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QUARTERLY WATER QUALITY REPORT 1-2025

01 FEBRUARY 2025 TO 30 APRIL 2025

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File No. 16/2/7/C112/C155, 2013**

Mooiplaats Colliery (Pty) Ltd

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ABBREVIATIONS

AMD	Acid Mine Drainage
Ag	Silver
Al	Aluminium
As	Arsenic
AWQR	Annual Water Quality Report
BDL	Below detection limit
BH	Borehole
BPG	Best Practice Guideline
Ca	Calcium
Cd	Cadmium
Cl	Chloride
CoC	Chain of Custody
COD	Chemical Oxygen Demand
Co	Cobalt
Cr6+	Hexavalent Chrome
CSIR	Council for Scientific and Industrial Research
Cu	Copper
DEA	Department of Environmental Affairs
DMRE	Department of Mineral Resources and Energy
DRO	Diesel Range Organics
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
F	Fluoride
Fe	Iron
GC-MS	Gas Chromatography Mass Spectrometer



GD-VO	Grootdraai Dam Guidelines - Vaal Origin Catchment
GPS	Global Positioning System
GRO	Gasoline Range Organics
GSW	Geo Soil & Water (Pty) Ltd GSW
GW	Groundwater
HCO ₃ ⁻	Bicarbonate
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
IWUL	Integrated Water Use License
K	Potassium
mamsl	metres above mean sea level
mbgl	metres below ground level
Mg	Magnesium
mg/l	milligram per litre
Mn	Manganese
mg/L	Milligrams per Liter
MPN	Mooiplaats Colliery North
MPS	Mooiplaats Colliery South
Na	Sodium
NEMA	National Environmental Management Act (Act No. 107 of 1998)
Ni	Nickel
NO ₃ ⁻	Nitrate
NWA	National Water Act (Act No. 36 of 1998)
ORP	Oxidation Reduction Potential
Pb	Lead
QWQR	Quarterly Water Quality Report
RQO	Resource Quality Objective
SANAS	South African National Accreditation System
SANS	South African National Standard
SAR	Sodium Absorption Ratio
Se	Selenium



SO₄

Sulphate

TDS

Total Dissolved Solids

WGS 84

World Geodetic System 1984

WUL

Water Use License

Zn

Zinc



DEFINITIONS

Acid Mine Drainage

Acid Mine Drainage (AMD) refers to the outflow of acidic water from metal or coal mines due to the oxidation of sulphide minerals.

Anions

Ions with a net negative charge. Examples: OH⁻, O²⁻, SO₄²⁻, Alk (HCO₃⁻), Cl⁻, etc. The Bicarbonate (HCO₃⁻) ion is the largest component of Alkalinity.

Artesian borehole

Boreholes that penetrate confined aquifers, in which the piezometric surface is above ground level, so that the boreholes spontaneously discharge water without being pumped.

Aquifer vulnerability

Tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer.

Borehole

Includes a well, excavation, or any other artificially constructed or improved underground cavity which can be used for the purpose of intercepting, collecting, or storing water in or removing water from an aquifer; observing and collecting data and information on water in an aquifer; or recharging an aquifer. Source: National Water Act (Act No. 36 of 1998).

Cations

Ions with a net positive charge. Examples: Ca⁺, Mg⁺, Na⁺, K⁺, Fe²⁺.

Compliance monitoring

Monitoring done in compliance with permit or license conditions.

Contamination

Substances that make it impure and unfit for consumption or an intended use and can cause harm to human health or the environment. Contaminants can be naturally occurring or caused by humans.

Data interpretation

The analysis of data to obtain information concerning the groundwater system which in turn can be used to manage/remediate the system.



Data management

The effective use of the data while ensuring its integrity and providing a centralized repository for storage.

Drawdown

The distance between the static water level and the surface of the cone of depression.

