ENVIRONMENTAL MONITORING PROGRAMME

2018

MOOIPLAATS COLLIERY (PTY) LTD

OCTOBER 2018

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ABBREVIATIONS

Best Practice Guidelines	BPG's
Cubic Meters	m^3
Department of Water and Sanitation	DWS
Environmental Management Plan	EMP
Geographical Positioning System	GPS
Geo Soil and Water cc	GSW
Integrated Water Use Licence	IWUL
Kilometers per hour	km/h
Liters	L
Meter per second	m/s
Mining Right	MR
Mooiplaats Colliery (Pty) Ltd,	Mooiplaats Colliery
Mooiplaats Information Management System Database for Flow Meter Readings	MIMS-FM
National Dust Control Regulations 2013	NDCR, 2013
National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)	NEM: AQA
National Water Act, 1998 (Act 36 of 1998)	NWA
Natural Scientific Service	NSS
South African Bureau of Standards	SABS
South African Scoring System	SASS5
Sub-Quaternary Reach	SQR
South African National Accreditation System	SANAS
The Biodiversity Company	TBC
UIS Organic and Sediba Laboratory	UIS
Water Management Area	WMA
World Geodetic System	WGS

EXECUTIVE SUMMARY

Mooiplaats Colliery holds a Mining Right (MP30/5/1/2/2/68/MP) in respect of Portions 1 and 9 of the farm Mooiplaats 290 IT, Ermelo and an Integrated Water Use Licence No. 08/C11B/AGJ/2141, File No: 16/2/7/C112/C155 dated 02 May 2013 (IWUL), issued in terms of the National Water Act (Act No. 36 of 1998) (NWA).

Geo Soil & Water cc (GSW) and The Biodiversity Company (TBC) were appointed by Mooiplaats Colliery (Pty) Ltd to conduct monitoring in line with the requirements of the Integrated Water Use Licence (IWUL) at Mooiplaats Colliery on a monthly, quarterly, biannual and annual basis to determine the current state, improvement or deterioration of the associated environment caused by historical, current and future mining operations to implement effective control measures.

Individual Monitoring programmes required by the IWUL, implemented and managed by Mooiplaats and conducted by GSW and TBC.:

- Surface water monitoring (GSW),
- Groundwater monitoring (GSW),
- Groundwater level monitoring (GSW),
- Section 21 water use monitoring (GSW),
- Aquatic biomonitoring (TBC).

Additional monitoring programmes

- Dust fallout monitoring (GSW),
- Invasive species survey and eradication monitoring and control plan (TBC).

Monitoring programmes will be updated on an annual basis, or with the renewal/addition of legislative requirements.

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1. INTRODUCTION

Mooiplaats Colliery holds a Mining Right (MP30/5/1/2/2/68/MP) in respect of Portions 1 and 9 of the farm Mooiplaats 290 IT, Ermelo and an Integrated Water Use Licence No. 08/C11B/AGJ/2141, File No: 16/2/7/C112/C155 dated 02 May 2013 (IWUL), issued in terms of the National Water Act (Act No. 36 of 1998) (NWA).

Geo Soil & Water cc (GSW) and The Biodiversity Company (TBC) were appointed by Mooiplaats Colliery (Pty) Ltd to conduct monitoring in line with the requirements of the Integrated Water Use Licence (IWUL) at Mooiplaats Colliery on a monthly, quarterly, biannual and annual basis to determine the current state, improvement or deterioration of the associated environment caused by historical, current and future mining operations to implement effective control measures.

1.1 Location

Mooiplaats Colliery, in terms of Portion 1 and 9, the farm Mooiplaats 209 IT is located approximately 20 km east of Ermelo, south of the N2, in the Msukaligwa Local Municipality, situated in the Gert Sibande District Municipality in the Mpumalanga Province, South Africa.

The predominant land uses in the immediate surroundings are agricultural (grazing, pasture and fodder production), industrial and township development.

The location of Mooiplaats within the Gert Sibande District Municipality, Mpumalanga are indicated in **Figure 1**.

Figure 1 Mooiplaats Colliery located within Gert Sibande District Municipality.

2. WATER MONITORING PROGRAMME

2.1 Objectives

Objectives of Section 9 of the NWA, entailed in this monitoring programme and in correlation with the catchment management strategy, are as follows:

- To establish a continuous database specific to Mooiplaats Colliery,
- Assessing the general temporal condition of water quality of resources in the vicinity likely to be impacted upon by the mine;
- Identifying any potential pollution sources and determining their extent, in order to circumvent relevant legal liabilities potentially resulting from recorded impacts on the receiving aquatic environment;
- Quantifying and assessing any impacts in obstruction of legislative stipulations in order to develop mitigation or remedial plans where necessary; and
- To set out strategies, objectives, plans, guidelines and procedures for protection, use, development, conservation, management and control of water resources within the water management area.

3. TERMS OF REFERENCE

The terms of reference for the monitoring programme at Mooiplaats Colliery are to comply with the requirements of the IWUL and Grootdraai Dam In-stream Water Quality Guidelines, Vaal Origin. The SANS 241:2015 drinking water standards and DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering will be included as supplementary comparative guidelines and not for compliance purposes.

3.1 Changes/Additions in/to Monitoring Network

Although ten (10) IWUL surface water monitoring points and nine (9) groundwater monitoring points are included in the IWUL, Mooiplaats Colliery monitors additional surface and groundwater monitoring points to determine impacts and sources more accurately.

Several additional surface and groundwater monitoring points are sampled on a monthly and biannual basis.

Several parameters are analysed in addition to the parameters set in the 2013 IWUL.

3.2 Surface Water

The surface water monitoring points are being sampled on a monthly basis for chemical water quality and levels as prescribed in the IWUL.

Ten (10) IWUL surface water monitoring points **and** fifteen (15) additional surface water monitoring points are included in the surface water monitoring programme.

Figure 2 indicates the positions of the surface water monitoring points relative to Mooiplaats and water resources.

Figure 3 display the photographic evidence of the surface water monitoring points.

Table 1 presents a summary of the surface water monitoring programme/points including the name, description, coordinates and the frequency of monitoring.

