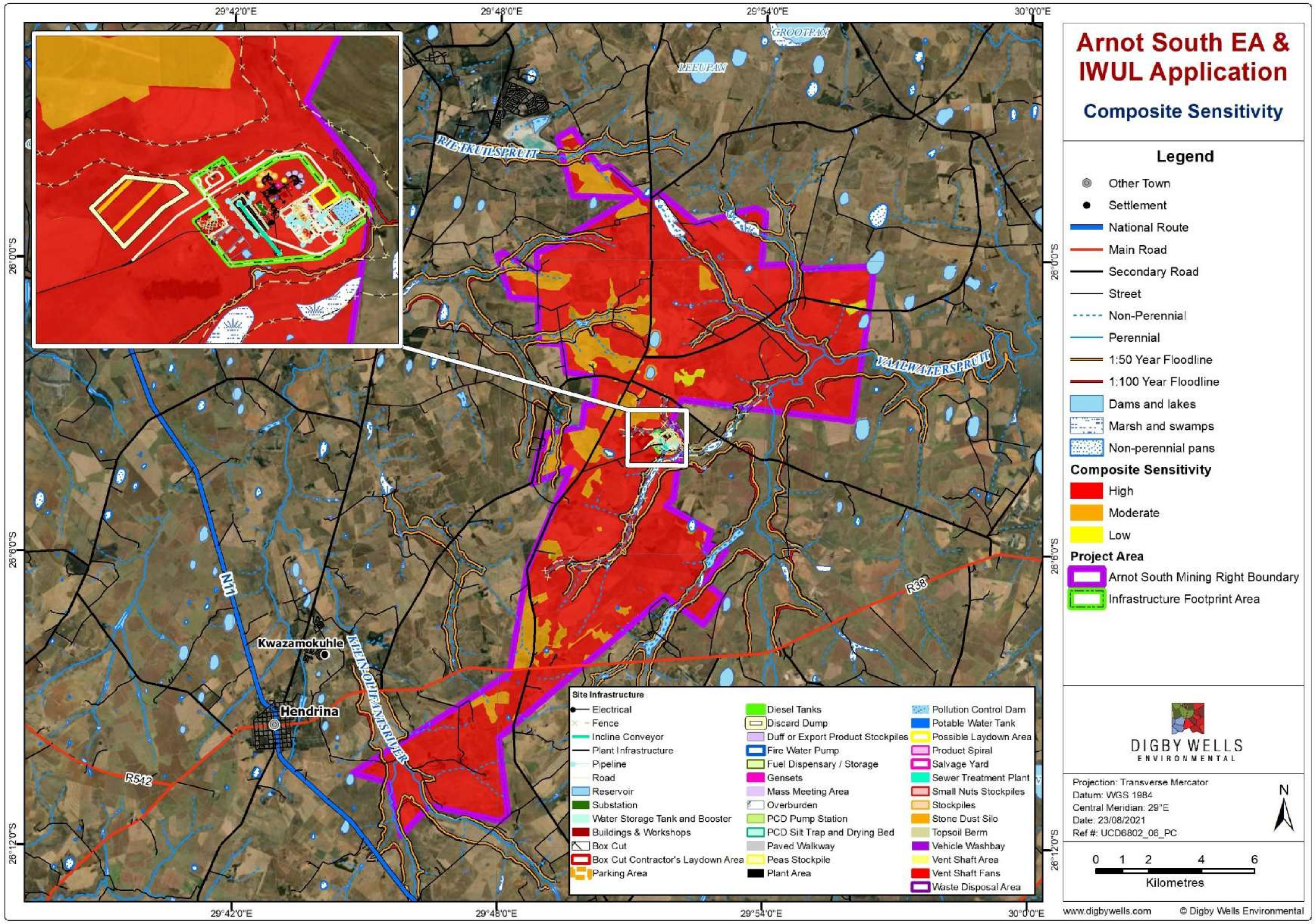


Figure 3-1: Composite Map

4 Item 1(d): Description of Impact Management Objectives Including Management Statements

The Closure and Rehabilitation Phases of the Project are important as their successful management aims to return the Project area, as much as possible, to its original state of environment. The following subsections describe the closure objectives, and the Emergency Response Plan.

4.1 Item 1(d)(i): Determination of closure objectives

Outlined below are specific objectives which support the overall closure vision and the closure measures developed:

- Return land disturbed by mining activities as far as possible to land capabilities similar to that which existed prior to mining;
- Ensure that contamination of surrounding areas by mine affected water is limited as far as possible, and that mine affected water is contained or treated post-closure;
- Remove mine infrastructure that cannot be used by a subsequent landowner or a third party. Where buildings can be used by a third party, arrangements will be made to ensure their long-term sustainable use;
- Clean up all stockpile footprint areas and loading areas and rehabilitate these areas to a land capability similar to that which existed prior to mining;
- Follow a process of closure that is progressive and integrated into the short and long term mine plans, and that will assess the closure impacts proactively at regular intervals throughout project life;
- Rehabilitate the disturbed land to a state that facilitates compliance with applicable environmental quality objectives,
- Landscape the rehabilitated areas in alignment with the surrounding topography to prevent the unnecessary ponding of water and ensure all rehabilitated areas are free draining;
- Physically and chemically stabilise any remaining mining structures (i.e. discard dumps), where required, to minimise residual risk post-closure;
- Leave a safe and stable environment for both humans and animals;
- Prevent soil and surface/groundwater contamination by effectively managing water on site, and ensure clean/ dirty water separation is implemented during the operational period to minimise post-closure contamination potential;
- Comply with local and national regulatory requirements; and

- Ensure the Social and Labour Plan speaks to the closure plan and land use plan, and that social closure objectives (e.g. reskilling, retrenchment management, land use engagement etc.) are progressively met during the operational phase.

4.2 Item 1(d)(ii): Volumes and rate of water use required for the operation

The annual average water balance indicates a total volume of 1,583,189.68 m^3/annum that will circulate within the Arnot South operations. Water supply for the Arnot Project is indicated to come from boreholes, groundwater ingress from underground workings, rainfall and runoff that is collected in storage facilities and used in the operations. A dewatering volume of 73,200 m^3/annum is pumped to Underground Dams where it is used for underground dust control. Excess water from the Underground Dams will be pumped to the PCD for use as make-up water for mining operations. A volume of 48,330 m^3/annum will be obtained from the PCD and used for dust suppression within haul roads and relevant open surfaces. A small reverse osmosis WTP will be used to treat borehole water for potable uses at the offices, workshop and change houses. The Arnot Project shall make maximum use of recycled water through the use of the filter press and thickener that clarify process water for re-use.

The water reticulation system at Arnot South is presented in Table 4-1 to Table 4-3 below for the different phases of production.

4.3 Item 1(d)(iii): Has a water use licence has been applied for

Exxaro is in the process of applying for an Water Use Licence from DWS as per the requirements in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). The Project infrastructure and activities trigger water uses in terms of Section 21 of the NWA and as such a Water Use Licence is required.

Table 4-1: Annual average water balance for Arnot South

Annual Average Water Balance for Arnot South					
		Water In		Water Out	Balance
Facility Name	**Water Circuit/stream**	**Quantity (m^3/annum)**	**Water Circuit/stream**	**Quantity (m^3)/annum**	
Underground Dams					
	From: Groundwater Seepage (Arnot Project U/G Workings)	73 200.00	To: Underground Dust Control	21 960.00	
			To: PCD	50 874.00	
			To: Seepage	366.00	
	Total	**73 200.00**		**73 200.00**	-
Water Treatment Plant (WTP)					
	From: Borehole Water Supply	79 056.00	To: Storage in Jojo Tank	79 056.00	
	Total	**79 056.00**		**79 056.00**	-
Coal Handling & Processing Plant (CHPP)					
	From: Underground Workings (Now-closed Arnot Colliery)	436 376.49	To: Process Water Tank	417 240.00	
	From: Process Water Tank	417 240.00	To: Process losses	21 960.00	
	From: PCD	2 823.51	To: Recycled through filter press and thickener	417 240.00	
	Total	**856 440.00**		**856 440.00**	-
Process Water Tank					
	From: Processing Plant	417 240.00	To: Processing Plant	417 240.00	
	Total	**417 240.00**		**417 240.00**	-
Pollution Control Dam (PCD)					
	From: Rainfall	828.46	To: Evaporation	28 964.89	
	From: Runoff from dirty areas	28 416.24	To: Dust Suppression	48 330.30	
	From: Underground Dams	50 874.00	To: Coal Handling & Processing Plant (CHPP)	2 823.51	
	Total	**80 118.70**		**80 118.70**	-
Offices, Workshop & Change House					
			To: Consumption	15 083.80	
	From: Jojo Tank	15 591.60	To: Sewage Treatment Plant	507.80	
	Total	**15 591.60**		**15 591.60**	-
Sewage Treatment Plant (STP)					
			To: PCD	406.24	
	From: Offices, Workshop & Change House	507.80	To: System Losses	101.56	
		507.80		**507.80**	
Discard Dump					
	From: Rainfall	1 035.58	To: Evaporation	196.76	
			To: PCD	828.46	
			To: Seepage	10.36	
		1 035.58		**1 035.58**	-
Total Water Balance		**1 523 189.68**		**1 523 189.68**	

Table 4-2: Monthly average water balance for Arnot South

Monthly Average Water Balance for Arnot South					
		Water In		Water Out	Balance
Facility Name	Water Circuit/stream	Quantity (m^3/mon)	Water Circuit/stream	Quantity (m^3)/mon	
Underground Dams					
	From: Groundwater Seepage (Arnot Project U/G Workings)	6 100.00	To: Underground Dust Control	1 830.00	
			To: PCD	4 239.50	
			To: Seepage	30.50	
	Total	6 100.00		6 100.00	-
Water Treatment Plant (WTP)	From: Borehole Water Supply	6 588.00	To: Storage in Jojo Tank	6 588.00	
	Total	6 588.00		6 588.00	-
Coal Handling & Processing Plant (CHPP)	From: Underground Workings (Now-closed Arnot Colliery)	36 364.71	To: Process Water Tank	34 770.00	
	From: Process Water Tank	34 770.00	To: Process losses	1 830.00	
	From: PCD	235.29	To: Recycled through filter press and thickener	34 770.00	
	Total	71 370.00		71 370.00	-
Process Water Tank	From: Processing Plant	34 770.00	To: Processing Plant	34 770.00	
	Total	34 770.00		34 770.00	-
Pollution Control Dam (PCD)	From: Rainfall	69.04	To: Evaporation	2 413.74	
	From: Runoff from dirty areas	2 368.02	To: Dust Suppression	4 027.53	
	From: Underground Dams	4 239.50	To: Coal Handling & Processing Plant (CHPP)	235.29	
	Total	6 676.56		6 676.56	-
Offices, Workshop & Change House			To: Consumption	1 256.98	
	From: Jojo Tank	1 299.30	To: Sewage Treatment Plant	42.32	
	Total	1 299.30		1 299.30	-
Sewage Treatment Plant (STP)			To: PCD	33.85	
	From: Offices, Workshop & Change House	42.32	To: System Losses	8.46	
		42.32		42.32	
Discard Dump	From: Rainfall	86.30	To: Evaporation	16.40	
			To: PCD	69.04	
			To: Seepage	0.86	
		86.30		86.30	-
Total Water Balance		126 932.47		126 932.47	

Table 4-3 Daily average water balance for Arnot South

Daily Average Water Balance for Arnot South					
		Water In		Water Out	Balance
Facility Name	Water Circuit/stream	Quantity (m^3/day)	Water Circuit/stream	Quantity (m^3)/day	
Underground Dams	From: Groundwater Seepage (Arnot Project U/G Workings)	200.00	To: Underground Dust Control	60.00	
			To: PCD	139.00	
			To: Seepage	1.00	
	Total	**200.00**		**200.00**	-
Water Treatment Plant (WTP)	From: Borehole Water Supply	216.00	To: Storage in Jojo Tank	216.00	
	Total	**216.00**		**216.00**	-
Coal Handling & Processing Plant (CHPP)	From: Underground Workings (Now-closed Arnot Colliery)	1 192.29	To: Process Water Tank	1 140.00	
	From: Process Water Tank	1 140.00	To: Process losses	60.00	
	From: PCD	7.71	To: Recycled through filter press and thickener	1 140.00	
	Total	**2 340.00**		**2 340.00**	-
Process Water Tank	From: Processing Plant	1 140.00	To: Processing Plant	1 140.00	
	Total	**1 140.00**		**1 140.00**	-
Pollution Control Dam (PCD)	From: Rainfall	2.26	To: Evaporation	79.14	
	From: Runoff from dirty areas	77.64	To: Dust Suppression	132.05	
	From: Underground Dams	139.00	To: Coal Handling & Processing Plant (CHPP)	7.71	
	Total	**218.90**		**218.90**	-
Offices, Workshop & Change House			To: Consumption	41.21	
	From: Jojo Tank	42.60	To: Sewage Treatment Plant	1.39	
	Total	**42.60**		**42.60**	-
Sewage Treatment Plant (STP)			To: PCD	1.11	
	From: Offices, Workshop & Change House	1.39	To: System Losses	0.28	
		1.39		**1.39**	
Discard Dump	From: Rainfall	2.83	To: Evaporation	0.54	
			To: PCD	2.26	
			To: Seepage	0.03	
		2.83		**2.83**	-
Total Water Balance		**4 161.72**		**4 161.72**	

5 Item 1(e): Impact to be Mitigated in their Respective Phases

The proposed mitigation measures and its compliance with the relevant standards are presented in Table 5-1.