Environment

The external circumstances, conditions and objects that affect the existence and development of an individual, organism, or group. These circumstances include biophysical, social, economic, historical, cultural, and political aspects. 'Environment' is described as the surroundings within which humans exist and is made up of:

- the land, water, and atmosphere of the earth,
- micro-organisms, plant, and animal life,
- any part or combination of (i) and (ii) and the interrelationships among and between them; and
- the physical, chemical, aesthetic, and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Groundwater Flow

The movement of water through openings in sediment and rock; occurs in the zone of saturation in the direction of the hydraulic gradient.

Groundwater modelling

Numerical representation of a groundwater flow system that attempts to mimic the natural processes in nature. It is a simplified version of a natural system, compiled with geological, hydrogeological, hydrological, and meteorological data, which utilises a governing equation to incorporate all this data to simulate the hydraulic properties of the groundwater system.

Hydrocensus

Gathering of hydrogeological information through field measurements.

Hydrogeology

The study of the interrelationships of geologic materials and processes with water, especially groundwater.



Impact Assessment

A formal process used to predict the environmental consequences (positive or negative) of a plan, policy, program, or project prior the implementation decision, it proposes measures to adjust impacts to acceptable levels or to investigate new technological solution.

Infiltration

The downward movement of water from the atmosphere into the ground.

Leaching

The process by which soluble materials in the soil, such as salts, nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

Monitoring Programme

A programme for taking regular measurements of the quantity and/or quality of a water resource, waste, or wastewater discharge at specified intervals and at specific locations to determine the chemical, physical and biological nature of the water resource, waste, or wastewater discharge.

Piezometric surface

An imaginary or hypothetical surface of the piezometric pressure or hydraulic head throughout all or part of a confined or semi-confined aquifer; analogous to the water table of an unconfined aquifer.

Plume

An underground pattern of contaminant concentrations in groundwater created by the movement of groundwater beneath a contaminant source. Contaminants spread mostly laterally in the direction of groundwater movement. The source site has the highest concentration, and the concentration decreases away from the source.

Recharge

Water added to a groundwater aquifer. For example, when rainwater seeps into the ground. Recharge may occur naturally through precipitation or surface water or artificially through injection wells or by spreading water over groundwater reservoirs. See also infiltration.



Reserve

The quantity and quality of water required to supply basic needs of people to be supplied with water from that resource, and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of water resources. This is a unique water resource management requirement of South African legislation.

Resource Quality Objectives

Used to put a Classification and Reserve into practice by specifying conditions that will ensure that the Class is not compromised, and the Reserve can be met. Resource quality may relate to critical flows, groundwater levels and quality that must be maintained.

Sampling and monitoring controls: Control measures to demonstrate the accuracy (how close to the real result you are) and precision (how reproducible your results are) of your monitoring.

STIFF Diagram

A graphical representation or fingerprint of chemical analyses displaying the major ion composition of a water sample. A polygonal shape is created from three parallel horizontal axes extending on either side of a vertical zero axis. Cations are plotted in mill equivalents per liter on the left side of the zero axis, one to each horizontal axis, and anions are plotted on the right side. Stiff patterns are useful in making a rapid visual comparison between water from different sources.

Transmissivity

The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is expressed as the product of the average hydraulic conductivity and thickness of the saturated portion of an aquifer.

Water Quality

The physical, chemical, toxicological, biological (including microbiological) and aesthetic properties of water that determine sustained (1) healthy functioning of aquatic ecosystems and (2) fitness for use (e.g., domestic, recreational, agricultural, and industrial). Water quality is therefore reflected in (a) concentrations or loads of substances (either dissolved or suspended) or micro-organisms, (b) physico-chemical attributes (e.g., temperature) and (c) certain biological responses to those concentrations, loads or physico-chemical attributes.



Water Resource

A water resource includes any watercourse, surface water, estuary, or aquifer. Watercourses include rivers, springs, and natural perennial and non-perennial channels, wetlands, lakes, dams, or any collection identified as such by the Minister in the Government Gazette.

Water Use License

An authorisation from the Department of Water and Sanitation to a designated water user to use water. The authorisation will provide details on the timeframes and conditions for the designated water use.