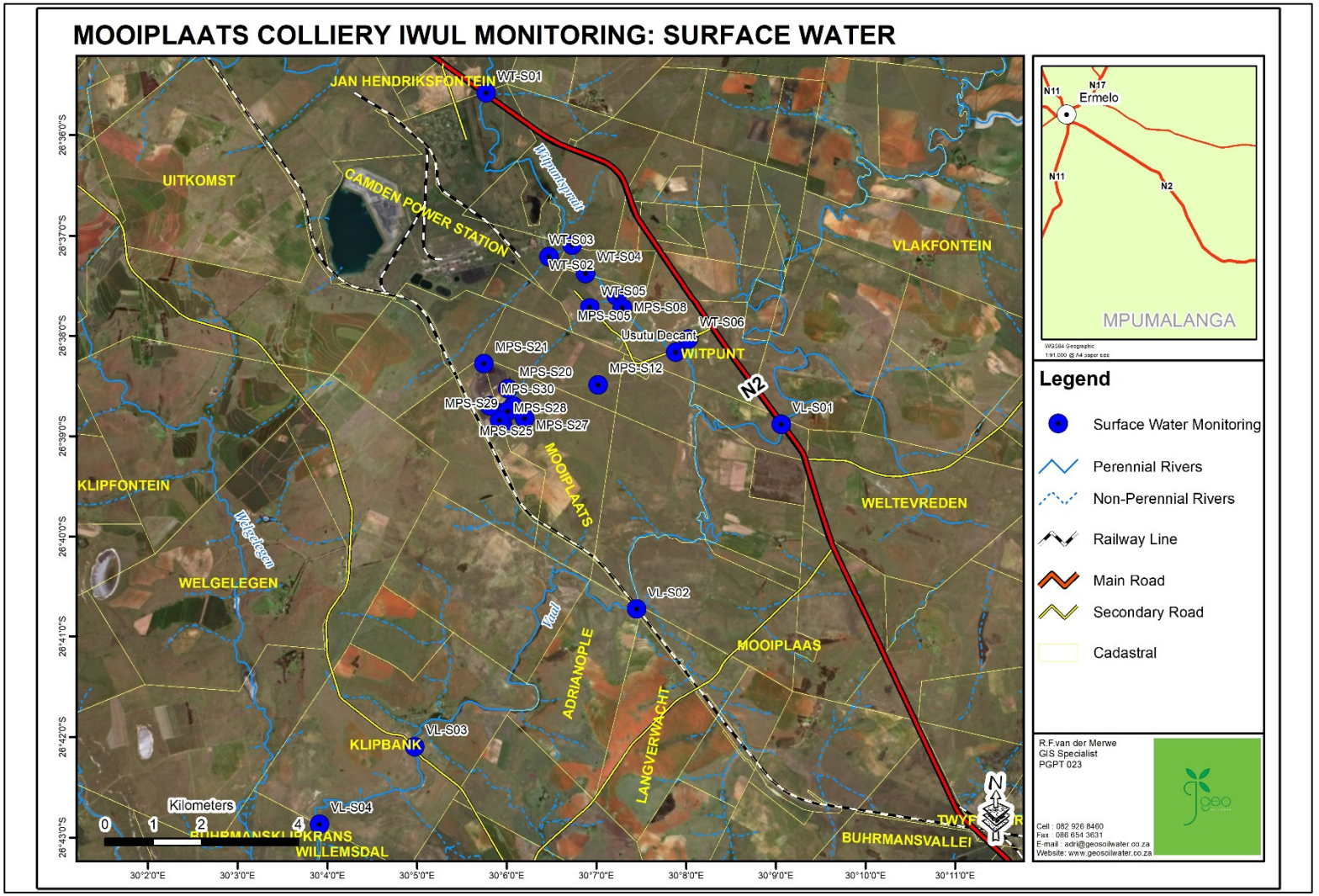


Figure 2 Location of surface water monitoring points.

Table 1 Summary of surface water monitoring points.

Mooiplaats Colliery Monitoring Programme			
Surface Water Monitoring Points			
Locality	**Locality Description**	**Coordinates WGS 84 ddd.ddddd**	**Monitoring Frequency**
VL-S01	Vaal River 1 Upstream	S26.64616° E30.09890°	Monthly
VL-S02	Vaal River 2 Downstream 1	S26.64804° E30.15098°	Monthly
VL-S03	Vaal River 3 Downstream 2	S26.67879° E30.12411°	Monthly
VL-S04	Vaal River 4 Downstream 3	S26.70167° E30.08288°	Monthly
WT-S01	Witpuntspruit 1 Upstream	S26.71447° E30.06519°	Monthly
WT-S02	Witpuntspruit 2 Midstream	S26.59307° E30.09617°	Monthly
WT-S03	Witpuntspruit Tributary North DS 1	S26.61826° E30.11211°	Monthly
WT-S04	Witpuntspruit 3 Midstream	S26.62014° E30.10781°	Monthly
WT-S05	Witpuntspruit Tributary South DS 2	S26.62294° E30.11463°	Monthly
WT-S06	Witpuntspruit 6 Downstream	S26.62863° E30.11539°	Monthly
MPS-S08	Witpuntspruit 5 MS	S26.62873° E30.12149°	Monthly
MPS-S12	Witpuntspruit Tributary @ Access Road	S26.64150° E30.11697°	Monthly
MPS-S13	Runoff from Loading Area	S26.64837° E30.09888°	Monthly
MPS-S14	Gen-sub PCD	S26.64616° E30.09890°	Monthly
MPS-S15	Stormwater trench @ Security	S26.64837° E30.09888°	Monthly
MPS-S16	DS Area of Erikson's + Settling Dams	S26.64505° E30.10121°	Monthly
MPS-S20	Erickson Dams	S26.64505° E30.10121°	Monthly
MPS-S21	Main Holdings Dam	S26.64198° E30.10059°	Monthly
MPS-S25	Workshop Trench DS of Workshop	S26.63826° E30.09506°	Monthly
MPS-S27	Witpuntspruit Tributary entering MP	S26.64716° E30.10336°	Monthly
MPS-S28	Confluence of MPS-S13 and MPS-S15	S26.64808° E30.09925°	Monthly
MPS-S29	Storm water @ Offices	S26.64743° E30.09802	Monthly
MPS-S30	Plant PCD	S26.64508° E30.09674°	Monthly
Usutu Decant	Decant from Old Usutu Workings Decanting into the Witpuntspruit Upstream of WT-06	S26.63611°E30.13139°	Monthly
	Additional Monitoring Points		
	IWUL Monitoring Points		

VL-S01

VL-S02

	
VL-S03	VL-S04
	
WT-S01	WT-S02
	
WT-S03	WT-S04
	
WT-S05	WT-S06
	
MPS-S08	MPS-S13

	
MPS-S14	MPS-S15
	
MPS-S16	MPS-S20
	
MPS-S21	MPS-S25
	
MPS-S27	MPS-S28
	
MPS-S29	MPS-S30

Usutu Decant

Figure 3 Photographic record of surface water monitoring points.