Table 5-1: Impacts to be Mitigated in their Respective Phases

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Construction	• Site/vegetation clearance (52.28 ha) • Construction of diesel storage and explosives magazine • Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) • Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office. • Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long. • Construction of Pollution control dam (PCD) (1.61 ha), Raw water pipeline, Process water, Sewage treatment plant (STP). • Stockpiling of soils, rock dump and discard dump establishment.	Soil, Land Use, and Land Capability	• Loss of usable soil (high land capability soils); • Soil erosion and sedimentation; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Soil contamination and deterioration; and • Increased runoff from hardened surfaces (soil compaction).	• If the destruction of soils with a High land capability is unavoidable, disturbance must be minimised and appropriately rehabilitated; • Environmental Practitioner to be present during soil stripping to prevent mixing of soils and ensure correct stockpiling methods, and top soil and sub-soil must be stockpiled separately(i.e., stockpile height, separate stockpiling for topsoil, subsoil and waste rock); • Long term soil stockpiles must be vegetated and allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater;; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction, • Monitor infrastructure, stockpiles and dumps to ensure no runoff, erosion and sedimentation and decreased land capability; • Monitor PCD, STP, raw water, processed water and washing plant, if spills have occurred, clean up immediately and implement a monitoring program for at least three months after the spill has occurred; • If any erosion occurs on site and adjacent of the Project Area, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; • Restrict extent of disturbance within the Project Area and minimise activity within designated areas of disturbance; • Minimise the period of exposure of soil surfaces through dedicated planning; • Ensure proper storm water management designs are in place; and • Spill containment and clean up kits should be available onsite and clean-up from any spill must be in place and executed at the time of a spillage with appropriate disposal as necessary.	• Chamber of Mines Guidelines • NEMA; and • The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA).	Life of Construction Phase.
Construction	• Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	• Fauna and Flora	• Loss of plant communities and sensitive landscapes including, Grassland and Wetland habitats; • Loss of biodiversity and SCC;	• Keep site clearing to a minimal, and restrict vehicle movement to dedicated areas; • AIP Eradication strategy should be implemented; • Make use of existing roads to encourage minimal impacts/footprint;	• NEMA; • NEM: PAA, as amended; • NFA;	Construction Phase

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			• Increased erosion; • Potential for AIP proliferation; • Loss of faunal habitat including faunal SCC.	• Avoid sensitive areas such as Rocky Outcrops, Primary Grasslands and Wetlands; • Environmental Practitioner and botanist to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct input area; • The footprint of the mine should be as compact as possible from a design point of view; and • Adhere to recommended protective buffers around wetlands as stipulated in the Wetland Report, refer to Appendix F	• MPNCA; and National Environmental Biodiversity Act (NEMBA),2004 (Act 10 of 2004).	
Construction	Stockpile of soils, rock dump and discard dump establishment	Fauna and Flora	• Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal; • Natural vegetation will be removed, damaged and fragmented promoting edge effects and AIP proliferation; • Change in habitat and potential change in species composition; and • Increased soil compaction, runoff and erosion into surrounding sensitive landscapes.	• Construction must be kept within the infrastructure footprint area, to reduce fragmentation as much as possible; • Bare land surfaces must be vegetated to limit soil erosion from surface runoff associated with stockpiles and dumps. Revegetate disturbed areas immediately after construction; • Monitor stockpiles to ensure no erosion, runoff, and sedimentation into surrounding areas; • No establishment of rubble piles; • AIPs should be continuously monitored and controlled throughout the life of the mine and thereafter with the establishment of an AIP Eradication Plan; and • Corridors (infrastructure and ecological) set aside within the mine area would mitigate fragmentation substantially, especially if this could be managed with the community over an extended period of time.	• NEMA; and • NEM:BA	Life of Construction and Operational Phase
Construction	Access and haul road construction	Fauna and Flora	• Removal of vegetation and basal layer; • Increased proliferation of AIPs; • Increased faunal casualties; and • Increased dust pollution.	• Keep site clearing to a minimum; • If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events; • Staff of the mine must adhere to policies within the operation of the mine, such as adhering to designated speed limits; • Restoration and rehabilitation of any removed vegetation and SCC should occur during the rehab phase; • Identify migratory crossing links between watercourses for herpetofauna, install correct signage to make all staff personnel aware and create safe underpasses for fauna at risk; and	• NEMA; • NEM:BA; • The Convention on International Trade in Endangered Species (CITES).	Life of Construction Phase

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• AIPs should be continuously monitored and controlled throughout the life of the mine; and thereafter, with the establishment of an AIP Eradication Plan.		
Construction	Construction of infrastructure, and ventilation Shafts	Fauna and Flora	• Increased faunal casualties and vegetation removal; • Increased risk of AIP proliferation and edge effects; and • Changes to the landscape and undulating topographies.	• AIPs should be continuously monitored and controlled throughout the life of the mine; and thereafter, with the establishment of an AIP Eradication Plan; • Keep areas of infrastructure to the absolute minimum and stay within the demarcated footprint; • Minimise the areas that are to be stripped of vegetation; • Seal ventilation shaft with a concrete to avoid plugging of any 'open shaft or excavation' that may lead to the underground workings; • No harvesting of floral or poaching of faunal species may take place by the construction employees; and • No dirty water may be disposed of in the immediate environment.	• NEM:BA • NEMA; and • National Environmental Management: Protected Areas Act, 2003 (Act No.57 of 2003)	Life of Construction Phase
Construction	Site/vegetation clearance (52.28 ha)	Wetlands	• Direct loss of 79.76 ha wetlands; • Loss of habitat and biodiversity; • Erosions and sedimentation of adjacent wetlands and water courses; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Water and soil contamination and deterioration; • Increased runoff from hardened surfaces; • Decreased water supply to the wetlands systems; and • Change in habitat and potential change in species composition.	• If the destruction of wetlands is unavoidable, disturbance must be minimised and suitably rehabilitated; • At areas where road crossings have been designed, these roads should cross wetland or river features at the narrowest point and a 90-degree angle with suitable drainage designed into the relevant bridge/culvert crossing; • Environmental Practitioner to be present during vegetation clearing to prevent unnecessary clearing of extensive areas not part of the direct footprint area; • Bare land surfaces must be vegetated to limit erosion from surface runoff associated with infrastructure areas. Revegetate disturbed areas immediately after construction, • Monitor infrastructure, stockpiles and dumps to ensure no runoff, erosion and sedimentation into the adjacent areas, especially the wetlands and freshwater systems; • Monitor PCD, STP, raw water, processed water and washing plant, if spills have occurred, clean up immediately and implement a monitoring program for at least three months after the spill has occurred; • Stockpiles must be vegetated and allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; and • Locate stockpiles and dumps outside wetlands and at least a 100 m buffer.	• NWA; • NEMB:BA; • NEMA	Construction Phase
Construction	Construction of diesel storage and explosives magazine	Wetlands				
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office	Wetlands				
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long	Wetlands				
Construction	Construction of Pollution control dam (PCD) (1.6078 ha), Raw water pipeline, Process water, Sewage treatment plant (STP)	Wetlands				
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Wetlands				

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing in proximity to the watercourses.	General mitigation actions provided in the wetlands and surface water studies conducted by Digby Wells should be used to guide the effective management of aquatic resources potentially affected by the proposed Project. However, more specific management actions for the Construction Phase are listed below: • Limit vegetation removal to the IFA only. Where removed or damaged, vegetation areas (riparian or aquatic related) should be revegetated as soon as possible; • Bare land surfaces downstream of construction activities must be vegetated to limit erosion from the expected increase in surface runoff from infrastructure; • Environmentally friendly barrier systems, such as silt nets or, in severe cases, use trenches downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction; trenches should be used as a 'temporary' management action during the construction phase, thus water (likely rainwater and dust suppression water) trapped in the trenches is expected to evaporate. However they should be closely inspected during the rainy season; • Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow; • Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses; • Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; • All vehicles must be frequently inspected for leaks; • No material may be dumped or stockpiled within any rivers, drainage lines in the vicinity of the proposed project; • All waste must be removed and transported to appropriate waste facilities; and • High rainfall periods (usually November to March) should be avoided during construction to possibly avoid increased surface runoff in attempt to limit erosion and the entering of external material (i.e. contaminants and/or dissolved solids) into associated aquatic systems.	• NWA; • NEM:BA; • NEMA; and • National Freshwater Ecosystems Priority Areas (NFEPA, Nel et al., 2011).	Prior to construction activities are initiated

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Construction	Removal of vegetation / topsoil for establishment of mining infrastructure such as the haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas.	Hydropedology	Sedimentation and siltation of watercourses through overland flow leading to reduced water quality.	The recommended management/mitigation measures are as follows: • Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised to minimise creation of new ones; • If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments and hazardous substances from construction vehicles used during site clearing; • Dust suppression with water on the haul roads and cleared areas must be undertaken to limit dust mobilisation which contribute to sedimentation of watercourses • Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath; and • Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors.	• NEMA; and • NWA	During Construction Phase.
Construction	Moving vehicles and machinery during construction of infrastructure including haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas. Handling of hydrocarbon residues and spills during construction operations.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas		• NEMA; and • NWA	During Construction Phase.
Construction	Removal of vegetation/topsoil for establishment of mining and linear infrastructure. Stockpiling of soils, rock dump and discard dump establishment.	Surface water	Sedimentation and siltation of water resources reducing flow regime within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	The recommended mitigation/management measures: • Limit vegetation clearing and limit disturbing the soil to the project/building footprint; • Control fluvial erosion and sedimentation by establishing a stormwater management plan; • Control through use of spill kits and accredited vendors for waste disposal; • Control by training of personnel in proper hydrocarbon and chemical handling methods; and • Control by bunding hydrocarbon and other waste storage facilities.	• NEM: BA; • NEMA; and • National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PAA) as amended; • NFA; • Mpumalanga Nature Conservation Act, 1998 (Act No.10 of 1998) (MPNCA); and • CARA	During the Construction Phase
Construction	Handling of hydrocarbons and general waste. Diesel storage and explosives magazine	Surface water	Surface water contamination leading to deteriorated water quality within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries			
Construction	Construction of infrastructure, and ventilation fans	Surface water	Interception of rainfall, runoff and subsurface flow leading to reduced downstream runoff yield			

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Construction	Site Clearing, Construction of Infrastructure, Access Road, Stockpiling of Topsoil and Establishment of Rock and Discard Dumps	Air Quality	Reduction in ambient air quality	• Application of a dust suppressant on the haul roads and exposed areas; • Limit activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on haul roads and have these limits enforced; • The area of disturbance must be kept to a minimum at all times and no unnecessary clearing, digging or scraping must occur, especially on windy days; and • The drop heights when loading onto trucks and at tipping points should be minimised to reduce dust generation.	• NEMA; • National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; and • National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).	On commencement of the Construction Phase and for the duration of the phase
Construction	Removal of vegetation/topsoil for the establishment of mining and linear infrastructure	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.	The following management measures are recommended as good practice guidelines: • Construction activities should be restricted to daylight hours; • Construction activities should be carried out in phases; • Construction machinery and vehicles should be switched off when not in use; • Construction vehicles should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.	Mitigation measures will assist in keeping noise levels as low as possible to comply with the National Noise Control Regulations.	During Construction Phase.
Construction	Establishing the box cut	Noise				
Construction	Construction of infrastructure, and ventilation Shafts.	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.			
Construction	Construction of access road and haul roads	Noise				
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Noise				
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting	Visual	Removal of all vegetation within the localised infrastructure area alters the aesthetics of the immediate area and creates a contrast between the stripped area and the surrounding vegetation	• Keep site clearing to a minimal, and restrict vehicle movement to dedicated areas; • Make use of existing roads to encourage minimal impacts/footprint; and • The footprint of the mine should be as compact as possible from a design point of view.	NEMA	Construction Phase

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Construction	Stockpiling of soils, rock dump and discard dump establishment	Visual	• Alteration to the baseline visual environment by creating sharp topographic variation over a relatively moderately undulating terrain. • Includes removal of natural vegetation which creates a sharp contrast.	• Stockpiles should be created with a rehabilitation design which details a favourable slope; and • Bare land surfaces must be vegetated to limit soil erosion from surface runoff associated with stockpiles and dumps. Revegetate disturbed areas immediately after construction.		Throughout LoM

Construction	All construction activities	Socio-economic	Creation of employment opportunities	• As per the legal requirements update, disclose, and implement the Social and Labour Plan.
				• Develop and implement the site-specific Employment Policy in compliance with the South African legal framework and company standards. As part of the Policy:
				  ◦ Set employment targets aimed at increasing local employment;
				  ◦ Set monitoring indicators for local employment;
				  ◦ Integrate local employment targets into all procurement contracts to which the appointed contractors must adhere to;
				  ◦ To accommodate those that do not have access to android phones or internet, widely advertise employment opportunities using community newspapers, notice boards, etc;
				  ◦ All employment opportunities must be advertised in predominantly spoken languages within the primary study area; and
				  ◦ Ensure that no employment take place at the entrance to the site (to avoid people congregating at the work site). Only formal channels for employment will be used.
				• Develop and implement a grievance mechanism. The mechanism must be widely communication to stakeholders within the primary study area, and a grievance register must be kept up-to-date.
					• NEMA;
					• Employment Equity Act, 1997 (Act No. 75 of 1997);
					• Labour Relations Act 1995 (Act No. 66 of 1995);
					• Skills Development Act, 1998 (Act No. 97 of 1998);
						Pre-construction and construction

Construction	• Establishment of infrastructure; • Construction of access and haulage road; • Site/vegetation clearance; • Infrastructure construction;	Socio-economic	Creation of Opportunities Within the Supply Chain	• Implement the SLP commitments as they relate to the local business development; • Development a Local Procurement Strategy with local business development targets aligned to the commitments set-up in the SLP for the project; • Effectively communicate the benefits of local procurement to external stakeholders;		

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
	• Diesel storage and explosive magazine ; • Sewage treatment plant ; and • Sewage treatment plant, pollution control dam.			• Considerations for local procurement should support groups, such as women, visible minorities, and youths; • Strengthen the capacity of local businesses to ensure that they are in a better position to supply the services required by the project, through holding workshops and seminars geared towards explain the tender requirements; • Consider unbundling of contracts into small work programs to ensure that small and locally based businesses can benefit; • Propose and promote joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development; • Establish a time-bound commitments to increase local procurement; Such commitments could include annual or mid-term targets for local procurement spending, supplier development programmes, local procurement plans, local procurement key performance indicators (KPIs) for procurement staff, and other local procurement objectives; • All tender process must follow existing Exxaro's SMME development strategies and programs; • Host workshops to provide training for current and potential suppliers to build up skills that were commonly identified as lacking in the supplier audits (e;g;, business plan creation, tender preparation, etc;); and • Implement the grievance mechanism.		
Construction	All project related activities associated with construction and operation	Socio-economic	Increased Incidences of Livestock Theft	• Ensure that no employment take place at the entrance to the site; • Within the limits of the law, livestock owners should consider adopting an appropriate animal identification system in accordance with the Draft Document for Livestock Identification and Traceability System South Africa (LITS SA)[19]; • Livestock owners are encouraged to regularly count their livestock to ensure that all are still accounted for. In case of missing livestock, the incident must be reported to the nearest police station; • Where site access requires that Project personnel use farm parameter fences or gates – these must be closed immediately upon entry or exit; • Livestock owners are encouraged to regularly monitor, and mend broken fences;		Pre-construction and construction

[19] Draft Document for Livestock Identification and Traceability System South Africa (LITS SA) which allows an integrated platform for livestock keeping such as animal registration.