EXECUTIVE SUMMARY

Mooiplaats Colliery (Pty) Ltd (Mooiplaats) appointed Geo Soil & Water (Pty) Ltd (GSW) to conduct water sampling, water quality analyses and water quality reporting at Mooiplaats in accordance with the requirements of the 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).

The reporting period is from 01 February to 30 April 2025.

Water qualities were compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.

The monitoring network provides information for risk-based decision making to Mooiplaats management with regard to effectiveness of pollution prevention measures and areas requiring management attention.

The following is a summary of the results:

Note: Removing coal from underground / mining ceased on 31 December 2021, with only the coal washing plant being operational currently.

Wastewater - Water quality from the mine water/pollution control dams exceeded limits in terms of EC, TDS, CaCO₃, Ca, Mg, Cl, SO₄, Fe, and Mn - typical of water associated with coal washing/mining activities. Wastewater is contained in storage facilities and circulated in a closed circuit. The pH of process / wastewater should be closely monitored and managed to prevent damage to water infrastructure.

Witpuntspruit – Although historic pollution from upstream of Mooiplaats is evident (at **WT-S01**), water quality recorded a general deterioration in terms of several variable concentrations towards downstream despite dilution from rainfall. With **WT-S05** and the **Usuthu decant** inflow between **WT-S04** and **WT-S06** the water quality deteriorated. From **WT-S01** to **WT-S06**, a net deterioration was recorded. However, current and historical activities have a detrimental effect on this Spruit, which will have a long-term negative effect on the downstream environment of the Vaal River system.



Vaal River – A continuous deterioration was recorded after the confluence of the Witpuntspruit with the Vaal River (between **VL-S01** and **VL-S02**). The increase / deterioration in variable concentrations during the reporting period can be ascribed to the addition of variables received from the Witpuntspruit drainage.

Although Al and Fe exceeded the IWUL limits, concentrations remained low, relative consistent, and in line with historical trends, from upstream to downstream indicating the presence might possibly be geological / natural.

Groundwater - Outside the mining right area, water quality remains mostly stable and of good quality, with slight seasonal fluctuations. Neutral to high neutral pH values, Alkalinity (CaCO_3), and Ca concentrations indicate geological conditions. The movement of pH values, EC concentrations and variables associated with geology indicate the consistent recharge of natural groundwater without mining impacts.

Groundwater levels continued to fluctuate according to seasonal factors and not due to mining impacts.



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1. INTRODUCTION

1.1 Scope of Work

Mooiplaats Colliery (Pty) Ltd (Mooiplaats) appointed Geo Soil & Water (Pty) Ltd to conduct water sampling, water quality analyses and water quality reporting at Mooiplaats in accordance with the requirements of the 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).

Various activities of an anthropogenic nature take place in South Africa's riverine environments. As custodian of the natural water resources, it is an integral function of the Department of Water and Sanitation (DWS) to manage the effects of these activities on the country's water resources.

Water quality monitoring is a mandatory requirement, stipulated in the National Water Act (1998) and forms an integral part of the auditing requirements in terms of the Mineral and Petroleum Resources Development Act (2002) (MPRDA). The MPRDA, Section 39 (1) (2) (3) stipulates that each mine in possession of a mining right must conduct an Environmental Impact Assessment (EIA) and prepare an Environmental Management Program (EMP) of which a monitoring and report auditing process is an integral part of.

The NWA provides for the development of regulations to, amongst others:

- Require that the use of water from a water resource be monitored, measured, and recorded,



- Regulate or prohibit any activity in order to protect a water resource or in-stream or riparian habitat, and
- Prescribe the outcome or effect, which must be achieved through management practices for the treatment of waste, or any class of waste before it is discharged into or allowed to enter a water resource.

In order to reach the above-mentioned objectives monitoring systems need to be established, according to Section 137 (2) and implemented to assess, among others:

- Quality of water resources,
- Use and rehabilitation of water resources,
- Compliance to resource water quality objectives, and
- Health of aquatic ecosystems.