3.3 Groundwater

The IWUL groundwater monitoring points are being sampled on a **monthly** basis for chemical water **quality** and **levels** where additional groundwater monitoring points are being sampled on a **biannual** basis.

Nine (9) IWUL and twenty (20) additional groundwater monitoring points are included in the Groundwater monitoring programme.

Refer to **Annexure A** for in-field sampling sheets.

Figure 4 indicates the positions of the groundwater monitoring points.

Figure 5 display the photographic evidence of the groundwater monitoring points.

Table 2 is a summary of the monitoring points including the name, description, coordinates and the frequency of monitoring.

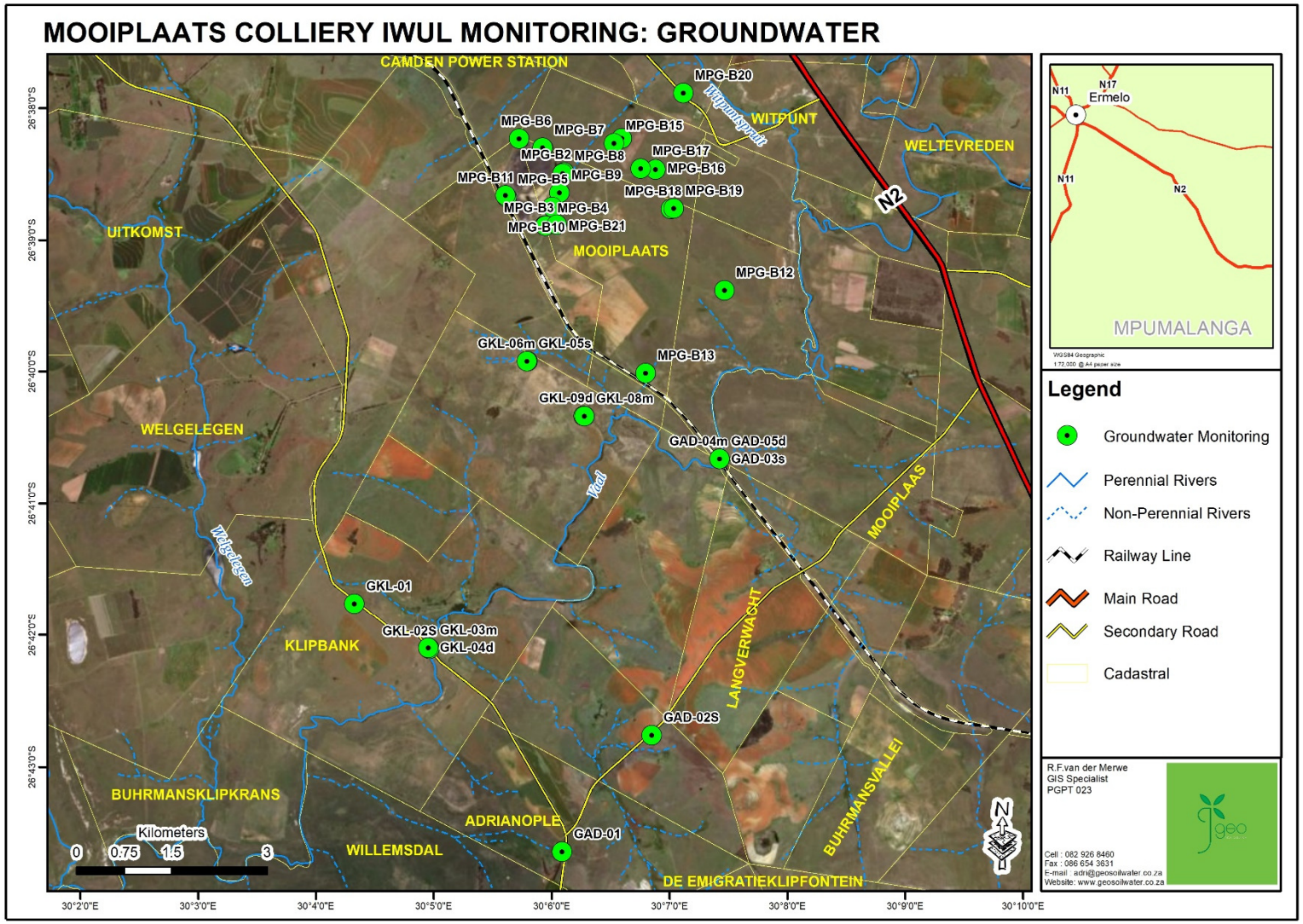


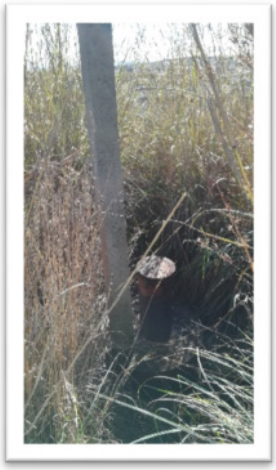
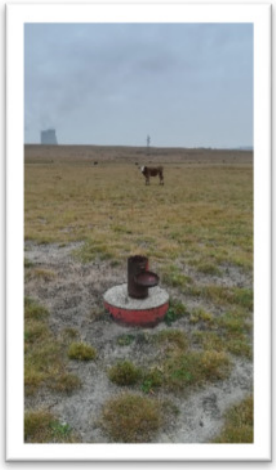
Figure 4 Location of groundwater monitoring points.

Table 2 Summary of groundwater monitoring points.