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• Livestock should be kept away from fences or roads to reduce exposure to pedestrians; • Once the relevant environmental and mine authorisations are in place, the applicant will commence with negotiations with affected landowners to discuss suitable compensation methods to address livestock theft; and • Implement the grievance mechanism.		
Construction	All project related activities associated with construction and operation	Socio-economic	Impacts Associated with Community Health, Safety and Security	• Design and implement measures to minimise the risk of hazardous substances entering the environment, including development of an Emergency Prevention, Preparedness and Response Plan for accidents involving release of hazardous substances to the environment. • Secure storage and labelling of hazardous substances in line with the manufacturer's recommendations and measures to prevent contact with untrained personnel, birds, and animals. • Secondary containment using impervious, chemically resistant material and designed to prevent contact between incompatible materials in the event of a release. • Develop information, education and communication campaigns around diseases and health practices including communicable diseases such as HIV/AIDS, TB, and Covid-19; etc. Regularly review and update as necessary its existing communicable diseases management strategy. • During the project lifecycle, the risks and impacts to health and safety of affected landowners and communities should be evaluated and preventative measures should be taken early in the project. • Integration of organisational policies, programs, and practices, including those relevant to the control of hazards and exposures, the organisation of work, compensation, and benefits, built environment supports, leadership, changing workforce demographics, policy issues, and community supports, that will contribute to safety, health, and wellbeing. • Road safety interventions may need to range beyond their fleets of company vehicles and their workers' commutes and should consider the driving, walking, and riding practices of community members in the locality.		Pre-construction, construction, and operational phases
Construction	All Construction Activities	Socio-economic	Loss of Agricultural Land	• The Project shall purchase the land required from the directly affected landowners at the current market value to be determined by a qualified and registered land valuer. This will allow landowners who		Pre-construction, construction, and operational phases

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				want to continue their farming activities to purchase replacement farmland elsewhere. • The Project shall identify farm portions which will not be immediately mined or used and where possible, lease such to the directly affected farmers to enable them to continue with their crop production. • All Project land purchase agreements with the landowners shall include special provisions for farmworkers and / or farm dwellers. Should the landowner plan to sell he / she must do the following: ◦ Inform all farm workers and farm dwellers of the change in ownership of the land; ◦ Explain in detail the consequences of the sale of land as it relates to the farmworkers and farm dwellers; ◦ In case where the farmers will no longer continue with farming, he or she must pay the farmworkers severance packages from the sale of the farm; and ◦ In discussions with the municipality and the department of rural development and land reforms, ensure that all farm dwellers are accommodated elsewhere within eleven months after the sale of the farm. • Implement the grievance mechanism.		
Construction	All project related activities associated with construction and operations.	Socio-economic	Potential Physical Displacement of Farm Dweller Households	• Develop and implement a Resettlement Action Plan (RAP) to best practice guidelines; • Provide transitional support to displaced farm dweller households to support livelihoods during the transitional period; • Establish a consultative structure to comply with the RAP's requirements for informed participation and consultation of affected households and relevant government representatives and departments; and • Ensure that RAP implantation is monitored across time to ensure that displaced households' livelihoods are restored or improved and that they have obtained security of tenure at resettlement site. Note: Once all relevant environmental authorisations and licences are attained, the applicant will commence negotiations with the relevant affected landowners to determine suitable compensation.		Pre-construction, construction, and operational phases
Construction	All project related activities associated with construction and operations.	Socio-economic	Change Sense of Place	• Implement mitigation measures proposed in the Visual Impact Assessment Study. Implement induction programmes for all employees and contractors to increase sensitivity to local norms and customs;		All project phases

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• Project Contractors shall implement a 'no fraternization' policy at the worker's camp to minimise relations with prostitutes and unsafe sexual interaction with residents; • Implement traffic safety measures, particularly speed control and driver awareness training for all drivers; • Minimise the construction footprint in forested areas and ensure that disturbed areas are rehabilitated with indigenous trees and other plants; • Adequate plan for rehabilitation; • Offset negative experience of altered sense of place by maximising local employment/ economic benefits; and • Implementation of the grievance procedure.		
Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Soil, Land Use, and Land Capability	Infrastructure area: • Soil quality contamination and deterioration; • Loss of usable soil for agriculture; • Soil erosions and sedimentation; and • Increased runoff and flow from hardened surfaces (soil compaction). Underground mined areas: • Subsidence; • Dewatering; • Groundwater and soil contamination; and • Decreased land capability and agricultural potential.	• All vehicle maintenance and refuelling must occur within designated areas and inspected regularly for leaks; • All spills must be cleaned up immediately to prevent contaminants to enter the soils and groundwater. Monitoring must take place at least for three months after the spill have occurred to determine any contamination; • Culverts, roads, conveyors, powerlines and river crossings must be maintained, cleared and monitored; • All vehicles must remain on demarcated roads and within the operational footprint; • Stockpiles should be monitored and vegetated to ensure no runoff, erosion, sedimentation and loss of soil fertility; • Stockpiles must be allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; • A Storm Water Management Plan (SWMP) should already be implemented. This should consider all wetlands and other watercourses adjacent and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses. The SWMP should also convey contaminated water to silt traps to limit erosion and subsequent contaminants into soils and groundwater;	• Chamber of Mines Guidelines; • NEMA; and • CARA.	Life of Operational Phase
Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Soil, Land Use, and Land Capability				
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Soil, Land Use, and Land Capability				

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	Soil, Land Use, and Land Capability		• Monitoring of subsidence, dewatering and contamination must take place regularly to access possible impacts to soils; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; • Chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions; • Re-vegetate cleared areas and stockpiles to avoid wind and water erosion; • Preserve looseness of stockpiled soil by executing fertilisation and seeding operations by hand; • If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; • A Topsoil Management Plan (TMP) must be prepared to demonstrate how topsoil will be preserved in a condition as near as possible to its pre-mining condition to allow successful mine rehabilitation (Statham, 2014); • Long term stockpiles should be revegetated to minimise loss of soil quality. This will minimise AIPs, maintain soil organic matter levels, maintain soil structure, and microbial activity; and • Compacted areas are to be ripped to loosen the soil structure.		
Operational	Continue with exploration activities	Soil, Land Use, and Land Capability				
Operational	Underground blasting and operation of the underground workings.	Fauna and Flora	• Increased risk of post-mining land subsidence; • Loss of topsoil; • Impacts on the hydrological systems (water table) impacting the habitat ecology and ecosystem services; and • Potential contamination of underground water with hydrocarbons, polluting sensitive habitats for sensitive faunal and floral species..	• Adhere to all management and mitigation measures as prescribed within other specialist reports; • To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the mining personal; and • Prevent impacts from reaching downstream water resources and hydrophilic environments (wetlands) by ensuring installation and proper functioning of stormwater systems and drains to prevent contaminated water entering the natural environment. This will be prudent in this development, since petroleum and other hydrocarbons associated with the trucks and vehicle-based activities are likely to be spilled in the environment if not managed well. As referenced by the Digby Wells Hydropedology Report (2021), implementation of a proposed water stormwater management plan is important to reduce sedimentation and siltation of nearby watercourses.	• NEMA; • NEM:BA; and • CITES.	Life of Operational Phase

DIGBY WELLS ENVIRONMENTAL

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste.	Fauna and Flora	Contamination of soil, water and surrounding areas / habitats (pan and wetland vegetation) from hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	• All spills should be immediately cleaned up, and treated accordingly; and • Re-fuelling must take place on a sealed surface area away from sensitive habitats such as the pan vegetation to prevent the ingress of hydrocarbons into the topsoil.		
Operational	Continue with exploration activities	Fauna and Flora	• Continuous disturbances to the fauna and flora by explorative activities;; • Increased vehicle activity; and • Continuous anthropogenic influence stemming from staff, residents and visitors that infiltrate the unexplored natural veld areas will damage and impact on species communities within certain areas. This could disturb unidentified SCC.	• All footprint areas should remain as small as possible; • If any SCC are encountered within the Project Area the future, the following should be ensured: • If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas or within designated open space on the subject property; • All rescue and relocation plans should be overseen by a suitably qualified specialist; and • Obtain relevant permits/consent, if applicable, for each protected or endangered floral species identified within the proposed development area that will be destroyed. • Human and vehicle movement should be restricted from taking place in sensitive habitats.		

Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Wetlands	• Infrastructure area:
			  • Water and soil quality contamination and deterioration;
			  • Loss of habitat and biodiversity;
			  • Erosion and sedimentation;
			  • Increased runoff and flow from hardened surfaces; and
			  • Change in habitat and potential change in species composition.
			• Underground mined areas:
			  • Subsidence;
			  • Dewatering; and
			Groundwater contamination.
				• Freshwater resource monitoring must be carried out during the operational phase by a wetland specialist to ensure no unnecessary impact to the freshwater resources present, and if so that a remedy is put in place as soon as possible;
				• If it is unavoidable that any of the wetlands will be affected, the disturbance must be minimised and suitably rehabilitated;
				• All vehicle maintenance must occur within designated areas and inspected regularly for leaks;
				• All spills must be cleaned up immediately to prevent contaminants to enter the wetlands. Monitoring must take place at least three months after the spill have occurred to determine any contamination;
				• Re-fuelling and maintenance must take place on a sealed surface area away from wetlands to prevent the ingress of hydrocarbons into topsoil;
				• All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off-limits to all unauthorised vehicles and personnel;
				• No material is to be dumped or stockpiled within any rivers, tributaries or drainage lines;
					• NEMA;
					• NWA;
					• NEM: BA; and
					• The Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP).
						Pre-construction and construction

Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Wetlands				
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Wetlands				
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater	Wetlands				

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
	management infrastructure and stockpile areas.			• Culverts, roads, conveyors, powerlines and river crossings must be maintained, cleared and monitored;		
Operational	Continue with exploration activities	Wetlands		• No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas or their buffer areas. All vehicles must remain on demarcated roads and within the operational footprint; • Stockpiles should be monitored and vegetated to ensure no runoff, erosion and sedimentation into the adjacent areas, especially the wetlands and freshwater systems; • Stockpiles must be allocated to specific areas and stockpiled on hardened surfaces to prevent leaching of contaminants into the soil and groundwater; • Stockpiles must be located outside wetlands and at least a 100 m buffer; • A Storm Water Management Plan (SWMP) should already be implemented. This should consider all wetlands and other watercourses adjacent and downstream of the new developments/infrastructure which should divert stormwater and wastewater away from the surface infrastructure and back into natural watercourses to maintain catchment yield as far as possible. The SWMP should also convey contaminated water to silt traps to limit erosion and the subsequent increase of suspended solids in downstream watercourses; • Monitoring of subsidence, dewatering and contamination must take place regularly to access possible impacts to wetlands; • Care must be taken to ensure that contamination of the receiving environment as a result of mining activities is minimised as far as possible; and • Chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions.		
Operational	Uncontrolled runoff of stormwater or process water from or through the surface infrastructure.	Aquatics	Water quality deterioration of watercourses receiving unnatural/contaminated runoff.	The following management actions are recommended to guide the effective management of stormwater and water generated on site: • Runoff from dirty areas should be directed to the storm water management infrastructure (drains and PCDs) and should not be allowed to flow into the nearby watercourses, unless DWS discharge authorisation and compliance with relevant discharge standards are adhered to; • If discharge of water occurs, bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants;	• NWA; • NEM:BA; • NEMA; and • NFEPA, Nel et al., 2011).	Ongoing

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; • The Dynamic Subsidence Reclamation or DSR techniques, similar to concurrent mining and reclamation concepts used in surface mining should be applied (reader is referred to Hu et al. (2016)); and • Monitoring of the associated water courses should be done by an aquatic specialist to determine potential impacts where after new mitigation actions should be implemented as per the specialist's recommendations.		
Operational	Operation of the Box Cut as a means for secure and safe entrance and access to the decline of the underground mine	Hydropedology	Disruption of water flow paths will likely reduce the quantity of water reporting to the Vaalwaterspruit thereby affecting the availability of water for downstream water users	Recommended management/mitigation measures are as follows: • Implementation of the proposed stormwater management plan to reduce sedimentation and siltation of nearby watercourses. The recommended perimeter berms around the discard dump, lay down areas, box cut, overburden dump and stockpiles will ensure that clean water is diverted from the dirty areas; Similar to the construction phase the following should be conducted to mitigate contamination of water resources during the operation phase: • Hydrocarbon waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills; • Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath; and • Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas. Any used oil should be disposed of by accredited contractors.	• NEMA; and • NWA	During Operational Phase
Operational	• Overland flow and interflow from the dirty areas or catchments (coal stockpile areas, mine processing plant, workshops, lay down areas etc.). • Hydrocarbon residues including oil, grease and fuel spillages from equipment, moving haulage trucks and machinery transported to watercourses.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas		• NEMA; and • NWA	During Operational Phase
Operational	Areas containing topsoil stockpiles, overburden, and discard dumps.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	Recommended mitigation/management measures are as follows: • Control by implementing a comprehensive storm water management plan which addresses fluvial erosion control; • Stockpiles should be stored away from the drainage line; • Control through implementation of a SWMP for dirty water management; • Control through water quality and quantity monitoring and updating the mine-wide water balance;	• NEMA; • NEM:WA; and • NWA	During the Operational Phase
Operational	• Handling of hydrocarbons and general waste; and Spillages and leakages from maintenance of haul	Surface water	Contamination of water resources and deterioration of water quality.			

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
	roads, pipelines, and machinery. • Use of water for mining operations and production of contaminated effluent/process water.			• Maintenance of infrastructure and mining vehicles to reduce leakages; and • Remedy through re-profiling and rehabilitation of previously disturbed landscapes		
Operational	Operation of the Underground Mine, Ventilation Shaft, Use and Maintenance of Haul Road, and Concurrent Rehabilitation	Air Quality	Dust generation and release of gaseous pollutants leading to poor air quality	• Application of dust suppressant on the haul roads and exposed areas; • Limit dust-generating activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on dirt roads and have these limits enforced; • The drop heights when loading onto trucks and at tipping points should be minimised; and • Dust mitigation equipment for the vent shaft.	• NEM: AQA and • National Ambient Air Quality Standards	Measurements must commence before the start of the operation phase and for the LoM.
Operational	Ventilation fans and infrastructure area containing stockpile areas	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance	The following management measures are recommended as good practice guidelines. • Machinery and vehicles used for mining and/ maintenance work should be switched off when not in use; • Vehicles used for mining and maintenance work should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • A concrete wall should be used as the perimeter fence instead of a wire fence; • Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.	Mitigation measures will assist in keeping noise levels as low as possible to comply with the National Noise Control Regulations.	Operational Phase
Operational	Underground blasting	Noise	Noise impacts are considered to be negligible therefore was not assessed further.			
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent, and stormwater management infrastructure and stockpile areas.	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.			
Operational	Removal of rock (blasting).	Noise	Noise impacts are considered to be negligible therefore was not assessed further.			
Operational	Establishment and upkeep of Mine related structures along with the box cut	Visual	• Alterations of the natural visual character of the region • Long term vegetation loss • Land cover and land use changes	• As far as possible, preserve the natural vegetation to reduce the visual impact; • Sensitive receptors should be mitigated from the visual impact by a strategic usage of tree-lines and on site berm features which integrate with effective landform design; and	• NEMA; • NEM: PAA; and • NHRA.	Operational Phase

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• Buildings on site should be kept to a colour that does not bear a large contrast to the existing natural vegetation and landscape.		
Operational	Establishment and operation of the stockpile and plant region during operations	Visual	Constant topographical changes to the stockpiles, which also have a sharp contrast to the natural landcover in the region	Visual screens be placed in the form of tree-lines, particularly along highly sensitive areas along the R38.		
Operational	Lighting of mine infrastructure at night	Visual	• The mine site would contain lighting for security and operational safety purposes. • The artificial lighting could provide a source of distraction to receptors in the region.	• Focus the lights towards components of the mine that require specific lighting to avoid light dispersal; and • Consider utilizing lower lumen lighting that does now spill outside of the mine region.		