1.2 Purpose of Monitoring Report

As part of the commitments made in the Environmental Management Programme Report (EMPR) and conditions set out in the IWUL, surface - and groundwater monitoring will be implemented and quarterly reports, reflecting the results, submitted to the DWS.

GSW was commissioned by Mooiplaats to implement and conduct surface - and groundwater monitoring as prescribed in the IWUL, 2013. Surface and groundwater water monitoring points are sampled on a monthly and quarterly basis.

The results of the monitoring report are used to inform Mooiplaats management of the impact from mining activities on water resources, the effectiveness of mitigation measures and the potential need to improve water resource impact prevention measures.

With regular and accurate monitoring of resources a comprehensive management system interprets and assists in pollution prevention, pollution management, the determination, improvement, or deterioration of the receiving and surrounding resources.

1.3 Approach to Study

This report investigates and provides summarised information of the monitoring system and various monitoring points at Mooiplaats Colliery. The work done during the monitoring period of the contract included:



Routine monitoring:

- **February 2025 to April 2025** - **IWUL water monitoring:**
- Monthly Surface water monitoring,
- Quarterly Groundwater Monitoring, and
- Quarterly Groundwater Level Monitoring.

2. PROJECT BACKGROUND INFORMATION

Mooiplaats operates an underground mine on Portions 1 and 9 of the Farm Mooiplaats 290IT, approximately 20 km east of Ermelo in the Mpumalanga Province, South Africa. The relevant infrastructure consists of a wash plant, pollution control dams, co-disposal dump, offices, workshops, weighbridge, diesel bowsers, coal stockpiles, overburden stockpiles, etc. Wastewater is contained in storage facilities and circulated in a closed circuit.

Mooiplaats received a Mining Right MP 30/5/1/2/2/68 MP, 2007 (MR) and was granted an Integrated Water Use Licence No. 08/C11B/AGJ/2141, File No: 16/2/7/C112/C155 dated 02 May 2013 (IWUL), from the Department of Water and Sanitation in accordance with the National Water Act, 1998 (NWA).

2.1 Location

Mooiplaats is situated on Portions 1 and 9 of the Farm Mooiplaats 290IT, in the magisterial district of Ermelo, within the Msukaligwa Local Municipality, situated in the Gert Sibande District Municipality. Refer to **Figure 1**.

2.2 Catchment, Rainfall Supply and Use and Surrounding Activities

Mooiplaats is situated in the Upper Vaal Catchment Management Area (WMA), within the C11B quaternary catchment. Several streams, wetlands and springs are located in the area which drains south and east towards the Witpuntspruit and Vaal River, within the Grootdraai Dam / Upper Vaal Catchment.