Mooiplaats Colliery Groundwater Monitoring Programme			
Groundwater Monitoring Points			
Locality	**Locality Description**	**Coordinates WGS 84 ddd.ddddd**	**Monitoring Frequency**
GKL-1	IWUL Borehole	S26.69603° E30.07208°	Monthly
GKL-4d	IWUL Borehole	S26.70167° E30.08253°	Monthly
GKL-3m	Borehole	S26.70178° E30.08269°	Monthly
GKL-2s	IWUL Borehole	S26.70178° E30.08269°	Monthly
GAD-2s	IWUL Borehole	S26.71269° E30.11414°	Monthly
GAD-1	IWUL Borehole	S26.72733° E30.10144°	Monthly
GKL-9D	IWUL Borehole	S26.67231° E30.10450°	Monthly
GKL-8M	IWUL Borehole	S26.67233° E30.10464°	Monthly
GKL-5S	IWUL Borehole	S26.66542° E30.09647°	Monthly
GKL-6M	IWUL Borehole	S26.66542° E30.09658°	Monthly
GAD-3s	Borehole	S26.67772° E30.12374°	Monthly
GAD-4m	Borehole	S26.67772° E30.12374°	Monthly
GAD-5d	Borehole	S26.67772° E30.12374°	Monthly
MPG-B1	Down gradient (north) of the co-disposal facility.	S26.63843° E30.09878°	Biannually
MPG-B2	Down gradient (east) of the lined Settling Dams and co-disposal.	S26.64143° E30.10175°	Biannually
MPG-B3	Near the security gate.	S26.64816° E30.09905°	Biannually
MPG-B4	Near the security gate.	S26.64819° E30.09910°	Biannually
MPG-B5	Up-gradient (south-west) of the plant area next to the railway line.	S26.64457° E30.09363°	Biannually
MPG-B6	Adjacent to the return water dam.	S26.63719° E30.09540°	Biannually
MPG-B7	Down gradient (north) of the co-disposal facility.	S26.63832° E30.09870°	Biannually
MPG-B8	Down gradient (east) of the lined Settling Dams.	S26.64160° E30.10155°	Biannually
MPG-B9	Down gradient (east) of the plant area.	S26.64403° E30.10107°	Biannually
MPG-B10	Down gradient (east) of the plant area.	S26.64581° E30.10007°	Biannually
MPG-B11	Up-gradient (south-west) of the plant area next to the railway line.	S26.64435° E30.09344°	Biannually
MPG-B12	At MPN Vunene extension	S26.65633° E30.12443°	Biannually
MPG-B13	South of the mine next to the railway line.	S26.66689° E30.11329°	Biannually
MPG-B14	Between Usutu/MPN	S26.63716° E30.10992°	Biannually
MPG-B15	Between Usutu/MPN	S26.63778° E30.10881°	Biannually
MPG-B16	Between Usutu/MPN	S26.64106° E30.11469°	Biannually
MPG-B17	Between Usutu/MPN	S26.64095° E30.11259°	Biannually
MPG-B18	Between Usutu/MPN	S26.64608° E30.11685°	Biannually
MPG-B19	Between Usutu/MPN	S26.64600° E30.11725°	Biannually
MPG-B20	Usutu UG. BH intersecting mine at 90 m	S26.63144° E30.11860°	Biannually
	Additional Monitoring Points		
	IWUL Monitoring Points		

		
GKL-1	GKL-2S	GKL-3M
	No image available No Access to Area	No image available No Access to Area
GKL-4D	GKL-5S	GKL-6M
No image available No Access to Area	No image available No Access to Area	
GKL-8M	GKL-9D	GAD-1

		
GAD-2S	GAD-3S	GAD-4M
		
GAD-5D	MPG-B1	MPG-B2
		
MPG-B3	MPG-B4	MPG-B5

		
MPG-B6	MPG-B7	MPG-B8
		
MPG-B9	MPG-B10	MPG-B11
No image available No Access to Area	No image available No Access to Area	
MPG-B12	MPG-B13	MPG-B14

MPG-B15

MPG-B16

MPG-B17

*

MPG-B18

MPG-B19

MPG-B20

MPG-B21

Figure 5 Photographic record of groundwater monitoring points.

4. METHODOLOGY

The following is a description of the sampling protocol, analyses and reporting included in the Mooiplaats Colliery monitoring programme. Please refer to **Section 3** of this report for a complete description of the monitoring points.

4.1 Sampling Protocol

GSW is responsible for the sampling of the monitoring points, the assessment evaluation and report writing.

All fieldwork is conducted on the protocols and specifications, and code of practice contained in the SABS ISO 5667-1-15. These international standards address all aspects from the program design, sampling methods, as well as sample preservation and many other aspects.

Boreholes are not purged prior to sampling.

The DWS developed a series of Best Practice Guidelines (BPG's) for water quality management in the South African mining industry. This series of BPG's forms a component of the overall source directed water policy for mining and related activities implemented by the DWS. The Best Practice Guideline H1: Integrated Mine Water Management, the Best Practice Guideline G2: Water and salt balances and the Best Practice Guideline G3: Water Monitoring Systems make specific references to water monitoring requirements and was thus used as a guiding tool in this study and the subsequent development of a surface water and groundwater monitoring program for Mooiplaats Colliery.

4.2 Surface water

For chemical analyses, a 200 mL plastic container was used to collect a grab sample. Bottles are properly labelled, filled to the brim and sealed before being taken to a South African National Accreditation Systems (SANAS) accredited laboratory, for analyses.

Furthermore, all field data is captured in a custom-made field data sheet, wherein all relevant information regarding each monitoring point is recorded, including date, time, sampler, and immediate environment in terms of potential contributors to recorded qualities.

A geographical coordinate of each monitoring point is collected and a photograph is captured (only at project initiation).

Monitoring occurs at twenty five (25) surface water monitoring points on a monthly basis.

Monthly surface water samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity $CaCO_3$/L
- Ca mg/L
- Mg mg/L
- Na mg/L
- K mg/L
- F mg/L
- Cl mg/L
- SO_4 mg/L
- NO_3 mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH_3 mg/L

4.3 Groundwater

For groundwater analyses, a static depth measurement is captured before sampling commences. Disposable, plastic bailers (sealed in separate sleeves) are used to collect the water samples. This way contamination of each sample is prevented to obtain representative samples from each borehole. Bailers are lowered to approximately 5 meters below the static water level where a sample is collected.

Geographical coordinates, photos and the date, time and field analyses for each sample are recorded.

Monitoring occurs at thirty three (33) groundwater monitoring points. Thirteen (13) IWUL groundwater points on a monthly basis and the additional twenty (20) groundwater points on a biannual basis.

Groundwater samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity $CaCO_3$/L
- Ca mg/L
- Mg mg/L
- Na mg/L
- K mg/L
- F mg/L
- Cl mg/L
- SO_4 mg/L
- NO_3 mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH_3 mg/L

4.4 Water levels

Water levels at groundwater monitoring points are recorded on a monthly and biannual basis (as per Section 5.3) using an electronic water level meter with a probe which measures water levels accurately in boreholes and wells (Section 6.9).

4.5 Water sample analyses

Both, surface - and groundwater samples are submitted to UIS Laboratories (UIS), for organic, physical and chemical analyses. Surface - and groundwater samples are analysed for variables as described in **Sections 4.2** and **4.3** or additionally as requested on an ad hoc basis.

5. AQUATIC BIOMONITORING

The aquatic biomonitoring assessment includes the assessment of the biophysical attributes of the aquatic ecosystems, specifically pertaining to water quality, macroinvertebrates, fish community structures and habitat quality.