Operational	All project related activities associated with construction and operation.	Socio-economic	Creation of Long-term Employment Opportunities, Skills Development and Work Experience	• As per the legal requirements update, disclose, and implement the Social and Labour Plan.
				• Develop and implement the site-specific Employment Policy in compliance with the South African legal framework and company standards. As part of the Policy:
				  • Set employment targets aimed at increasing local employment;
				  • Set monitoring indicators for local employment;
				  • Integrate local employment targets into all procurement contracts to which the appointed contractors must adhere to;
				  • To accommodate those that do not have access to android phones or internet, widely advertise employment opportunities using community newspapers, notice boards, etc;
				  • All employment opportunities must be advertised in predominantly spoken languages within the primary study area; and
				  • Ensure that no employment take place at the entrance to the site (to avoid people congregating at the work site). Only formal channels for employment will be used.
				• Develop and implement a grievance mechanism. The mechanism must be widely communication to stakeholders within the primary study area, and a grievance register must be kept up-to-date.
					• NEMA;
					• MPRDA;
					• Employment Equity Act, 1998 (Act No. 55 of 1998);
					• Skills Development Act (Act No. 97 of 1998 as amended); and
					• Company employment policies.
						Construction and operation

Operational	All project related activities associated with construction and operation.	Socio-economic	Opportunities and Capabilities within the Supply Chain	• Implement the SLP commitments as they relate to the local business development;		

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• Development a Local Procurement Strategy with local business development targets aligned to the commitments set-up in the SLP for the project; • Effectively communicate the benefits of local procurement to external stakeholders; • Considerations for local procurement should support groups, such as women, visible minorities, and youths; • Strengthen the capacity of local businesses to ensure that they are in a better position to supply the services required by the project, through holding workshops and seminars geared towards explain the tender requirements; • Consider unbundling of contracts into small work programs to ensure that small and locally based businesses can benefit; • Propose and promote joint ventures between large and small Contractors to ensure equitable sharing of economic benefits and skills development; • Establish a time-bound commitments to increase local procurement; Such commitments could include annual or mid-term targets for local procurement spending, supplier development programmes, local procurement plans, local procurement key performance indicators (KPIs) for procurement staff, and other local procurement objectives; • All tender process must follow existing Exxaro's SMME development strategies and programs; • Host workshops to provide training for current and potential suppliers to build up skills that were commonly identified as lacking in the supplier audits (e;g;, business plan creation, tender preparation, etc;); and • Implement the grievance mechanism.		
Operational	All project related activities associated with construction and operation.	Socio-economic	Changes to the Water Quality	• Implement mitigation measures outline in the Surface and Ground Water Specialist Studies associated with this project; and • Implement a grievance mechanism.		Construction and operation
Operational	All project related activities associated with construction and operation.	Socio-economic	Impacts Associated with Surface Subsidence	• Develop a Subsidence Management Plan (SMP) prior to the establishment of the mine. The Plan should prioritise the adequate protection of important natural and built features within the Project area. Management could include avoidance of damage to particularly natural features, mitigation of damage or rehabilitation; • Possible relocation of people away from all infrastructure areas while surface subsidence occurs could be implemented in accordance with		

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				best practice guidelines for resettlement. In all cases, adequate budget must be provided for repairs to water and electrical supply systems, walls of buildings, fencing, and roadways; and • Implement a grievance mechanism.		

Operational	All project related activities associated with construction and operation.	Socio-economic	Occupational Health Risks to Mine Workers	• Develop and implement a detailed Occupational Health and Safety Management Plan and System. The Occupational Health and Safety (OHS) management plan should include, but not limited to:
				  ◦ Hazard identification and risk assessment procedure;
				  ◦ A 'fitness for work' programme to ensure that all employees are physically able to undertake their work without impact to their health;
				  ◦ Mandatory OHS training programmes provided to all employees, including contractors to ensure staff are aware of the health and safety guidelines;
				  ◦ Specific OHS training programmes provided for workers assigned to tasks associated with H&S risks;
				  ◦ All workers should be provided with Personal Protective Equipment (PPE) and be mandated to use it;
				  ◦ Placement of visual warning signs in place, including those for the electrical and mechanical equipment safety warning, and chemical hazard warning;
				  ◦ Toolbox talks or health and safety meeting daily to ensure that procedures are being adhered to, and to discuss any incidents that have occurred;
				  ◦ Develop and implement a workforce grievance procedure where they can raise issues and concerns relating to OHS;
				  ◦ Conduct information, education, and communication campaigns amongst Project Personnel on hygiene and sanitation; and
				  ◦ Provide awareness, counselling, and testing (ACT) for all Project personnel, including voluntary testing for STIs and HIV/AIDS in pre-employment and on-going health screening. (Workers will not be denied employment or discriminated against in any way based on their HIV status).
				• Project workers including third party Contractors to be subject to health and safety standards and policies; and
				• Develop and implement a workforce grievance mechanism.		

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Operational	All project related activities associated with construction and operation	Socio-economic	Economic Multiplier	• Implement enhancement measures linked to employment creation and opportunities associated with the supply chain; • Implement the SLP related interventions; • Compliance with SLP commitments to make maximum use of local SMMEs and BBBEE companies; and • Implement the grievance mechanism.		
Operational	All project related activities associated with construction and operation.	Socio-economic	Social Development as part of Social and Labour Plan (SLP)	• Consultation with Project beneficiaries regarding proposed community development needs and associated initiatives; • Early identification of community members for enrolment in ABET and portable skills training to improve likelihood of employment on the mine; • Conduct baseline socio-economic survey of households located within primary study area prior to commencement of community development initiatives to enable accurate identification of eligible Local Economic Development (LED) project and skills training beneficiaries and measure impacts of development initiatives on households; • Collaboration with other developmental role players during implementation; • Establishing an external monitoring programme to monitor and evaluate community development initiatives as well as HRDP and procurement policy implemented by the mine and its contractors; • Expanding skills development and capacity building programmes to non-employees; and • Maintaining a record of training courses completed per individual and community. Where training is offered to non-employees, their contact information and qualifications can be shared with other industries		
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Ground Vibration	• Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing; and • Monitor ground vibration and air blast from blasting operations	• NEMA; • MPRDA; • Mine Health and Safety Act, 1996 (Act No. 29 of 1996); and	Operational Phase
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Air blast	Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths.		

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Fly rock	• Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect; and • Monitor fly rock situation using video camera	• Explosives Act, 2003 (Act No. 15 of 2003).	
Decommissioning	Demolition and removal of infrastructure.	Soil, Land Use, and Land Capability	• Soil erosion and sedimentation; • Decreased soil fertility and increased AIPs; • Soil contamination due to decanting and the groundwater contamination plume; • Subsidence; • Dewatering; and • Decreased land capability and agricultural potential.	• Rehabilitation and decommissioning should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation; • Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material, and sedimentation; • Implement and maintain a AIPs Management Plan for the duration of the rehabilitation phase and into closure; • Rehabilitation must be done as soon as any impacts are observed (decanting, subsidence and contamination); • Monitor subsidence and possible decant of Acid Mine Drainage (AMD) and implement management measures which include for example an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021); • Impacts associated with surface subsidence will be to undertake a detail photographic exercise on all infrastructure in close proximity of the project area. This record can be used as baseline prior to construction; • Newly shaped and topsoiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; • Ensure proper storm water management designs are in place and should be kept in place until all infrastructure is removed. Where infrastructure will remain, stormwater and culverts should be maintained and monitored for erosion and AIPs; • Continue with Concurrent Rehabilitation, and implement land rehabilitation measures; • Address compacted areas by deep ripping to loosen the soil, and revegetate the area; and • The backfilled, reprofiled landscape should be top soiled and revegetated to allow free drainage close to the pre-mining conditions.	• Chamber of Mines Guidelines; • NEMA; and • CARA.	Life of Decommissioning Phase
Decommissioning	Post-closure monitoring and rehabilitation.	Soil, Land Use, and Land Capability				
Decommissioning	Closure of the underground mine.	Soil, Land Use, and Land Capability				
Decommissioning	Demolition and removal of infrastructure.	Fauna and Flora	• Disturbance of soils, and subsequent erosion by wind and water;	• Continue with concurrent Rehabilitation, begin with stockpiles, bare grounds and dumps, implement rehabilitation measures;	• NEM: BA; • NEMA	Decommissioning Phase

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			• Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Unexpected changes in topography and landscape as a result of subsidence.	• Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible to prevent AIP sprawl; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and • Only designated access routes are to be used to reduce any unnecessary compaction.	• NEM: PAA (as amended); and • CARA.	
Decommissioning	Post-closure monitoring and rehabilitation	Fauna and Flora	• Minimal negative impacts on the environment; • Activities involve the rehabilitation processes of reprofiling the soils and re-vegetation thereafter; • Impacts include the possibility of erosion and sedimentation; • Proliferation of AIPs; and • Change in the habitat and species composition.	• During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season (October to February) to ensure adequate plant recruitment; • Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible; • Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged; and • Only designated access routes are to be used to reduce any unnecessary compaction.		
Decommissioning	Closure of the underground mine.	Fauna and Flora	• Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats. • Change in the land topography and species composition.	• Ensure mitigations measures to prevent subsidence are enforced and maintained throughout the decommissioning phase; and • Impacts associated with surface subsidence will be to undertake a detail photographic exercise on all infrastructure in close proximity of the project area. This record can be used as baseline prior to construction.		

Decommissioning	Demolition and removal of infrastructure.	Wetlands	• Impacts to the wetlands and watercourses include:
			  • Erosion and sedimentation;
			  • Increased AIPs;
				• Rehabilitation should occur in the dry season to avoid high rainfall events that could lead to increased runoff, erosion, contamination and sedimentation of the wetlands;
				• Mine-affected water should be reintroduced into the environment without treatment, if necessary, and a WUL;
					• NWA;
					• NEM:BA; and
					• NEMA
						During the decommissioning phase and post-decommissioning phase

Decommissioning	Post-closure monitoring and rehabilitation.	Wetlands				
Decommissioning	Closure of the underground mine.	Wetlands				

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
			• Change in habitat and potential change in species composition; • Soil and water contamination due to decanting and the groundwater contamination plume; • Subsidence; and • Dewatering.	• Actively landscape and re-vegetate disturbed areas as soon as possible to avoid loss of soil, organic material, and sedimentation into wetland areas; • Implement and maintain a Wetland and AIPs Management Plan for the duration of the rehabilitation phase and into closure; • No material should be dumped/stockpiled within any wetlands or watercourses; • No vehicles or heavy machinery should be allowed to drive indiscriminately within any wetland areas or their buffers. All vehicles must remain on demarcated roads; • Wetland monitoring must be carried out during the Rehabilitation phase into mine closure to ensure no unnecessary impact to wetlands takes place; • Rehabilitation must be done as soon as any impacts are observed (decanting, subsidence and contamination); • Monitor subsidence and possible decant of AMD and implement management measures which include for example an abstraction borehole placed down gradient of the decant point and in-situ passive treatment or neutralisation and electrolytic treatment using a WTP to get purified water for discharge to the natural environment or other beneficial uses (refer to Groundwater Impact Assessment, 2021); • Impacts associated with surface subsidence will be to undertake a detail photographic exercise on all infrastructure in close proximity of the project area. This record can be used as baseline prior to construction; • Newly shaped and topsoiled areas must be revegetated as soon as possible to prevent sedimentation and erosion; and • Implement a Wetland Offset Strategy to compensate for residual impacts to the wetlands.		
Decommissioning	Decant and runoff of contaminated water entering aquatic ecosystems.	Aquatics	Water quality deterioration of watercourses in contact with contaminated water resulting in AMD.	The goal of mitigation should be to prevent and or limit the decant of contaminated water into associated aquatic ecosystems. The following measures may be utilised in attempt to reduce the Decommissioning and Post Closure impacts: • The demolition of infrastructure should occur during the dry season to avoid increase runoff of contaminated water into associated watercourses; • Best practise rehabilitation should be utilised to trap and contain the deep sediments that contain the acid forming rock responsible for acid water formation;	• NWA; • NEM:BA; and • NEMA;	During the decommissioning phase and post-decommissioning phase

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• Subsidence and decant should be monitored to prevent changes to the geomorphology of the water courses and potential contamination with AMD; • Impacts associated with surface subsidence will be to undertake a detail photographic exercise on all infrastructure in close proximity of the project area. This record can be used as baseline prior to construction; and • If decant occurs post-closure, passive treatment with lime or other alkaline compounds can be applied to neutralise AMD at the decant points. Aquatic biomonitoring is also recommended to monitor any changes in the aquatic ecosystems and to provide solutions for identified, additional/unforeseen impacts for at least three years after rehabilitation.		
Decommissioning	Demolition and removal of infrastructure	Hydropedology	Sedimentation and siltation of watercourses due to increased soil erosion leading to reduced water quality.	• The following mitigation/management measures are recommended: • Soil disturbances during demolition should be restricted to the relevant footprint area; • All decommissioning activities should be undertaken in a way to minimise disturbance of soils which will lead to erosion, sedimentation and siltation of the Vaalwaterspruit. • In the event of decanting, passive treatment (through application of calcium compounds) should be implemented to neutralise and treat the AMD before being discharged back into freshwater resources; • Use of constructed wetlands can also be considered as a mitigation measure against AMD; • Alternatively, when passive treatment fails to correct the situation active Water Treatment (e.g. Reverse Osmosis) should be considered; and • Post closure monitoring should be conducted for at least 5 years after decommissioning to help with the early detection of decant and prevent or reduce contamination of water resources.	• NEMA; and • NWA	During Decommissioning Phase
Decommissioning	After decommissioning, dewatering ceases and water accumulates within the mine shaft and the water reacts with the pyrite in the backfilled material, thereby becoming acidified and starts decanting at low lying positions, including the adjacent Vaalwaterspruit.	Hydropedology	Contamination of soil and water resources from potential decant of AMD and movement of contamination plume due to the re-watering of the mine shaft		• NEMA; and • NWA	During Decommissioning Phase
Decommissioning	Demolition and removal of infrastructure.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries.	Recommended mitigation/management measures: • Control through limiting disturbance of soils to where demolition will be taking place and the demolition site should be cleared as quickly as possible to avoid sediment erosion; • Maintain demolition vehicles to ensure that no leakages occur, and all chemical related waste and storages should be handled by trained personnel; • Control the quality of water through water quality monitoring;	• NEMA; • NEM:WA; • NWA; • GN R 704; and • DWA BPGs, 2008.	During the Decommissioning Phase
Decommissioning	Spillages and leakages from vehicles and machinery during demolition of infrastructure.	Surface water	Contamination of water resources from AMD and deterioration of water quality.			

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation

Decommissioning	Decant of AMD.	Surface water	Water Contamination from AMD into surface water resources.	• Options to deal with AMD include the following:
				  ◦ Actively treating AMD decant to acceptable water quality levels for re-use or prior to discharge into the natural stream; and
				  ◦ Passive treatment or neutralisation of AMD effluent with calcium carbonate or lime at identified decant points to obtain water with acceptable quality.
				• Remedy through rehabilitation of areas previously occupied by ventilation fans and other infrastructure, post-closure; and
				• Remedy through re-profiling and rehabilitation of previously disturbed landscapes.		