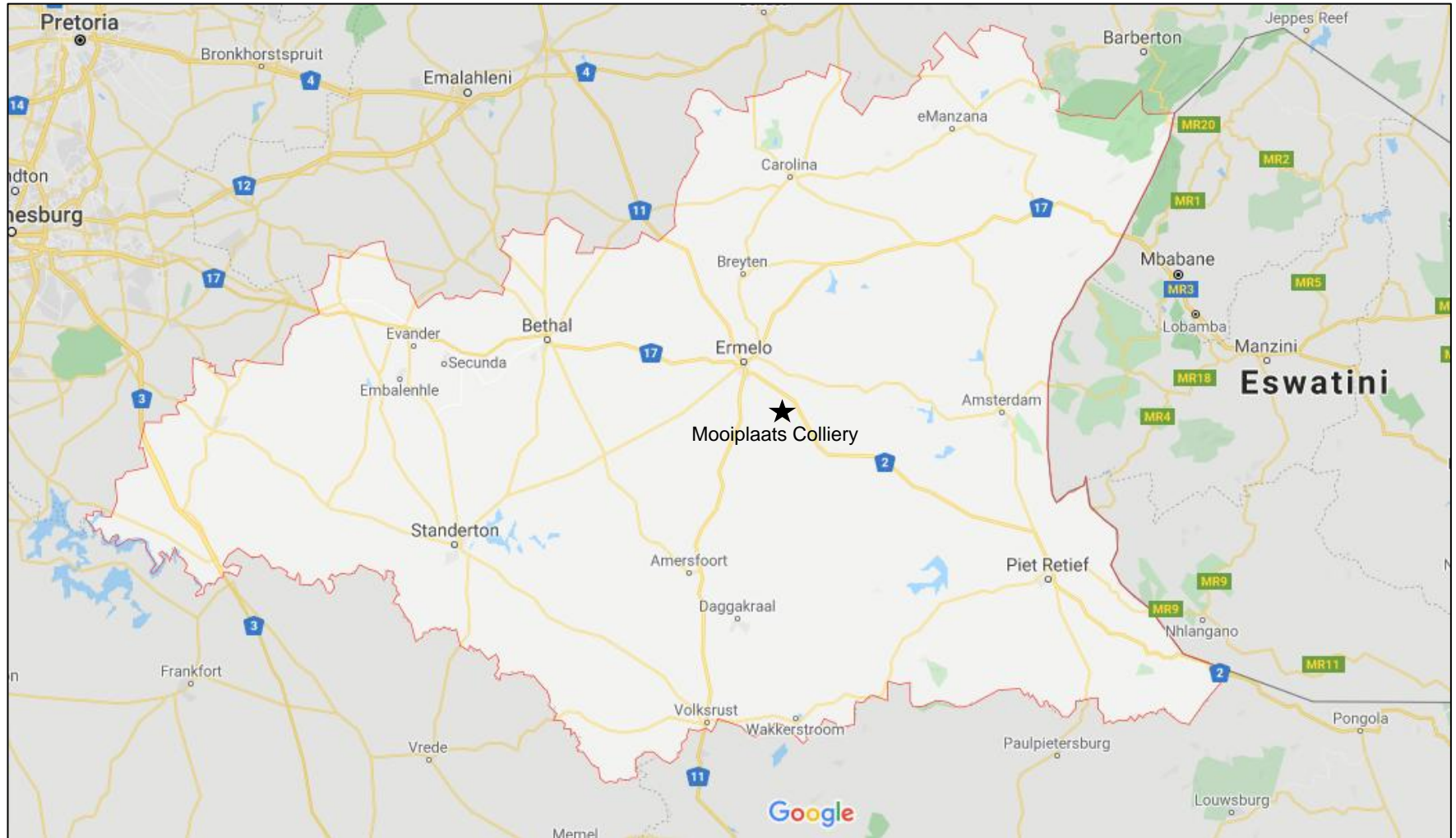


Figure 1: Locality map.



The Witpuntspruit is heavily modified due to the impact of previous and current mining activities. Well known decant water enters the Humanspruit, which enters the Witpuntspruit and eventually, the Vaal River which may have a detrimental effect on downstream users. The Witpuntspruit passes Mooiplaats and joins the Vaal River.

“The Upper Vaal water management area lies in the eastern interior of South Africa. From a water resources management perspective, it is a pivotal water management area in the country. Large quantities of water are transferred into the area from two neighbouring areas, as well as water sourced from the Upper Orange River via Lesotho. Similarly, large quantities of water are transferred out to three other water management areas, which are dependent on water from the Upper Vaal water management area to meet much of their requirements.

Extensive urbanisation and mining and industrial activity, which relate to the rich gold and coal deposits in the area, occur in the northern part of the water management area. Economic activity in the remainder of the Upper Vaal water management area mainly relates to livestock farming and rain fed cultivation.

Because of the high level of urbanisation and economic activity in the area and its pivotal role as a water transfer point to other water management areas, water resources in the area are highly developed and regulated, and only marginal potential for further development remains. The total yield transferred into the catchment is in excess of 120 per cent of the yield from local surface resources, while virtually the same quantity of water is again transferred out of the area. Groundwater is mainly used for rural domestic needs and for stock watering, while a substantial quantity of water is also abstracted from dolomitic aquifers for urban use.

The Upper Vaal water management area is highly developed and impacted upon by human activity. The quantities of water transferred into and out of the area are largely dictated by the population needs and economic activity in this as well as similar needs in other recipient water management areas.