5.1 Objectives

The Mooiplaats Colliery is located in the upper reaches of the Vaal River south of Ermelo, Mpumalanga, South Africa. The watercourses associated with Mooiplaats Colliery are located within the Vaal Water Management Area (WMA 5) (NWA, 2016) and the Highveld Lower ecoregion (Dallas, 2007).

The Vaal River and Witpuntspruit are the primary drainage features associated with Mooiplaats Colliery and thus the study subject. The area surrounding the project site consists predominantly of agricultural fields (dryland), Camden Power Station and mining.

A total of five biomonitoring sites were selected for the study (**Figure 8**). The sites used in this study were selected according to previous biomonitoring studies conducted in 2012 by Natural Scientific Services (NSS). These sites were selected to effectively monitor impacts stemming from the activities at the Mooiplaats Colliery on a **biannual basis**. Sites **MPU**, **MPD** and **MP2** are situated in the Witpuntspruit Sub-Quaternary Reach (SQR) (C11B-1641), while site **MV1** is situated in Vaal SQR (C11B-1693), and site **MPW** is situated in Vaal SQR (C11B-1770). A site description, photographs and GPS coordinates for the sampled river reaches are presented in **Figures 7** and **8**.

5.2 Methodology

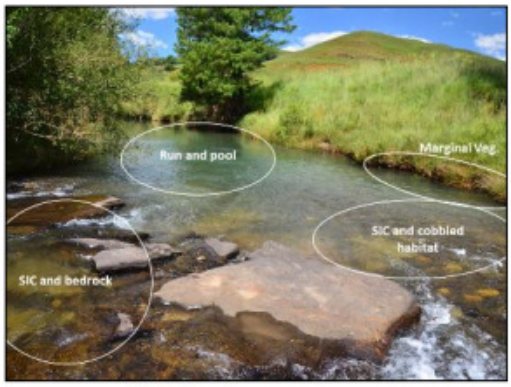
Standard aquatic sampling methods are used for the Mooiplaats aquatic biomonitoring study. Various methods are conducted as illustrated in **Figure 6**.

Figure 6 indicates the standard aquatic sampling techniques.

Figure 7 display the biomonitoring sites relative to Mooiplaats.

Figure 8 is a summary of the monitoring points including the name, description, coordinates.

Water quality analysis (*In situ*)



Habitat Assessments

Kick and sweep sampling method, SASS5 (South African Scoring System Version 5)

Electrofishing

Figure 6 Standard aquatic sampling at biomonitoring sites.

Aquatic biomonitoring for Mooiplaats incluce:

- In-situ water quality,
- Habitat Assessment,
- Aquatic Macroinvertebrates,
- Biotic Integrity based on SASS5,
- Fish Assessment.

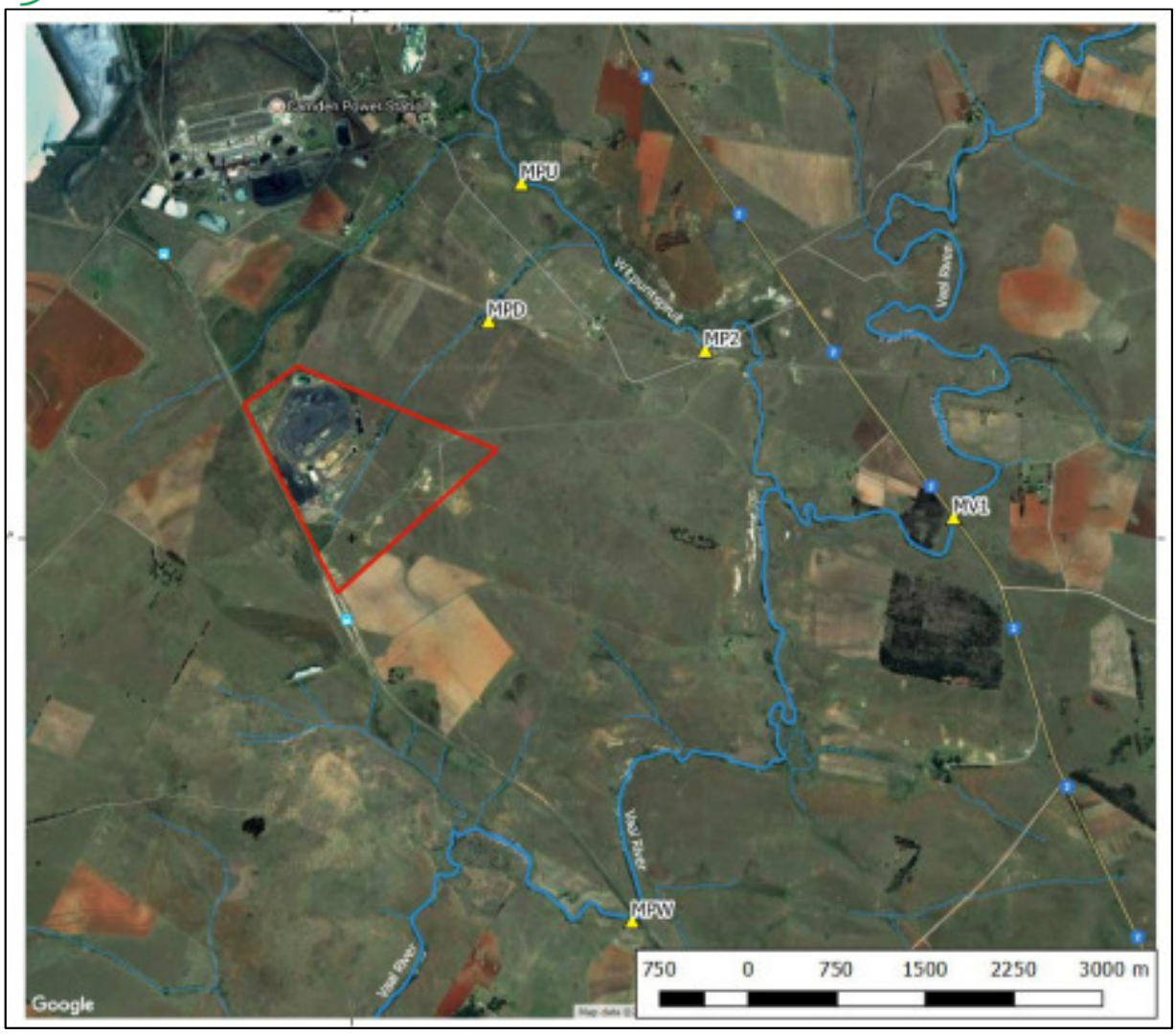


Figure 7 Illustration of the aquatic biomonitoring points in relative to Mooiplaats.