Decommissioning	Post-closure monitoring and rehabilitation Closure of the underground mine.	Surface water	Restoration of free drainage and runoff yield at least to a certain extent.			
Decommissioning	Demolition and Removal of Infrastructure and Rehabilitation	Air Quality	Dust generation leading to poor air quality	• Application of dust suppressant on the haul roads and exposed areas; • Limit activity to non-windy days (wind speed less than 5.4 m/s); • Set maximum speed limits on dirt roads and have these limits enforced; • The area of disturbance must be kept to a minimum at all times and no unnecessary clearing, digging or scraping must occur, especially on windy days; • The drop heights when loading onto trucks and at tipping points should be minimised and • Rehabilitation of disturbed land to allow for vegetation growth.	• NEM: AQA and • National Ambient Air Quality Standards.	On commencement of the decommissioning phase and for the duration of the phase
Decommissioning	Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation for the final land rehabilitation	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance. However, the removal of noise generating sources will also lead to a reduction in the noise levels.	• Restrict decommissioning activities to daylight hours; • Construction vehicles should be equipped with a Brigade white noise reversing alarm (buzzer type reverse alarm) installed, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Regularly service machines and vehicles to ensure noise suppression mechanisms are effective e.g., installed exhaust mufflers; • Regulate speed limits on access roads; and • Switch off equipment when not in use.	SANS 10103	Decommissioning and Rehabilitation Phase
Decommissioning	Rehabilitation – rehabilitation mainly consists of spreading and landscaping of the preserved subsoil and topsoil, profiling of the land, and re-vegetation.	Noise	Noise impacts are considered to be negligible therefore will not be assessed further.			
Decommissioning	Post-closure monitoring and rehabilitation.	Noise				
Decommissioning	Decommissioning	Socio-economic	Economic Boom-Bust after the Operation Phase	• Develop and implement an integrated Mine Closure Plan; and	NEMA	Decommissioning and Rehabilitation Phase

Phase	Project Activity	Aspect	Impacts	Mitigation Measures	Compliance with standards	Time frame for implementation
				• Proactively assess and manage the social and economic impacts on individuals, regions, and economies where retrenchment and/or closure of the Project are certain.		

6 Item 1(f): Impact Management Outcomes

Table 6-1 explains the measures to rehabilitate the environment affected by the undertaking of any listed activity.

Table 6-1: Impacts to be Mitigated in their Respective Phases

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Construction	• Site/vegetation clearance (52.28 ha) • Construction of diesel storage and explosives magazine • Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) • Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office. • Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long. • Construction of Pollution control dam (PCD) (1.61 ha), Raw water pipeline, Process water, Sewage treatment plant (STP). • Stockpiling of soils, rock dump and discard dump establishment.	Soil, Land Use, and Land Capability	• Loss of usable soil (high land capability soils); • Soil erosion and sedimentation; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Soil contamination and deterioration; and • Increased runoff from hardened surfaces (soil compaction).	• Concurrent rehabilitation through the life of mine	• Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation; and • To prevent the loss of topsoil as a resource.
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting.	Fauna and Flora	• Loss of plant communities and sensitive landscapes including, Grassland and Wetland habitats; • Loss of biodiversity and SCC; • Increased erosion; • Potential for AIP proliferation; • Loss of faunal habitat including faunal SCC.	• Modify, remedy, control, or stop • Concurrent rehabilitation through the life of mine	• To minimise disturbance of natural habitats; and • To minimise the loss of SCC
Construction	Stockpile of soils, rock dump and discard dump establishment	Fauna and Flora	• Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal; • Natural vegetation will be removed, damaged and fragmented promoting edge effects and AIP proliferation;		

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
			• Change in habitat and potential change in species composition; and • Increased soil compaction, runoff and erosion into surrounding sensitive landscapes.		
Construction	Access and haul road construction	Fauna and Flora	• Removal of vegetation and basal layer; • Increased proliferation of AIPs; • Increased faunal casualties; and • Increased dust pollution.		
Construction	Construction of infrastructure, and ventilation Shafts	Fauna and Flora	• Increased faunal casualties and vegetation removal; • Increased risk of AIP proliferation and edge effects; and • Changes to the landscape and undulating topographies.		
Construction	Site/vegetation clearance (52.28 ha)	Wetlands	• Direct loss of 79.76 ha wetlands; • Loss of habitat and biodiversity; • Erosions and sedimentation of adjacent wetlands and water courses; • Erosion and sedimentation from stockpiles, rock dump and discard dump; • Water and soil contamination and deterioration; • Increased runoff from hardened surfaces; • Decreased water supply to the wetlands systems; and • Change in habitat and potential change in species composition.	• Concurrent rehabilitation through the life of mine	• To prevent unnecessary impacts on wetlands.
Construction	Construction of diesel storage and explosives magazine	Wetlands			
Construction	Establishment of infrastructure (Infrastructure footprint - 13.2849 ha; linear infrastructure - 51 501 m) Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office	Wetlands			
Construction	Construction of access and haulage road (19 113 meters), Power line construction 22kV line, 2.3 km long	Wetlands			
Construction	Construction of Pollution control dam (PCD) (1.6078 ha), Raw water pipeline, Process water, Sewage treatment plant (STP)	Wetlands			
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Wetlands			
Construction	Site clearance and construction of proposed infrastructure	Aquatics	Land and vegetation manipulation/clearing in proximity to the watercourses.	• Modify through construction site planning • Control through stormwater management and sediment containment infrastructure.	• To prevent unnecessary impacts on Aquatic ecology

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Construction	Removal of vegetation / topsoil for establishment of mining infrastructure such as the haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas.	Hydropedology	Sedimentation and siltation of watercourses through overland flow leading to reduced water quality.	• Control through restricting clearance or disturbance to the project footprint	• To minimise impacts on water resources
Construction	Moving vehicles and machinery during construction of infrastructure including haul roads, discard dump, offices, workshop and change houses, PCD, silt traps and lay down areas. Handling of hydrocarbon residues and spills during construction operations.	Hydropedologv	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	• Control through training personnel in proper waste handling measures, and through monthly water quality monitoring for the life of mine	
Construction	Removal of vegetation/topsoil for establishment of mining and linear infrastructure. Stockpiling of soils, rock dump and discard dump establishment.	Surface water	Sedimentation and siltation of water resources reducing flow regime within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	• Control by implementing proposed stormwater management plan to minimise impacts on the environment	• To prevent unnecessary impacts on water resources.
Construction	Handling of hydrocarbons and general waste. Diesel storage and explosives magazine	Surface water	Surface water contamination leading to deteriorated water quality within the Vaalrivierspruit, Klein-Olifantsrivier and their tributaries		
Construction	Construction of infrastructure, and ventilation fans	Surface water	Interception of rainfall, runoff and subsurface flow leading to reduced downstream runoff yield		
Construction	Site Clearing, Construction of Infrastructure, Access Road, Stockpiling of Topsoil and Establishment of Rock and Discard Dumps	Air Quality	Reduction in ambient air quality	• Control through the implementation of an air quality management plan; • Dust control measures; and • Ambient air quality monitoring	• To prevent air pollution.
Construction	Removal of vegetation/topsoil for the establishment of mining and linear infrastructure	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.	• Noise control measures; and Noise monitoring.	• To comply with the definition of ‘noise disturbance’ as described by the National Noise Control Regulations.
Construction	Establishing the box cut	Noise			
Construction	Construction of infrastructure, and ventilation Shafts.	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.		
Construction	Construction of access road and haul roads	Noise			
Construction	Stockpiling of soils, rock dump and discard dump establishment.	Noise			

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Construction	Removal of vegetation / topsoil for establishment of surface infrastructure and box cutting	Visual	Removal of all vegetation within the localised infrastructure area alters the aesthetics of the immediate area and creates a contrast between the stripped area and the surrounding vegetation	• NEMA	• Construction Phase
Construction	Stockpiling of soils, rock dump and discard dump establishment	Visual	• Alteration to the baseline visual environment by creating sharp topographic variation over a relatively moderately undulating terrain. • Includes removal of natural vegetation which creates a sharp contrast.		• Throughout LoM
Construction	All construction activities	Socio-economic	Creation of employment opportunities	• Enhancement measures: • Promotion of employment of local people and compliance with national employment related legislation. • Promotion of local procurement of goods and services as well as SME capacity development.	• To enhance the positive impacts associated with the project to benefit the local communities and economy
Construction	• Establishment of infrastructure; • Construction of access and haulage road; • Site/vegetation clearance; • Infrastructure construction; • Diesel storage and explosive magazine ; • Sewage treatment plant ; and • Sewage treatment plant, pollution control dam.	Socio-economic	Creation of Opportunities Within the Supply Chain		
Construction	All project related activities associated with construction and operation	Socio-economic	Increased Incidences of Livestock Theft	• Remedy and control through monitoring of local employment targets	• To enhance the positive impacts associated with the project to benefit the local communities and economy
Construction	All project related activities associated with construction and operation	Socio-economic	Impacts Associated with Community Health, Safety and Security	• Remedy and control through monitoring of local employment targets	
Construction	All Construction Activities	Socio-economic	Loss of Agricultural Land	• Remedy and control through monitoring of local employment targets	
Construction	All project related activities associated with construction and operations.	Socio-economic	Potential Physical Displacement of Farm Dweller Households	• Remedy and Control through best practice and implementation of a RAP	• To ensure that compensation is received economic displacement impacts.
Construction	All project related activities associated with construction and operations.	Socio-economic	Change Sense of Place	• Control and prevention measures: • Limiting the modification of the area in terms of visual changes	• To enhance the positive impacts associated with the project to benefit the local communities and economy.

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
				through implementation of concurrent rehabilitation throughout LoM • Limiting interactions between local people and project workers.	
Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Soil, Land Use, and Land Capability	Infrastructure area: • Soil quality contamination and deterioration; • Loss of usable soil for agriculture; • Soil erosions and sedimentation; and • Increased runoff and flow from hardened surfaces (soil compaction). Underground mined areas: • Subsidence; • Dewatering; • Groundwater and soil contamination; and • Decreased land capability and agricultural potential	• Manage through: • Erosion control • Remedy through: • Rehabilitation through the LoM.	• Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation
Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Soil, Land Use, and Land Capability			
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Soil, Land Use, and Land Capability			
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	Soil, Land Use, and Land Capability			
Operational	Continue with exploration activities	Soil, Land Use, and Land Capability			

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Operational	Underground blasting and operation of the underground workings.	Fauna and Flora	• Increased risk of post-mining land subsidence; • Loss of topsoil; • Impacts on the hydrological systems (water table) impacting the habitat ecology and ecosystem services; and • Potential contamination of underground water with hydrocarbons, polluting sensitive habitats for sensitive faunal and floral species.	• Control through Rehabilitation Plan.	• To minimise disturbance of natural habitats; and • To prevent the establishment and manage alien invasive vegetation according to the NEM: BA.
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste.	Fauna and Flora	Contamination of soil, water and surrounding areas / habitats (pan and wetland vegetation) from hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).		
Operational	Continue with exploration activities	Fauna and Flora	• Continuous disturbances to the fauna and flora by explorative activities;; • Increased vehicle activity; and • Continuous anthropogenic influence stemming from staff, residents and visitors that infiltrate the unexplored natural veld areas will damage and impact on species communities within certain areas. This could disturb unidentified SCC.		

Operational	Operating STP (18.31 m (combination of two delineations)), PCD, raw water pipeline, process water, washing plant	Wetlands	• Infrastructure area:
			  • Water and soil quality contamination and deterioration;
			  • Loss of habitat and biodiversity;
			  • Erosion and sedimentation;
			  • Increased runoff and flow from hardened surfaces; and
			  • Change in habitat and potential change in species composition.
			• Underground mined areas:
				• Control through mitigation measures presented Table 5-1 above.	• To prevent unnecessary impacts on wetlands.

Operational	Mining of coal by underground mining (underground) (5 050.83 ha) Removal of rock (blasting). Rock/discard dumps, soils, ROM, discard dump (discard dump 2946 ha and Overburden stockpile 13716 ha)	Wetlands			
Operational	Storage, handling, and treatment of hazardous products (including fuel, explosives and oil) and waste	Wetlands			

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	Wetlands	• Subsidence; • Dewatering; and Groundwater contamination.		
Operational	Continue with exploration activities	Wetlands			
Operational	Uncontrolled runoff of stormwater or process water from or through the surface infrastructure.	Aquatics	Water quality deterioration of watercourses receiving unnatural/contaminated runoff.	• Control through inspection and monitoring, as well as stormwater management and sediment containment infrastructure.	• To prevent unnecessary impacts on water resources.
Operational	Operation of the Box Cut as a means for secure and safe entrance and access to the decline of the underground mine	Hydropedology	Disruption of water flow paths will likely reduce the quantity of water reporting to the Vaalwaterspruit thereby affecting the availability of water for downstream water users	• Not Applicable	• To minimise impacts on water resources
Operational	• Overland flow and interflow from the dirty areas or catchments (coal stockpile areas, mine processing plant, workshops, lay down areas etc.). Hydrocarbon residues including oil, grease and fuel spillages from equipment, moving haulage trucks and machinery transported to watercourses.	Hydropedology	Pollution of water resources by pollutants conveyed through overland flow and interflow from contaminated areas	• Control through implementation of the stormwater management plan and through monthly water quality monitoring for the life of mine.	
Operational	Areas containing topsoil stockpiles, overburden, and discard dumps.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries	• Control by implementation of proposed SWMP and regular monitoring of water quality and quantity to minimise the negative impacts of mining and related activities; and • Regular maintenance of SWMP to ensure effective functioning of storm water structures.	To minimise and prevent unnecessary impacts on water resources.
Operational	• Handling of hydrocarbons and general waste; and Spillages and leakages from maintenance of haul roads, pipelines, and machinery. • Use of water for mining operations and production of contaminated effluent/process water.	Surface water	Contamination of water resources and deterioration of water quality.		
Operational	Operation of the Underground Mine, Ventilation Shaft, Use and Maintenance of Haul Road, and Concurrent Rehabilitation	Air Quality	Dust generation and release of gaseous pollutants leading to poor air quality	• Control through the implementation of an air quality management plan; • Dust control equipment; and • Ambient air quality monitoring.	• To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Operational	Ventilation fans and infrastructure area containing stockpile areas	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance	• Control through operational hours; • Noise control measures; and • Noise monitoring.	• Mitigation measures will assist in keeping noise levels as low as possible to comply with the definition of a 'noise disturbance' as described by the National Noise Control Regulations.
Operational	Underground blasting	Noise	Noise impacts are considered to be negligible therefore was not assessed further.		
Operational	Maintenance of haul roads, pipelines, machinery, water, effluent, and stormwater management infrastructure and stockpile areas.	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance.		
Operational	Removal of rock (blasting).	Noise	Noise impacts are considered to be negligible therefore was not assessed further.		
Operational	Establishment and upkeep of Mine related structures along with the box cut	Visual	• As far as possible, preserve the natural vegetation to reduce the visual impact; • Sensitive receptors should be mitigated from the visual impact by a strategic usage of tree-lines and on site berm features which integrate with effective landform design; and • Buildings on site should be kept to a colour that does not bear a large contrast to the existing natural vegetation and landscape.	• NEMA; • NEM: PAA; and • NHRA.	Operational Phase
Operational	Establishment and operation of the stockpile and plant region during operations	Visual	Visual screens be placed in the form of tree-lines, particularly along highly sensitive areas along the R38.		
Operational	Lighting of mine infrastructure at night	Visual	• Focus the lights towards components of the mine that require specific lighting to avoid light dispersal; and • Consider utilizing lower lumen lighting that does now spill outside of the mine region.		
Operational	All project related activities associated with construction and operation.	Socio-economic	Creation of Long-term Employment Opportunities, Skills Development and Work Experience	• Enhancement and control measures: • Enhancement Promotion of targeted employment of local people and skills development; and • On-going communication about the project related opportunities. • Enhancement measures:	• To enhance the positive impacts associated with the project to benefit the local communities and economy
Operational	All project related activities associated with construction and operation.	Socio-economic	Opportunities and Capabilities within the Supply Chain		