Water quality in the Vaal River and in some tributaries downstream of Vaal Dam is seriously affected by urban and industrial and mining return flows and the intensive mining activity. The water resources are therefore carefully managed to maintain acceptable water quality standards. Particular attention is also to be given to the impacts that closure of mines may have on both surface and groundwater.” DWS, 2004.



2.3 Summary of Previous Studies

Several studies have been and are being conducted as part of impact determination in terms of the water resources. Studies include:

- Surface and Groundwater Monitoring,
- Groundwater Study, 2011.
- Mooiplaats Annual Water Quality Report 2019. GSW 2019,
- Mooiplaats Annual Water Quality Report 2020. GSW 2020,
- Mooiplaats Annual Water Quality Report 2021. GSW 2022.
- Mooiplaats Annual Water Quality Report 2022. GSW 2023.

Abstract from “Mooiplaats North Colliery geology and groundwater study.” Fourie, 2011.

Geology baseline

The B Upper seam is well developed throughout the succession and is the only seam which is considered to be economically viable. Because of the depth of this reserve only underground mining methods are proposed.

Within the mine layout the thickness of the seam range between 1.5 - 2.9 m, averaging at 2.1 m. The depth of the coal seam roof within the mine layout ranges between 40 - 165 meters below surface (mbs), averaging at 115 mbs.

Several dolerite dykes and sills have been identified in the area. A major dyke is present between MPN and the old Usutu underground workings. A sill breakthrough also occurs between MPN and MPS. This has resulted in the compartmentalisation of the MPN underground workings as the dolerite will form no-flow boundaries with relation to inter-mine flow. Drilling has been performed in order to target the dolerite between MPN and Usutu. The drilling results were incorporated into the groundwater study.

The geophysical survey confirmed the presence of a dyke between the Usutu and MPN underground mines, as well as the approximate depth of the dyke. The dyke was targeted with 6 boreholes. These boreholes will monitor the groundwater level and quality between the two mines, as well as any potential impact (on the aquifer) caused by pumping of the Usutu mine water by MPN. MBV-2A is the closest to the pumped borehole MS-B7 and shows a slight depletion in groundwater level.



Groundwater baseline

Geohydrological drilling and groundwater field work was completed in April 2011. Field work included measurements of the water levels, as well as slug testing of all monitoring boreholes. A hydro-census within at least 1 km buffer zone around MPN was performed in order to identify the presence and status of existing boreholes and fountains, as well as groundwater use in the area. A total of 10 external users' boreholes were surveyed that are located around MPN, near homesteads, or present in the farming field. Of the 10 boreholes only 2 external user boreholes (WT-B1 and MS-B4) are currently in use for domestic (for a guesthouse) and stock watering purposes, respectively. This indicates the low level of groundwater use in the area. A total of 3 fountains were included in the survey. Two of them (WT-F1 and F2) are used for domestic and stock watering purposes, respectively.

Hydro-chemical samples were taken from all monitoring boreholes and several external users' boreholes and fountains. Overall, the groundwater in the area is of good quality with only 1) the Usutu monitoring borehole that has non-compliant concentration of Na and F, as well as marginally elevated SO₄, and 2) a slightly elevated SO₄ in one plant monitoring borehole. The background groundwater could be classified as Na(Ca)-CO₃ dominated water. Groundwater with SO₄ contamination could be distinguished from the background groundwater as SO₄ becomes the dominant anion. Any future mining impact could therefore easily be identified.

The hydraulic conductivity for the shallow weathered aquifer, the deep fractured aquifer and alluvium/soils were determined from slug tests at Mooiplaats North and Mooiplaats South. The chosen hydraulic conductivity used for groundwater modelling is taken as 0.03 m/d, 0.007m/d and 4 m/d, respectively.

The Karoo Formation aquifer of the Mooiplaats area can in general be classified as a low yielding aquifer. It does have a viable exploitation potential for domestic and stock-watering application and as such is the main water resource for these applications to the farming communities in the area. The aquifers will however not support formal irrigation application over any extensive area (> 10 ha). The shallow weathered aquifer can therefore be classified as a minor aquifer system in terms of aquifer management.