	Upstream	Downstream
MPU		
GPS	26°37'22.41"S 30° 6'51.69"E	
Site	Site MPU was located upstream of the Mooiplaats Colliery on the Witpuntspruit. The site is further located approximately 1 km downstream of Camden Power Station. The site was characterized by slow flowing waters over sand, mud and stone. Marginal vegetation was abundant in the form of reeds, with moderate amounts of aquatic vegetation present.	

	Upstream	Downstream
MPD		
GPS	26°38'0.24"S 30° 6'41.62"E	
Site	Site MPD was situated in a dam, approximately 1.4 km downstream of the Mooiplaats Colliery on a tributary of the Witpuntspruit. The site was characterised by standing water.	

	Upstream	Downstream
MP2		
GPS	26°38'7.53"S 30° 7'46.81"E	
Site	Site MP2 was located on the Witpuntspruit downstream of the Mooiplaats Colliery and sites MPU and MPD. The site is further located approximately 1 km downstream of Camden Power Station. The site was characterised by slow flowing water over bedrock and sand. Marginal vegetation was abundant.	

	Upstream	Downstream
MV1		
GPS	26°38'54.09"S 30° 9'4.09"E	
Site	Site MV1 was located on the Vaal River upstream of the Witpuntspruit and Mooiplaats Colliery. The site was characterised by slow to fast flowing water over stones, gravel, sand and mud substrate. Marginal and aquatic vegetation were abundant.	

	Upstream	Downstream
MV1		
GPS	26°38'54.09"S 30° 9'4.09"E	
Site	Site MV1 was located on the Vaal River upstream of the Witpuntspruit and Mooiplaats Colliery. The site was characterised by slow to fast flowing water over stones, gravel, sand and mud substrate. Marginal and aquatic vegetation were abundant.	

Figure 8 Photographic record, coordinates and description of biomonitoring sites.

6. SECTION 21 WATER USE

Mooiplaats Colliery holds a Mining Right (MP30/5/1/2/2/68/MP) in respect of Portions 1 and 9 of the farm Mooiplaats 290 IT, Ermelo and an Integrated Water Use Licence No. 08/C11B/AGJ/2141, File No: 16/2/7/C112/C155 dated 02 May 2013 (IWUL), issued in terms of the National Water Act (Act No. 36 of 1998) (NWA) for the following water uses:

- Section 21(a): Taking of water from a water resource;
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(j): Removing, discharging or disposing of water found underground.

6.1 Objectives

All quantities of water removed and disposed, are metered in the form of self-registering flow meters, installed on the delivery lines. Volumes are recorded on a daily basis and the daily and monthly flow meter readings are captured into the Mooiplaats Information Management System Database for Flow Meter Readings (MIMS-FM), which are updated on a monthly basis for submission to the Regional Head as stipulated in the IWUL.

Apart for submission to the Regional Head, water use is an integral part of the mining operations and assist Mooiplaats in critical decision making.

Authorised water uses in terms of Section 21 are indicated in terms of Section 21(a) in **Table 3**, Section 21(g) in **Table 4** and the location of the water uses are indication in **Figure 9**.

No Table exist in the IWUL for Section 21(j) water uses. See Annexure IV, Condition 1.1 and 1.2, p14 of the IWUL.

Table 3 Section 21(a) authorised water uses and water uses metered (**Table 2** of IWUL).

Activity	Purpose	Properties	Total Water (m^3)	Coordinate
Section 21(a) Usutu Borehole 1	Process Water	Portion 2 of Mooiplaats 290 IT	16 425	S26°38'28.5 E30°07'00.1
Section 21(a) Usutu Borehole 2	Process Water	Portion 2 of Mooiplaats 290 IT	16 425	S26°38'28.5 E30°07'01.0
Section 21(a) Usutu Borehole 3	Process Water	Portion 2 of Mooiplaats 290 IT	16 425	S26°38'29.4 E30°06'59.1
Section 21(a) Usutu Borehole 4	Process Water	Portion 2 of Mooiplaats 290 IT	16 425	S26°38'29.4 E30°07'00.1
Section 21(a) Potable water 1 (north Shaft)	Potable Water	Portion 9 of Mooiplaats 290 IT	6 083	S26°39'04.4 E30°05'54.0
Section 21(a) Potable water 2 (north Shaft)	Potable Water	Portion 9 of Mooiplaats 290 IT	6 083	S26°38'56.6 E30°05'54.7
Section 21(a) Potable water 3 (north Shaft)	Potable Water	Portion 9 of Mooiplaats 290 IT	6 083	S26°38'53.0 E30°06'02.5

Table 4 Section 21(g) Volumes of water and water containing waste to be disposed at the waste disposal facilities (**Table 3** of IWUL).

Facility	Volume (m^3/a)	Waste Description	Geographic Position	Farm Name	Capacity (m^3)
North Shaft Settling Dam 1	459 030	Collects water from PCD and shaft water, sewage effluent and water from boreholes (dry period only)	S26.640262° E30.100379°	Portion 1 of Mooiplaats 290 IT	13 320
North Shaft Settling Dam 2	452 145	Stores water from settling Dam 1	S26.640889° E30.100444°	Portion 1 of Mooiplaats 290 IT	13 500

Facility	Volume (m^3/a)	Waste Description	Geographic Position	Farm Name	Capacity (m^3)
North Shaft Settling Dam 3	402 112	Water collected from settling Dam 2	S26.641667° E30.100583°	Portion 1 of Mooiplaats 290 IT	20 160
North Shaft Return Water Dam	320 645	Collects water from Codisposal Facility	S26.637667° E30.095250°	Portion 1 of Mooiplaats 290 IT	17 438
Plant Ericson Dam	423 400	Receives water from Settling Dam 3	S26.645639° E30.095639°	Portion 1 of Mooiplaats 290 IT	2 000
Underground Erickson Dams	21 900	Water used for underground supply, collect from plant Erickson Dam	S26.642179° E30.100230°	Portion 1 of Mooiplaats 290 IT	2 000
Pollution Control Dam	111 870	Collects dirty run off	S26.646171° E30.098823°	Portion 1 of Mooiplaats 290 IT	23 000

Section 21(j) Volumes of water and water containing waste to be disposed at the waste disposal facilities (Annexure IV, Condition 1.1 and 1.2, p14 of the IWUL).

The Licensee is authorised to remove a volume not exceeding forty three thousand eight hundred cubic meters per annum (43 800 m3/a) of groundwater from underground workings situated at Portion 9 of Mooiplaats 290 IT (Condition 1.1).