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
				• through promotion of local procurement, targeted and preference of locals for all employment opportunities as well as implementation of SLP related community developments.	
Operational	All project related activities associated with construction and operation.	Socio-economic	Changes to the Water Quality	• Prevention and management measures: • Implementation of control and remedial actions recommended by the Surface Water Specialist Studies.	• To manage water resources.
Operational	All project related activities associated with construction and operation.	Socio-economic	Impacts Associated with Surface Subsidence	• Remedy and Control through appropriate protection measures. Minimise impacts to people through appropriate relocation.	
Operational	All project related activities associated with construction and operation.	Socio-economic	Occupational Health Risks to Mine Workers	• Avoidance/ Prevention: • Through the implementation of hazard assessments and controls.	• To ensure the implementation of the Occupational Health and Safety Management Plan and System.
Operational	All project related activities associated with construction and operation	Socio-economic	Economic Multiplier	• Enhancement and control measures: • Enhancement Promotion of targeted employment of local people and skills development; and • On-going communication about the project related opportunities. • Enhancement measures: • through promotion of local procurement, targeted and preference of locals for all employment opportunities as well as implementation of SLP	• To enhance the positive impacts associated with the project to benefit the local communities and economy

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
				related community developments.	
Operational	All project related activities associated with construction and operation.	Socio-economic	Social Development as part of Social and Labour Plan (SLP)	• Enhancement: • Through the implementation of SLP related community development and monitoring of performance against the set targets.	• To expand skills development and capacity building programmes to the community.
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Ground Vibration	• Prevention and Management measures.	• To minimise the impacts of blasting operations on a range of structures.
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Air blast		
Operational	Blasting operations in the proposed box-cut for Arnot South Underground Coal Mining Project	Blast and Vibration	Fly rock		
Decommissioning	Demolition and removal of infrastructure.	Soil, Land Use, and Land Capability	• Soil erosion and sedimentation; • Decreased soil fertility and increased AIPs; • Soil contamination due to decanting and the groundwater contamination plume; • Subsidence; • Dewatering; and • Decreased land capability and agricultural potential.	• Concurrent rehabilitation through the life of mine and after mine	• Soil Management in terms of the Chamber of Mines Guidelines for Rehabilitation.
Decommissioning	Post-closure monitoring and rehabilitation.	Soil, Land Use, and Land Capability			
Decommissioning	Closure of the underground mine.	Soil, Land Use, and Land Capability			
Decommissioning	Demolition and removal of infrastructure.	Fauna and Flora	• Disturbance of soils, and subsequent erosion by wind and water;	• Manage through:	• To minimise disturbance of natural habitats.

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
			• Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Unexpected changes in topography and landscape as a result of subsidence.	• Footprint reduction and limitation; • Vegetation establishment; • Replanting of endangered species; and • Rehabilitation Plan.	
Decommissioning	Post-closure monitoring and rehabilitation	Fauna and Flora	• Minimal negative impacts on the environment; • Activities involve the rehabilitation processes of reprofiling the soils and re-vegetation thereafter; • Impacts include the possibility of erosion and sedimentation; • Proliferation of AIPs; and • Change in the habitat and species composition.		
Decommissioning	Closure of the underground mine.	Fauna and Flora	• Potential risk for land subsidence, preluding to topography changes, underground water contamination and change to faunal habitats. • Change in the land topography and species composition.		
Decommissioning	Demolition and removal of infrastructure.	Wetlands	• Impacts to the wetlands and watercourses include: • Erosion and sedimentation; • Increased AIPs; • Change in habitat and potential change in species composition; • Soil and water contamination due to decanting and the groundwater contamination plume; • Subsidence; and • Dewatering.	• Concurrent rehabilitation through the life of mine and after mine.	
Decommissioning	Post-closure monitoring and rehabilitation.	Wetlands			
Decommissioning	Closure of the underground mine.	Wetlands			
Decommissioning	Decant and runoff of contaminated water entering aquatic ecosystems.	Aquatics	Water quality deterioration of watercourses in contact with contaminated water resulting in AMD.	• Control through water quality monitoring;	• To prevent AMD from contaminating the water resources.

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Decommissioning	Demolition and removal of infrastructure	Hydropedology	Sedimentation and siltation of watercourses due to increased soil erosion leading to reduced water quality.	• Control through water quality monitoring; • Remedy through passive treatment of AMD	• To prevent AMD from contaminating the water resources.
Decommissioning	After decommissioning, dewatering ceases and water accumulates within the mine shaft and the water reacts with the pyrite in the backfilled material, thereby becoming acidified and starts decanting at low lying positions, including the adjacent Vaalwaterspruit.	Hydropedology	Contamination of soil and water resources from potential decant of AMD and movement of contamination plume due to the re-watering of the mine shaft	• Control through water quality monitoring; • Remedy through passive treatment of AMD	• To prevent AMD from contaminating the water resources.
Decommissioning	Demolition and removal of infrastructure.	Surface water	Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein-Olifantsrivier and their tributaries.	• Monitoring of water quality and quantity post-closure; and • Rehabilitation of disturbed landscapes monitoring and maintenance of rehabilitated areas until vegetation has fully been established	To minimise and prevent unnecessary impacts on water resources.
Decommissioning	Spillages and leakages from vehicles and machinery during demolition of infrastructure.	Surface water	Contamination of water resources from AMD and deterioration of water quality.	• Monitoring of water quality and quantity post-closure; and • Rehabilitation of disturbed landscapes monitoring and maintenance of rehabilitated areas until vegetation has fully been established	To minimise and prevent unnecessary impacts on water resources.
Decommissioning	Decant of AMD.	Surface water	Water Contamination from AMD into surface water resources.	• Monitoring of water quality and quantity post-closure; and • Rehabilitation of disturbed landscapes monitoring and maintenance of rehabilitated areas until vegetation has fully been established	To minimise and prevent unnecessary impacts on water resources.
Decommissioning	Post-closure monitoring and rehabilitation Closure of the underground mine.	Surface water	Restoration of free drainage and runoff yield at least to a certain extent.	• Monitoring of water quality and quantity post-closure; and • Rehabilitation of disturbed landscapes monitoring and maintenance of rehabilitated areas until vegetation has fully been established	To minimise and prevent unnecessary impacts on water resources.
Decommissioning	Demolition and Removal of Infrastructure and Rehabilitation	Air Quality	Dust generation leading to poor air quality	• Control through: • The implementation of an air quality management plan; • Dust control measure; and • Ambient air quality monitoring.	• To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).

Phase	Project Activity	Aspect	Impacts	Mitigation Type	Standard to be Achieved
Decommissioning	Demolition and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation for the final land rehabilitation	Noise	Noise emissions from equipment/machinery will increase the noise levels at sensitive receivers and may result in a noise disturbance. However, the removal of noise generating sources will also lead to a reduction in the noise levels.	• Control through operational hours; and • Avoid through Machinery Maintenance Plan.	• Mitigation measures will assist in keeping noise levels as low as possible to comply with the definition of a 'noise disturbance' as described by the National Noise Control Regulations.
Decommissioning	Rehabilitation – rehabilitation mainly consists of spreading and landscaping of the preserved subsoil and topsoil, profiling of the land, and re-vegetation.	Noise	Noise impacts are considered to be negligible therefore will not be assessed further.		
Decommissioning	Post-closure monitoring and rehabilitation.	Noise			
Decommissioning	Decommissioning	Socio-economic	Economic Boom-Bust after the Operation Phase	• Preventative and Management: • Timeous development of Mine Closure Plan and ongoing consultation of stakeholders about mine closure.	• To avoid local community, collapse due to closure of the mine.

7 Item 1(g): Financial provision

To complete the Financial Provision Assessment there are several tasks which were undertaken. These tasks are discussed below.

7.1 Item 1(g)(i): Determination of the Amount of Financial Provision

7.1.1 Item 1(g)(a): Describe the Closure Objectives and the Extent to which they have been Aligned to the Baseline Environment described under the Regulation

The objective of the Rehabilitation Plan is to ensure activities associated with the infrastructure located within the mining footprint area will be designed to prevent, minimise or mitigate adverse, long-term, environmental and social impacts and create a self-sustaining ecosystem. The following objectives have been identified thus far:

- Return land disturbed by mining activities as far as possible to land capabilities similar to that which existed prior to mining;
- Ensure that contamination of surrounding areas by mine affected water is limited as far as possible, and that mine affected water is contained or treated post-closure;
- Remove mine infrastructure that cannot be used by a subsequent landowner or a third party. Where buildings can be used by a third party, arrangements will be made to ensure their long-term sustainable use;
- Clean up all stockpile footprint areas and loading areas and rehabilitate these areas to a land capability similar to that which existed prior to mining;
- Follow a process of closure that is progressive and integrated into the short and long term mine plans, and that will assess the closure impacts proactively at regular intervals throughout project life;
- Rehabilitate the disturbed land to a state that facilitates compliance with applicable environmental quality objectives,
- Landscape the rehabilitated areas in alignment with the surrounding topography to prevent the unnecessary ponding of water and ensure all rehabilitated areas are free draining;
- Physically and chemically stabilise any remaining mining structures (i.e. discard dumps), where required, to minimise residual risk post-closure;
- Leave a safe and stable environment for both humans and animals;
- Prevent soil and surface/groundwater contamination by effectively managing water on site, and ensure clean/ dirty water separation is implemented during the operational period to minimise post-closure contamination potential;
- Comply with local and national regulatory requirements; and

- Ensure the Social and Labour Plan speaks to the closure plan and land use plan, and that social closure objectives (e.g. reskilling, retrenchment management, land use engagement etc.) are progressively met during the operational phase.

7.1.2 Item 1(g)(b): Confirm Specifically that the Environmental Objectives in relation to Closure have been Consulted with Landowner and Interested and Affected Parties

A site visit was undertaken by Digby Wells project management and stakeholder engagement team on 21 December 2020 with the aim of conducting a stakeholder mapping exercise. The objectives of this exercise were:

50. To understand the state of the project-specific environment;
51. To identify I&APs that would potentially be impacted by the proposed project; and
52. To identify public places where the information material would be placed. The site notices for the stakeholder mapping exercise were placed at various places , refer to Table 10-1.

I&APs were consulted, all comments, concerns raised and received during the commenting period were addressed and included in this report in Section 10.2 of Part A.

7.1.3 Item 1(g)(c): Provide a Rehabilitation Plan that Describes and Shows the Scale and Aerial Extent of the main Mining Activities, Including the anticipated Mining Area at the tIme of Closure

Table 7-1 provides a summary of the rehabilitation actions and plans which need to be followed. A Rehabilitation Plan has been compiled for the proposed Arnot South Project area and is provided in Appendix S

Table 7-1: Closure and Rehabilitation Measures

Aspect	Rehabilitation measures
Infrastructure (Plant, Security, Offices & Workshop)	Infrastructure demolitions and clean-up: • Demolish and remove all concrete structures to 1 m below ground level; • Demolish all brick buildings ; • Demolish concrete bund wall; • Dismantle streel structures and store in designated salvage yard prior to removal/selling off; • Dispose of inert building rubble in inclined shaft prior to backfilling within a 1 km hauling distance; • Remove transformers prior to closure; • Remove fences; and Remove all contractor containers from site prior to closure. General rehabilitation • Shape and level all areas where infrastructure is removed to align surface water runoff with the site wide drainage framework; • Replace 300 mm of topsoil across the reshaped contractor yard footprint; • Rip to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix;
Linear Infrastructure	Haul roads and gravel roads • Rip all untarred roads to break compaction. Pipelines and Powerlines • Remove all wire fencing; • Demolish and remove all surface pipelines; and

Aspect	Rehabilitation measures
	• Remove all powerlines. General rehabilitation • Replace 300 mm of topsoil over gravel and tar roads; • Rip all areas to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.
Mining area (boxcut and incline shaft)	Boxcut and incline shaft • Seal the shaft portals according to the DMRE standard; • Backfill the void using a combination so truck and shovel and dozer, assuming a maximum load and haul distance of 1 km from overburden stockpile to void; • Shape area to be free draining as per the detailed landform design; • Place topsoil to a depth of at least 300 mm; • Rip to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix. All dumps (Hards, Softs, Topsoil & Berms) • Remove residual stockpile material to a depth of 300 mm; • Replace topsoil cover; • Rip all replaced topsoil to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.

Aspect	Rehabilitation measures
Discard dump	Discard dump • Shape side slopes to a gradient that does not exceed 1:5; • Implement the required storm management measures as per detailed engineering design; • Compact two layers of clay at 150 mm thickness each for use as a salinity breaker layer; • Apply dolomitic lime to increase the pH; • Place soft overburden material to a depth of 300 mm; • Place topsoil to a minimum depth of 800 mm (to be specified by the detailed engineering design), which should ensure water ingress does not exceed more than 5% MAP); • Rip to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix. Alternative to consider: Backfill boxcut/ incline shaft or the underground workings with the discard material to reduce the residual risk associated with continued contamination from the dump post-closure.
Pollution Control Dams	Pollution Control Dams • Remove contaminated sediment to a depth of 300 mm; • Remove and appropriately dispose of high density polyethylene (HDPE) liner; • Breach wall and reshape to at least 1:5 (V:H) where ancillary dam structures were removed to align storm water runoff with the surrounding surface water drainage framework; • Replace 300 mm of topsoil across the reshaped footprint; • Rip all areas to alleviate compaction; and • Establish vegetation including soil amelioration based on dedicated sampling and analysis, seed bed preparation and the application of an appropriate seed mix.

Aspect	Rehabilitation measures
Water Treatment Plant	No rehabilitation required since it is assumed that the water treatment plant will remain post-closure to treat water.
Monitoring and maintenance	• Surface and groundwater monitoring will continue for a minimum period of ten years post-closure, or until site relinquishment criteria are met; and • Vegetation monitoring and maintenance over rehabilitated areas will continue for a minimum period of five years post-closure, or until site relinquishment criteria have been met.

7.1.4 Item 1(g)(d): Explain Why it can be confirmed that the Rehabilitation Plan is Compatible with the Closure Objectives

The Rehabilitation Plan has been compiled in support of the primary closure objectives which are to remove unwanted infrastructure and rehabilitate the land to a suitable mixed end land use which provides a safe and stable environment for surrounding receptors. The post-closure land use should be conducive to livestock grazing and areas not impacted by mining should continue to be utilised as per pre-mining development land use. This end land use can only be determined closer to the end of the LoM. A Rehabilitation Plan has been compiled for the proposed Project area and is provided in Appendix S.

7.1.5 Item 1(g)(e): Calculate and State the Quantum of the Financial Provision required to Manage and Rehabilitate the Environment in Accordance with the Applicable Guideline

A summary of the closure costs for scheduled closure is reflected in Table 7-2. The total scheduled closure cost estimate amounts to **R 230,847,235.00** (excluding VAT) and including P&Gs and Contingencies at 15% and 10%, respectively.

Discounted residual closure cost estimates for long-term water treatment and subsidence management have also been included, and the methodology and assumptions applied in estimating these costs are included in the ERR.