The Licencee is authorised to extract groundwater from the mining shaft for the purposes of ensuring continued safe mining. (Condition 1.2).

Figure 9 Mooiplaats IWUL Section 21 authorised water uses.

7. DUST FALLOUT MONITORING

7.1 Objectives

The objectives of the dust fallout monitoring programme are as follows:

- Collect samples on a monthly basis through the use of dust buckets, from carefully selected locations, informed by an assessment of the predominant wind direction for the area;
- Submit samples on a monthly basis to an accredited laboratory for comprehensive analysis, to determine dust fallout;
- Report on compliance of analytical results against standards, on a quarterly basis, in order to identify problem areas and make recommendations for remedial actions;
- Identify areas and sources of pollution; and
- Submit copies of the dust fallout monitoring reports to the client for submission to the relevant government authorities, on a quarterly basis.

7.2 Methodology

Depending on the particulate size and wind velocity, loose particulate matters are airborne and subsequently, transported away from a source. As the wind speed subsides, suspended particulate matter starts settling out from the atmosphere. The distance travelled from source is directly proportional to the size of the particle. The monitoring of dust fallout, utilising bucket collection, is internationally recognised and documented as an accepted method of determining dust fallout from various sources.

The standard procedure accepted internationally is adopted by the South African National Standard (**SANS 1137:2012**) "Standard Test Method for Collection and Measurement of Dust fall" (Settleable Particulates Matter). This method uses a passive wet dust collector, which comprises of a vertical pole of ~2 meters above the ground, a 5-litre bucket with a surface area of 227 cm^2. Each bucket contains 4 litres of distilled water to which was added Copper Sulphate - $CuSO_4$ (25 mg-1 solution). The presence of $CuSO_4$ in solution prevents algae growth. Exposed buckets (for 30±2 days) are collected at the end of each exposure period and sent to the laboratory for gravimetric analysis. The mixture of dust and water is filtered through a sub-micronic, pre-weighed filter using a vacuum filter bench. The filters are oven dried for about 90 min before cooling in a desiccator for at least an hour and then reweighed to ascertain the collected mass (insoluble particulate).

7.3 Monitoring Sites

The monitoring sites are depicted in **Table 2.1** and **Figure 2.1.**

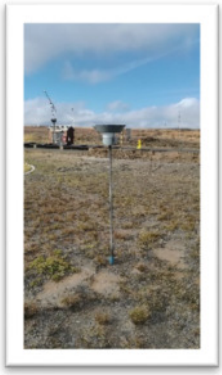
The dust fallout network comprises of eight (8) single buckets located on the boundaries, at the offices and high activity zones for the interpretation of the originating dust source.

The selection of sampling sites was in accordance with the latest **SANS 1137:2012** guidelines, which stipulates:

- the number of samplers that shall be sufficient to monitor dust fallout at representative locations; and
- criteria for site selection around the dust source.

Table 5 Description, presentation and location of dust fallout monitoring units.

Monitoring Point	Coordinates (WGS 84) ddd.ddddd°	Description	Photographic Evidence
East	S26.102714° E30.155242°	**Single** dust monitoring unit located on the **eastern** boundary.	
West	S26.102974° E30.156702°	**Single** dust monitoring unit located on the **western** boundary.	

Monitoring Point	Coordinates (WGS 84) ddd.ddddd°	Description	Photographic Evidence
Office	S26.104504° E30.156403°	**Single** dust monitoring unit located at the Main office area.	
Weighbridge	S26.103732° E30.154770°	**Single** dust monitoring unit located at the Weighbridge / Loading area.	
Shaft	S26.102553° E30.163236°	**Single** dust monitoring unit located at the shaft.	

Monitoring Point	Coordinates (WGS 84) ddd.ddddd°	Description	Photographic Evidence
North	S26.636833° E30.095530°	**Single** dust monitoring unit located north of the Codisposal.	
East PCD	S26.639753° E30.102974°	**Single** dust monitoring unit located east of Codisposal and Settling dams PCD.	
South	S26.651026° E30.097168°	**Single** dust monitoring unit located of Mooiplaats Colliery.	

7.4 Dust Fallout Analysis and Results

Results from the gravimetric analysis of the exposed dust buckets are reported in mg/m^2/day, 30-day average and compared against the NDCR, 2013.

In terms of dust fallout standards, a four-band scale: *target, action* and *alert* thresholds and permissible frequency of exceedances, described in **SANS1929:2011,** are now superseded

by the NDCR, 2013. The Minister of Water and Environmental Affairs, released on 01 November 2013 the National Dust Control Regulation, in terms of Section 53 (0), read with Section 32 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NDCR, 2013). In line with the NDCR, 2013 and on the basis of the cumulative South African experience, the National Department of Environmental Affairs published the acceptable dust fallout rates in residential and non-residential areas. The current National Dust Fallout Standard is given in **Table 6**

In the NDCR, 2013, terms like *target, action* and *alert* thresholds have been omitted. Another notable observation was the reduction of the margin of tolerance from the usual three to two incidences within a year (NEM: AQA-NDCR, 2013). The NDCR, 2013 adopted a more stringent approach than the previous standard, and would require dedicated mitigation plans now that it is in force.

Dust fallout that exceed the specified rates, but that can be shown to be the result of some extreme weather or geological event shall be discounted for the purpose of enforcement and control. Such an event might typically result in excessive dust fallout across an entire metropolitan region, and not be localized to a particular operation. Natural seasonal variations, for example the naturally windy months each year, will not be considered extreme events for this definition (**SANS 1929:2011**).

Any person who conducts any activity in such a way as to give rise to dust in quantities and concentrations that may exceed the dust fallout standard (**Table 2.2**) set out in Regulation 4 of the NDCR, 2013 must, upon receipt of a notice from an air quality officer, implement a dust fallout monitoring programme (NDCR, 2013).

Table 6 National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004). National Dust Control Regulations, 2013 - Acceptable Dust Fallout Rates.

NEMA: AQA - NDCR 2013 Acceptable Dust Fallout Rates		
Restriction Areas	**Dust fall Rate mg/m²/day 30-day average**	**Permitted frequency of exceeding dust fall rate**
Residential	D < 600	Two within a year, not sequential months
Non-residential	600 < D < 1200	Two within a year, not sequential months

Figure 10 Location and compliance of dust fallout monitoring sites relative to Mooiplaats Colliery.

8. INVASIVE SPECIES SURVEY AND ERADICATION MONITORING AND CONTROL PLAN

To identify the invasive species present within the project boundary, an area that is currently being mined, to map the presence of the invasive species as well as to determine a suitable method of clearing species which are currently listed as per NEM:BA listed invasive species (RSA 2014).

8.1 Terms of Reference

The Terms of Reference (ToR) included the following:

- Ensure that commitments described in the EMP regarding the management of alien vegetation are fulfilled.
- Consider baseline data for the identification and location of alien vegetation. These findings will be ground-truthed and re-assessed with a site visit.
- Adhere to the Alien and Invasive Species Regulations according to NEMBA
- Compile a practical and cost-effective plan which can be effectively implemented for the management of alien vegetation.

8.2 Key Legislative Requirements

The following legal framework and requirements apply to the study:

- The National Environmental Management Act (NEMA) No. 107 of 1198): Environmental Impact Assessment Regulations, 2014. Specifically, the requirements of the specialist report as per the requirements of Appendix 6; and
- The National Environmental Management: Biodiversity Act (NEM:BA) No. 10 of 2004: specifically, the management and conservation of biological diversity within the RSA and of the components of such biological diversity.

8.3 Alien Invasive Plant Species

Declared weeds and invader/alien plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of these systems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species.

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 78 of 2014). The Alien and Invasive Species Regulations were published in the Government Gazette No. 37886, 1 August 2014, and was amended in February 2018 in the Government Gazette No. 41445. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

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

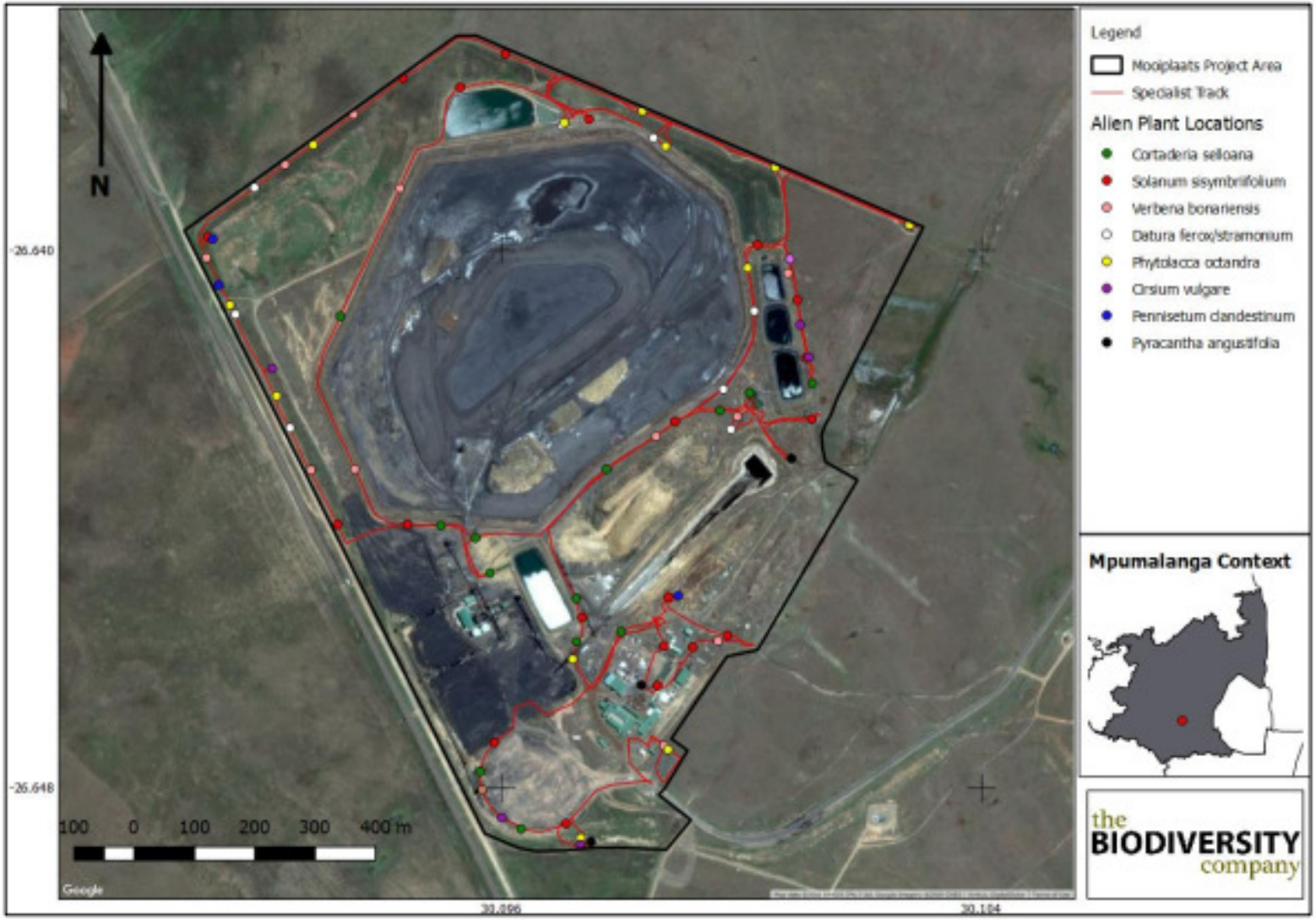


Figure 11 General project area of alien and invasive irradiation plan.

9. CONCLUSION

Mooiplaats Colliery holds a Mining Right (MP30/5/1/2/2/68/MP) in respect of Portions 1 and 9 of the farm Mooiplaats 290 IT, Ermelo and an Integrated Water Use Licence No. 08/C11B/AGJ/2141, File No: 16/2/7/C112/C155 dated 02 May 2013 (IWUL), issued in terms of the National Water Act (Act No. 36 of 1998) (NWA).

Geo Soil & Water cc (GSW) and The Biodiversity Company (TBC) were appointed by Mooiplaats Colliery (Pty) Ltd to conduct monitoring in line with the requirements of the Integrated Water Use Licence (IWUL) at Mooiplaats Colliery on a monthly, quarterly, biannual and annual basis to determine the current state, improvement or deterioration of the associated environment caused by historical, current and future mining operations to implement effective control measures.

Individual Monitoring programmes required by the IWUL, implemented and managed by Mooiplaats:

- Surface water monitoring (GSW),
- Groundwater monitoring (GSW),
- Groundwater level monitoring (GSW),
- Section 21 water use monitoring (GSW),
- Aquatic biomonitoring (TBC).

Additional monitoring programmes

- Dust fallout monitoring (GSW),
- Invasive species survey and eradication monitoring and control plan (TBC).

Monitoring programmes will be updated on an annual basis, or with the renewal/addition of legislative requirements.