Table 7-2: Closure Cost Summary

DIGBY WELLS ENVIRONMENTAL	Digby Wells Environmental
	Exxaro Coal Mpumalanga (Proprietary) Limited, Proposed Arnot South Project
Area and Description	Life of Mine 2039
Infrastructure Demolition	
Area 1: Arnot South Project	R11,306,841
Rehabilitation	
Area 1: Arnot South Project	R31,966,080
Total Demolition & Rehabilitation	R43,272,921
Monitoring and Maintenance	
Monitoring Costs (Groundwater and Surface water)	R4,772,259
Monitoring Costs (Vegetation)	R55,762
Maintenance Costs (Vegetation)	R1,925,315
Sub-total	R6,753,336

Residual Costs (Discounted)	
Monitoring of Subsided Areas (10 years)	R12,029,601
Water Treatment Costs (100 years)	R157,973,146
Sub-total	R170,002,747
Preliminary and General (15%)	R6,490,938
Contingency (10%)	R4,327,292
Sub-total	R10,818,230
GRAND TOTAL	R230,847,235

7.1.6 Item 1(g)(f): Confirm that the Financial Provision will be Provided as Determined

Provided that the Mining Right is approved, Exxaro will provide for closure as per the legal requirements. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

8 Item 1(h): Monitoring Compliance with and Performance Assessment

Exxaro will be responsible for the implementation of all monitoring of mitigation and management measures, as well as compliance with the EMPr. The recommended monitoring for the identified impacts is detailed in the subsections below. The Applicant will keep a record of all environmental monitoring taken on site. A summary of the environmental monitoring to be undertaken is included in Table 8-8.

8.1 Item 1(h)(i): Monitoring of Impact Management Actions

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented. The monitoring programmes have been discussed below.

8.1.1 Soil, Land Use and Land Capability

Table 8-1 describes the monitoring plan which should be followed from the Construction Phase through to the Rehabilitation and Monitoring phase. The table includes each element of monitoring together with the frequency of monitoring and person responsible thereof.

Table 8-1: Monitoring Plan

Monitoring Element	Comment	Requirement	Frequency	Phase	Responsibility	Duration
Stockpiles (Height, erosion, compaction, low vegetation cover)	Report any irregularities to the Environmental Officer for assessment and mitigation measures.	Stockpile update report and recommendations for impact mitigation, if any.	Quarterly	Construction	Environmental Officer	Up to Rehabilitation
				Operational		
			N/A	Rehabilitation		
Soil health and fertility	Implementation of intervention/mitigation measures.	Soil update report and recommendations for impact mitigation, if any.	Bi-annually	Construction	Environmental Officer	3 years after Rehabilitation
			Annually	Operational		
				Rehabilitation		
Soil physical attributes (vegetation, erosion, sedimentation)	Report any irregularities to the Environmental Officer for assessment and mitigation measures.	Take photos of impacted areas and record any impacts seen.	Bi-annually and after storm events	Construction	Mine Environmental Manager.	3 years after Rehabilitation
				Operational		
			Annually	Rehabilitation		
Soil contamination assessment (incl. decant points)	Report any irregularities to the Environmental Officer for assessment and mitigation measures.	Take soil samples for laboratory analysis, measuring heavy metals and potential harmful	Only after a spill has occurred	Construction	Environmental Officer	3 months after (monthly) the
				Operational		

Monitoring Element	Comment	Requirement	Frequency	Phase	Responsibility	Duration
		elements. Measure against the baseline data and SSV.		Rehabilitation		spill has occurred
Subsidence, decanting and dewatering	Report any irregularities to the Environmental Officer for assessment and mitigation measures. Implementation of intervention measures.	Soil update report and recommendations for impact mitigation, if any. Take photos of impacted areas and record any impacts seen.	Only when impacts are observed	Construction Operational Rehabilitation	Environmental Officer	Bi-annually (twice a year) for three years or subsidence are stable and land use are remediated

8.1.2 Fauna and Flora

A monitoring programme is essential as a management tool to detect negative impacts and variations as they arise and ensure that the necessary mitigation measures are implemented together with the effectiveness of the management measures in place. Table 8-2 describes the monitoring plan that is to be implemented from the construction phase through to monitoring after decommissioning. The program includes each element, frequency of monitoring and the person responsible thereof.

Monitoring should be done in terms of:

- Appendix 6 of the NEMA EIA Regulations, 2014, (as amended);
- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA);
- National Forest Act, 1998 (Act No. 84 of 1998) (NFA); and
- Mpumalanga Biodiversity Sector Plan (MBSP, 2014).

Table 8-2: Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Alien Invasive Management	During the operational phase the presence if AIPs should be detected and monitored every six (6) months. An active programme of weed management, to control the presence and spread of invasive weeds, will need to be instituted so that encroaching weeds (from edge effects and fragmentation) are controlled by means appropriate to the species. This should run for the life of the mine and five years after rehabilitation.	Annually during the wet season (December to February) for the first five years after rehabilitation.	Environmental Officer
Vegetation Cover Monitoring	The natural vegetation cover established on the disturbed areas needs to be monitored annually for the first five years after rehabilitation has been carried out, to ensure that the rehabilitation work has been successful in terms of stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces), and that the newly established vegetation cover is trending towards convergence with the original vegetation cover found on the areas prior to	Annually during the wet season for the first five years after rehabilitation.	Botanist / Flora Specialist

Monitoring Element	Comment	Frequency	Responsibility
	disturbance (and on adjacent undisturbed areas). Parameters to be followed during monitoring: • Plant species present/absent; • Weed species composition; • Species density (number of individuals); • Species frequency (number of times species is recorded); • Basal cover; and • Biomass for ground cover.		
Red Data listed fauna and flora	All protected and Red Data plant and animal species must be marked prior to any construction taking place.	Monitored every 6 months from rehabilitation	Field Specialist
Fauna monitoring	This will be closely linked to the flora monitoring to enable scientific conclusions and comparisons. To successfully monitor faunal and floral biodiversity with a Savannah biome, a solid baseline (pre-construction) will be established through the first round of monitoring. This needs to be supplemented with regular repeats to compile a reasonable comparison between the pre-construction faunal communities present and faunal communities found in the same areas during various stages of construction and operation of the proposed project. It is recommended that this monitoring be carried out through the life of the mine and concurrently during rehabilitation.	Monitored every 6 months from rehabilitation	Field Specialist

8.1.3 Wetlands

The monitoring programme is based on the following points:

- Undertake monitoring on the wetlands within the infrastructure areas, adjacent and downstream of the infrastructure areas as well as within the entire underground mining area to detect and rectify any secondary impacts caused by the Project;
- Commence with monitoring prior to the Construction Phase to collect baseline information regarding adjacent and downstream wetlands, soils and vegetation and to monitor any changes due to the proposed activities;

- Upon closure and rehabilitation, undertake annual monitoring for another three years to ensure there are no emerging impacts identified, which may need to be addressed;
- If subsidence, dewatering and decanting has occurred, wetland monitoring must be done bi-annually (twice a year) to determine any deterioration of wetlands; and
- Update the monitoring programme once a wetland offset plan has been developed and offsetting has been implemented.

8.1.4 Aquatics

An aquatic biomonitoring programme has been developed for the monitoring and preservation of the aquatic ecosystems assessed for the proposed Project. This programme is aimed at better determining the ecological health of the ecosystems as well as to act as an early detection tool for impacts that might severely affect the expected aquatic biota in the associated riverine systems.

Table 8-3 outlines the aquatic monitoring methods undertaken at the monitoring points set out above (Appendix G) on an biannual basis by a suitably-qualified, SASS-accredited aquatic ecologist. The annual programme comprises of a single survey during the autumn season (or low flow season) for the Study Area and a single survey during the spring season (or high flow). This will determine the PES for the assessed aquatic ecosystems which will further determine whether the proposed Project is impacting the associated aquatic ecology and to what extent. The following stressor, habitat and response indicators should be evaluated:

53. **Stressor indicators**
    - *In situ* water quality
54. **Habitat indicator:**
    - Instream and riparian habitat conditions (IHI, version 2)
    - Aquatic macroinvertebrate biotope evaluation (IHAS, Version 2.2).
55. **Response indicators:**
    - Aquatic macroinvertebrate assessment (SASS5 and MIRAI)
    - Ichthyological assessment (FRAI)
    - Determination of the integrated EcoStatus (EcoStatus 4, Version 1.02).

Table 8-3: Biomonitoring Programme

Monitoring Element	Comment	Frequency	Responsibility
Water Quality: *In situ* water testing focusing on temperature, pH, conductivity and oxygen content.	No noticeable change from determined baseline water quality for each respective season. Salt Concentrations must be maintained at levels where they do not render	Water quality should be tested on a biannual basis at each monitoring site to determine the extent of change from baseline results.	Aquatic Ecologist (SASS-accredited)

Monitoring Element	Comment	Frequency	Responsibility
	the ecosystem unsustainable.		
Habitat Quality: Instream and riparian habitat integrity; and Availability/suitability of macroinvertebrate habitat at each monitoring site.	The application of the IHI should be done for the associated aquatic systems. The IHAS must be applied at each monitoring site prior to sampling. The Ecological Category determined for each assessed site must be in a largely modified or better conditions to support the ecosystem.	Habitat quality should be assessed on a biannual basis	
Aquatic Macroinvertebrates: Aquatic Macroinvertebrate assemblages must be assessed biannually.	This must be done through the application of the latest SASS, incorporated with the application of the MIRAI as outlined in this Aquatic Study. Baseline Ecological Categories should not be allowed to drop in category for each assessed site.	The latest version of the SASS should be conducted on a biannual basis.	
Fish: Fish assemblages must be assessed biannually	Sampling of fish must be undertaken by utilising various methods such as cast nets in addition to the standard electro-narcosis technique to compensate for its ineffectiveness in elevated conductivity waters. Baseline Ecological Categories should not be allowed to drop in category for each assessed site.	Sampling of fish communities should be undertaken on a biannual basis	

Monitoring Element	Comment	Frequency	Responsibility
Integrated EcoStatus Determination	The Ecological Category for each assessed river reach should not deteriorate from the Resource Quality Objectives of the Olifants Catchment and the Inkomati Catchment.	The Integrated EcoStatus should be determined upon completion of the biannual aquatic surveys.	
***REC = Recommended Ecological Category**			

The Project should not commence without inclusion of the above Aquatic Biomonitoring Programme.

8.1.5 Hydropedology

The monitoring program assists with the early detection of water contamination therefore, allowing mitigation or management strategies to be implemented at an early stage, thus minimising the potential impacts on water resources. Table 8-4 presents the proposed surface water monitoring plan to ensure sustainability of the mining activities within the proposed Arnot South Project and surrounds.

Table 8-4: Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Water quality	Ensure regular water quality monitoring in the proposed monitoring sites/locations. This includes water within the mining sites in cases of potential overflow and water discharges into the surface water. Examples of parameters to be monitored include Total Dissolved Solids, Total Suspended solids, pH, Electrical Conductivity; Sulphate; major cations (K, Ca, Mg & Na).	Monitoring should be done on monthly bases during construction, operation, and decommissioning. After that monitoring should be done at least five years after closure or until rehabilitation becomes sustainable.	Environmental Officer

Monitoring Element	Comment	Frequency	Responsibility
Sedimentation and Siltation	Investigate the site after a rainfall event, during construction and demolishing to ensure that there is no erosion of soil which may lead to siltation and sedimentation of surface water resources. Rehabilitated sites should be inspected for any signs of erosion. Install filtration material or temporary silt fences and soil stabilizing blankets until vegetation has been established.	After rainfall events	Environmental Officer
Physical structures and Storm Water Management Plan (SWMP) performance	Facilities around the mine should be physically inspected and checked regularly for any anomalies/malfunctions and leakages.	It should be done frequently and continuously	Environmental Officer
	Ensure that there is no blockage of inflows in stormwater channels, dams and pipelines in order to maintain good hydraulic conditions. The overall SWMP performance should be monitored to ensure its' effectiveness.		
Surface inspection during rehabilitation	Surface inspection should be done during rehabilitation until the vegetation cover is established to prevent erosion and sedimentation which will subsequently lead to topsoil loss, sedimentation and siltation of nearby watercourse.	It should be done frequently and continuously	Environmental Officer

8.1.6 Surface Water

The monitoring program assists with the early detection of water contamination thereby allowing mitigation or management strategies to be implemented at an early stage, thus minimising the significance of potential impacts on water resources. Table 8-5 presents the proposed surface water resources monitoring plan to ensure sustainability of mining activities within the Arnot South Project site. The frequency of mitigation, timing of implementation and the responsible persons in ensuring the implementation of the EMP are indicated .

Table 8-5: Surface Water Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Water quality	Ensure water quality monitoring as per sampled and proposed monitoring locations (See Figure 11-37). Parameters should include but not limited to pH; Electrical Conductivity; major cations (K, Ca, Mg & Na); trace metals (Al, Fe, Zn, Cu, Mn, Co, Se, Mo, Cd, Ni, Cr (VI), Pb, Hg & As); Anions (NO_3, NO_2, NH_4, Cl, F, SO_4, PO_4); Total Dissolved Solids; Total Suspended solids. It is also recommended to monitor water quality within the mine water dams or water containment facilities at the existing NCC operations to determine the concentration levels in case of an overflow or need for discharge.	Monthly monitoring during construction, operation, decommissioning and for at least five (5) years after closure, or until rehabilitation has reached a sustainable state with no further changes.	Environmental Officer
Sedimentation	Inspect construction sites, sites where infrastructure is demolished and rehabilitated sites for traces of erosion to ensure no entrance of sediment occurs into nearby watercourses, especially after rainfall events. Temporary silt fences, soil stabilization blankets should be installed and maintained until vegetation is established.	After rainfall event, until the establishment of vegetation on all rehabilitated sites	Environmental Officer
Water quantity and water balance	Monitoring or measuring of all the water inflows into the mine, reticulation within the mine and the outflows from the mine. This can be achieved by installing automatic flow meters to ensure real time measurements of water.	In operational areas where automatic flow meters are in place, daily records need to be kept	Environmental Officer

Monitoring Element	Comment	Frequency	Responsibility
Physical structures and Storm Water Management Plan (SWMP) performance	Personnel should have a walk around facilities to determine the facilities conditions and pick out any anomalies such as leaks or overflows and system malfunctions.	Continuous process and yearly formal report	Environmental Officer
	Storm water channels, berms and storage facilities are inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitoring and maintenance of the overall SWMP performance.		

8.1.7 Air Quality

It is recommended that an air quality monitoring network be set up and maintained for the LoM to ensure that generated emissions associated with the day to day activities at the mine are below regulatory limit values. The frequency of monitoring will ensure that diurnal, seasonal, annual, and inter-annual ambient air quality records are available to inform management decision making. Table 8-6 shows the criteria pollutants that should be measured and the frequency of monitoring.

Table 8-6: Recommended Monitoring Plan

Method	Frequency	Target	Responsibility
Monitoring in accordance with: • EN14097 for $PM_{2.5}$; • EN12341 for PM_{10}; and • American Standard Test Method ASTM 1739-98 in SANS1137:2019	• Continuous PM_{10}, $PM_{2.5}$ monitoring; • Continuous monitoring of gases: SO_2, NO_2, and CO; • Monthly dustfall monitoring;	Particulate pollutants from the ongoing mining operation must be kept below the South African standards: • GN R 1210 of 24 December 2009 • GN R 486 of June 2012; and • GN R 827 of 1 November 2013	A designated Environmental Officer (EO) is onsite to collect ambient air quality data and submit it to an independent consultant for interpretation and reporting.

8.1.8 Noise

The noise emissions/impacts from the operational phase on the sensitive nearby noise receivers are high therefore, it is recommended that a monitoring plan be implemented to monitor future noise emissions (increases and/or decreases in noise levels) throughout the LoM. Components to be included in the proposed monitoring plan are discussed below:

- Noise monitoring is to be conducted throughout all phases (Construction, Operational and Decommissioning) of the Project's life; and

56. Quarterly noise measurements must be conducted at the prescribed locations as per the baseline noise measurement locations of this report.

Table 8-7: Noise Monitoring Programme

Monitoring Element	Comment	Frequency	Responsibility
Noise Monitoring	Noise monitoring in line with the requirements of SANS 10103:2008 on-site, and at selected receivers	Quarterly Noise Monitoring	Mine Environmental Officer

8.1.9 Socio-economic

The key relevant social aspects to be monitored are based on the social impacts and the relevant mitigation measures that have been identified. These social aspects are as follows:

- Water quality impacts;
- Procurement targets;
- Grievances;
- Community development initiatives as part of the SLP;
- Local employment targets; and
- Livestock monitoring.

8.2 Item 1(h)(ii): Monitoring and Reporting Frequency

The monitoring and reporting frequency for the monitoring programmes per environmental aspect are supplied in Table 8-8.

8.3 Item 1(h)(iii): Responsible persons

The responsible persons for the respective monitoring programmes are detailed in Table 8-8.

8.4 Item 1(h)(iv): Time period for implementing impact management actions

The time period for implementing impact management actions has been provided for in Table 8-8.

8.5 Item 1(h)(v): Mechanism for monitoring compliance

Table 8-8 sets out the monitoring and management programme of environmental impacts for the Arnot South Project.

Table 8-8 Monitoring and Management of Environmental Impacts

Project Activity	Aspect	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time periods for implementing impact management actions
All activities throughout the Project	Soils, Land Use and Land Capability	• Stockpiles (Height, erosion, compaction, low vegetation cover);	Report any irregularities to the Environmental Officer for assessment and mitigation measures.	Environmental Officer	• Quarterly- Up to Rehabilitation
	Soils, Land Use and Land Capability	• Soil health and fertility.	• Implementation of intervention/mitigation measures. • Soil update report and recommendations for impact mitigation, if any.	Environmental Officer	• Bi-annually (Construction Phase) and • Annually(Rehabilitation) (3 years after Rehabilitation)
	Soils, Land Use and Land Capability	• Soil physical attributes (vegetation, erosion, sedimentation)	• Report any irregularities to the Environmental Officer for assessment and mitigation measures. Report any irregularities to the Environmental Officer for assessment and mitigation measures. • Take photos of impacted areas and record any impacts seen	Mine Environmental Manager	• Bi-annually and after storm events (All Phases) • Annually (Rehabilitation)
	Soils, Land Use and Land Capability	• Soil contamination assessment (incl. decant points)	• Report any irregularities to the Environmental Officer for assessment and mitigation measures. • Take soil samples for laboratory analysis, measuring heavy metals and potential harmful elements. Measure against the baseline data and SSV.	Environmental Officer	• Only after a spill has occurred (All Phases) (3 years after Rehabilitation)
	Soils, Land Use and Land Capability	• Subsidence, decanting and dewatering	• Report any irregularities to the Environmental Officer for assessment and mitigation measures. • Implementation of intervention measures • Soil update report and recommendations for impact mitigation, if any. • • Take photos of impacted areas and record any impacts seen.	Environmental Officer	• Only when impacts are observed; • Bi-annually (twice a year) for three years or subsidence are stable and land use are remediated
	Wetlands	• Wetland extent (size) and • wetland health (PES, ES, EIS)	• Implementation of intervention measures. • Wetland update report and recommendations for impact mitigation, if any.	Environmental Officer:	• Annually
	Wetlands	• Wetland physical attributes (Vegetation, erosion, habitat, open water extent)	• Report any irregularities to the Environmental Officer for assessment and mitigation measures. • Take photos of wetlands and record any impacts seen.	Mine Environmental Manager:	• Quarterly and after storm events.
	Surface water	• Surface water and soil contamination assessment (incl. decant points)	• Report any irregularities to the Environmental Officer for assessment and mitigation measures. • Take water and soil samples for laboratory analysis, measuring heavy metals and potential harmful elements	Environmental Officer	• Only after a spill/decanting has occurred

Project Activity	Aspect	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time periods for implementing impact management actions
	Wetlands	• Subsidence, decanting and dewatering	• Report any irregularities to the Environmental Officer for assessment and mitigation measures. • Implementation of intervention measures. • Wetland update report and recommendations for impact mitigation, if any. • Take photos of wetlands and record any impacts seen.	Environmental Officer	• Only when impacts are observed
	Aquatics	**Water Quality:** • *In situ* water testing focusing on temperature, pH, conductivity and oxygen content.	• No noticeable change from determined baseline water quality for each respective season. • Salt Concentrations must be maintained at levels where they do not render the ecosystem unsustainable.	Aquatic Ecologist (SASS-accredited) Aquatic Ecologist (SASS-accredited)	• Water quality should be tested on a biannual basis at each monitoring site to determine the extent of change from baseline results.
	Aquatics	**Habitat Quality:** • Instream and riparian habitat integrity; and • Availability/suitability of macroinvertebrate habitat at each monitoring site.	• The application of the IHI should be done for the associated aquatic systems. •		• Habitat quality should be assessed on a biannual basis
	Aquatics	**Aquatic Macroinvertebrates:** • Aquatic Macroinvertebrate assemblages must be assessed biannually.	• This must be done through the application of the latest SASS, incorporated with the application of the MIRAI as outlined in this Aquatic Study. Baseline Ecological Categories should not be allowed to drop in category for each assessed site.		• The latest version of the SASS should be conducted on a biannual basis.
	Aquatics	**Fish:** • Fish assemblages must be assessed biannually	• Sampling of fish must be undertaken by utilising various methods such as cast nets in addition to the standard electro-narcosis technique to compensate for its ineffectiveness in elevated conductivity waters. • Baseline Ecological Categories should not be allowed to drop in category for each assessed site.		• Sampling of fish communities should be undertaken on a biannual basis
	Fauna and Flora	• Alien Invasive Management	• During the operational phase the presence if AIPs should be detected and monitored every six (6) months. An active programme of weed management, to control the presence and spread of invasive weeds, will need to be instituted so that encroaching weeds (from edge effects and fragmentation) are controlled by means appropriate to the species. This should run for the life of the mine and five years after rehabilitation	Environmental Officer	• Annually during the wet season (December to February) for the first five years after rehabilitation.
	Fauna and Flora	• Vegetation Cover Monitoring	The natural vegetation cover established on the disturbed areas needs to be monitored annually for the first five years after rehabilitation has been carried out, to ensure that the rehabilitation work has been successful in terms of	Botanist / Flora Specialist	**58.** Annually during the wet season for the first five years after rehabilitation

Project Activity	Aspect	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time periods for implementing impact management actions
			stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces), and that the newly established vegetation cover is trending towards convergence with the original vegetation cover found on the areas prior to disturbance (and on adjacent undisturbed areas). Parameters to be followed during monitoring: • Plant species present/absent; • Weed species composition; • Species density (number of individuals); • Species frequency (number of times species is recorded); • Basal cover; and 57. Biomass for ground cover		
	Fauna and Flora	• Red Data listed fauna and flora	• All protected and Red Data plant and animal species must be marked prior to any construction taking place.	Field Specialist	• Monitored every 6 months from rehabilitation.
	Fauna and Flora	• Fauna monitoring	• This will be closely linked to the flora monitoring to enable scientific conclusions and comparisons. To successfully monitor faunal and floral biodiversity with a Savannah biome, a solid baseline (pre-construction) will be established through the first round of monitoring. This needs to be supplemented with regular repeats to compile a reasonable comparison between the pre-construction faunal communities present and faunal communities found in the same areas during various stages of construction and operation of the proposed project. It is recommended that this monitoring be carried out through the life of the mine and concurrently during rehabilitation.		• Monitored every 6 months from rehabilitation
	Hydropedology	59. Water quality	• Ensure regular water quality monitoring in the proposed monitoring sites/locations. This includes water within the mining sites in cases of potential overflow and water discharges into the surface water. Examples of parameters to be monitored include Total Dissolved Solids, Total Suspended solids, pH, Electrical Conductivity; Sulphate; major cations (K, Ca, Mg & Na).	Environmental Officer	• Monitoring should be done on monthly bases during construction, operation, and decommissioning. After that monitoring should be done at least five years after closure or until rehabilitation becomes sustainable.
	Hydropedology	• Sedimentation and Siltation	• Investigate the site after a rainfall event, during construction and demolishing to ensure that there is no erosion of soil which may lead to siltation and sedimentation of surface water resources. Rehabilitated sites should be inspected for any signs of erosion. Install filtration material or temporary silt fences and soil stabilizing blankets until vegetation has been established.	Environmental Officer	• After rainfall events
	Hydropedology	• Physical structures and Storm Water Management Plan (SWMP) performance	• Facilities around the mine should be physically inspected and checked regularly for any anomalies/malfunctions and leakages. • Ensure that there is no blockage of inflows in stormwater channels, dams and pipelines in order to maintain good hydraulic conditions.	Environmental Officer	• It should be done frequently and continuously

Project Activity	Aspect	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time periods for implementing impact management actions
			The overall SWMP performance should be monitored to ensure its' effectiveness.		
	Hydropedology	• Surface inspection during rehabilitation	• Surface inspection should be done during rehabilitation until the vegetation cover is established to prevent erosion and sedimentation which will subsequently lead to topsoil loss, sedimentation and siltation of nearby watercourse.	Environmental Officer	• It should be done frequently and continuously
	Socio-economic	• Water Quality Impacts	• Ensure water quality monitoring as per sampled and proposed monitoring locations. Parameters should include but not limited to pH; Electrical Conductivity; Sulphate; major cations (K, Ca, Mg & Na); trace metals (Al, Fe, Zn, Cu, Mn, Co, Se, Mo, Cd, Ni, Cr (VI), Pb, Hg & As); Anions (NO_3, NO_2, NH_4, Cl, F, PO_4); Total Dissolved Solids; Total Suspended solids. • It is also recommended to monitor water quality within the mine water dams or water containment facilities to determine the concentration levels in case of an overflow or need for discharge.	Environmental Officer	• Monthly monitoring during construction, operation, decommissioning and for at least three (3) years after closure, or until rehabilitation has reached a sustainable state with no further changes.
	Socio-economic	• Procurement targets	• Targets for local employment should be monitored	Supply chain management/Human Resource management	• Quarterly
	Socio-economic	• Grievances	• Review, log, track and document all grievances related to the project	Community Development/Stakeholder Engagement	• Daily/Weekly
	Socio-economic	• Community Development Initiatives as part of the SLP	• Community Development initiatives should be monitored and evaluated through an external monitoring programme.	Community Development/Stakeholder Engagement	• Every six months
	Socio-economic	• Local Employment Targets	• Targets for local employment should be monitored	Human Resource Management	• Quarterly
	Socio-economic	• Livestock Monitoring	• Ensure regular monitoring of livestock	Livestock Owners	• Every six months
	Air Quality	Particulate pollutants from the ongoing mining operation must be kept below the South African standards: • GN R 1210 of 24 December 2009 • GN R 486 of June 2012; and • GN R 827 of 1 November 2013	Monitoring in accordance with: • EN14097 for $PM_{2.5}$; • EN12341 for PM_{10}; and • American Standard Test Method ASTM 1739-98 in SANS1137:2019	A designated Environmental Officer (EO) is onsite to collect ambient air quality data and submit it to an independent consultant for interpretation and reporting.	• Continuous PM_{10}, $PM_{2.5}$ monitoring; • Continuous monitoring of gases: SO_2, NO_2, and CO; • Monthly dustfall monitoring
	Noise	• Noise Monitoring	• Noise monitoring in line with the requirements of SANS 10103:2008 on-site, and at selected receivers	Mine Environmental Officer	• Quarterly Noise Monitoring

9 Item 1(i): Indicate the frequency of the submission of the performance assessment/ environmental audit report

In accordance with the EIA Regulations (2014), as amended, an external independent Environmental Audit will be undertaken every year. The Environmental Audit Report will be submitted to the DMRE and other relevant authorities where required.

10 Item 1(j): Environmental Awareness Plan

The sub-sections below outline the Environmental Awareness Plan for the proposed Arnot South Project. The Environmental Awareness Plan is primarily a tool to introduce and describe the requirements of the range of environmental and social plans for the proposed Project during the life of the Project.

10.1 Item 1(j)(i): Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

Section 39 of the MPRDA requires Mining to develop an environmental awareness plan to inform the employees of any environmental risks which may result from their work. Therefore, the objectives of the environmental awareness plan will be:

- To educate employees regarding their role in conserving the environment and the importance of conserving natural resources,
- To identify environmental training needs for employees and contractors at all levels,
- To ensure that employees whose work could cause significant environmental impact as identified by the mine are competent to perform those tasks to which they are assigned,
- To enable employees to identify environmental impacts or non-conformances of their work activities on the environment,
- To familiarise employees with emergency preparedness and response requirements,
- To be aware of the potential consequences of deviation from specified operating procedures, and
- To conduct their work and manage mining activities in an environmentally responsible manner.

10.2 Item 1(j)(ii): Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

Management shall establish and maintain procedures for the internal communication between the various levels and functions of the organisation, and receiving, documenting and responding to relevant communication from external I&APs. The organisation shall consider processes for external communication on its significant environmental aspects and record its decisions. Communication is a management responsibility. All line supervisors are responsible for effective communication within their own sections. Methods for the internal communication between the various levels and functions of the organisation, and receiving, documenting and responding to relevant communication from I&APs must be established for the Project. Environmental risks will be dealt

11 Item (k): Specific Information Required by the Competent Authority

The financial provision for the environmental rehabilitation and closure requirements of mining operations is governed by NEMA, as amended, which provides in Section 24P that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision will continue to be reviewed annually.

12 Undertaking

The EAP herewith confirms:-

- 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
- the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

Signature of the Environmental Assessment Practitioner:	 Xan Taylor
Name of Company:	Digby Wells Environmental
Date:	27/08/2021

Appendix A: EAP CV and Qualifications

Appendix B: Plans

Plan 1: Land Tenure Map

Plan 2: Regional Setting

Plan 3: Locality Map

Plan 4: Infrastructure Layout Map

Appendix C: PP Chapter

Appendix D: Soils, Land Use and Land Capability Assessment

Appendix E: Fauna and Flora Assessment

Appendix F: Wetlands Assessment

Appendix G: Aquatic Ecology Assessment

Appendix H: Hydropedological Assessment

Appendix I: Surface Water Assessment

Appendix J: Groundwater Report

DIGBY WELLS
ENVIRONMENTAL

Appendix K: Air Quality Assessment

Appendix L: Noise Assessment

Appendix M: Heritage Assessment

Appendix N: Visual Assessment

Appendix O: Traffic Assessment

Appendix P: Blast and Vibration Assessment

Appendix Q: Social Impact Assessment

Appendix R: Greenhouse Gas Emissions Assessment

DIGBY WELLS
ENVIRONMENTAL

Appendix S: Rehabilitation and Closure

Appendix T: Acknowledgement of the EA Application

Appendix U: Acceptance Letter of the Scoping Report