Groundwater impact assessment

The impact on the geohydrology has been assessed by means of a numerical groundwater model for the MPN area.



The objective of the groundwater flow and transport model was to quantify the impact of mining on the following aspects:

- Influx of groundwater into mine workings,*
- Inter-mine flow between adjacent mines,*
- Impact on external users' boreholes,*
- Impact on fountains and stream base flow,*
- Impact of pumping/groundwater use,*
- Development of pollution plume in aquifer down-gradient of the plant area.*

No significant impact will be presented by the bord-and-pillar mine towards the adjacent mining as the MPN is significantly compartmentalised by sills.

The MPN will also have a negligible impact on external users' boreholes and base flow to streams and fountains. As a worst case the mine may have a small impact on MS-B4 (windpump of Mr Klopper). The depth of this borehole was however not available, and the impact is uncertain.

Pumping of Usutu East by MPN will have no adverse effect for Usutu both in terms of the mine water quality and quantity. With respect to both the pumping may actually have a beneficial effect as decanting of Usutu is prolonged and the mine water quality will probably improve.

The most significant impact of MPN relates to the potential plume development down-gradient of the co-disposal facility after closure. The plume will eventually reach the Witpuntspruit tributary. The following comments relate to the seepage water quality:

- The co-disposal will show an increase in the total dissolved solids with SO_4 as the dominant anion and will most likely acidify after closure; and*
- Significant elevation of Al, Fe and Mn will occur. Other metals such as Cd, Sb and Se may also be present in seepage but most probably not at non-compliant concentrations.*

From the model it was calculated that the contamination plume will not develop further than about 100 - 200 m horizontally from the mine boundary within one hundred years after closure. The following relates to the mine water quality:

- The underground mine water will show an increase in the total dissolved solids with SO_4 as the dominant anion but will most likely not acidify; and*



- *No significant elevation of metals will occur in the near-neutral mine water.*

An important management measure during the operational and post-closure phase is the establishment of a groundwater monitoring system in order to detect any impact on the groundwater environment.

Monitoring of the impact on the groundwater relates to the following:

- *Development of cones of depression around the mine.*
- *Influxes of groundwater into the underground mine workings.*
- *Possible impact on the water levels and yields of external users' boreholes and fountains for at least a 1 km buffer zone around any old or active mine working.*
- *Possible depletion of groundwater base flow towards streams.*
- *Mine water levels in the underground mine."*

2.4 Information and Knowledge Gaps

The following are areas of uncertainty:

- The design of some of the monitoring boreholes and drill information (e.g., casing depth, perforated casing depth, drill water strike depth, lithology, and slug test results),
- Complete geophysical information on preferred flow paths; and
- The effect of local farming and associated contaminants.
- All possible pollution sources caused by current and historical mining. The extent / presence of informal historical mining in the catchment.
- Pre-mining / Baseline water quality.
- The impact from current upstream mining activities and industries.

3. OBJECTIVES OF THE MONITORING PROGRAMME

3.1 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.

4. TERMS OF REFERENCE

Water qualities were compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.

4.1 Changes/Additions in/to Monitoring Network.

Fourteen (14) surface water monitoring points and nine (9) groundwater monitoring points are included in the IWUL.

Several additional surface and groundwater monitoring points are sampled on an ad hoc, monthly, and / or quarterly basis, depending on need/request.

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

At surface water, Total Hardness, Alkalinity, Potassium and Nitrate are analysed additionally and at the groundwaters, Total Dissolved Solids, Total Hardness, Alkalinity, Potassium, Ammonia, Aluminium, Iron and Manganese are analysed additionally.

4.2 Surface Water

Surface water monitoring points are sampled on a monthly basis for quality, as prescribed in the IWUL. Refer to **Annexure A** for in-field sampling sheets.



Fourteen (14) IWUL surface water monitoring points are included in the water monitoring programme.

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

Figure 3 displays 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.

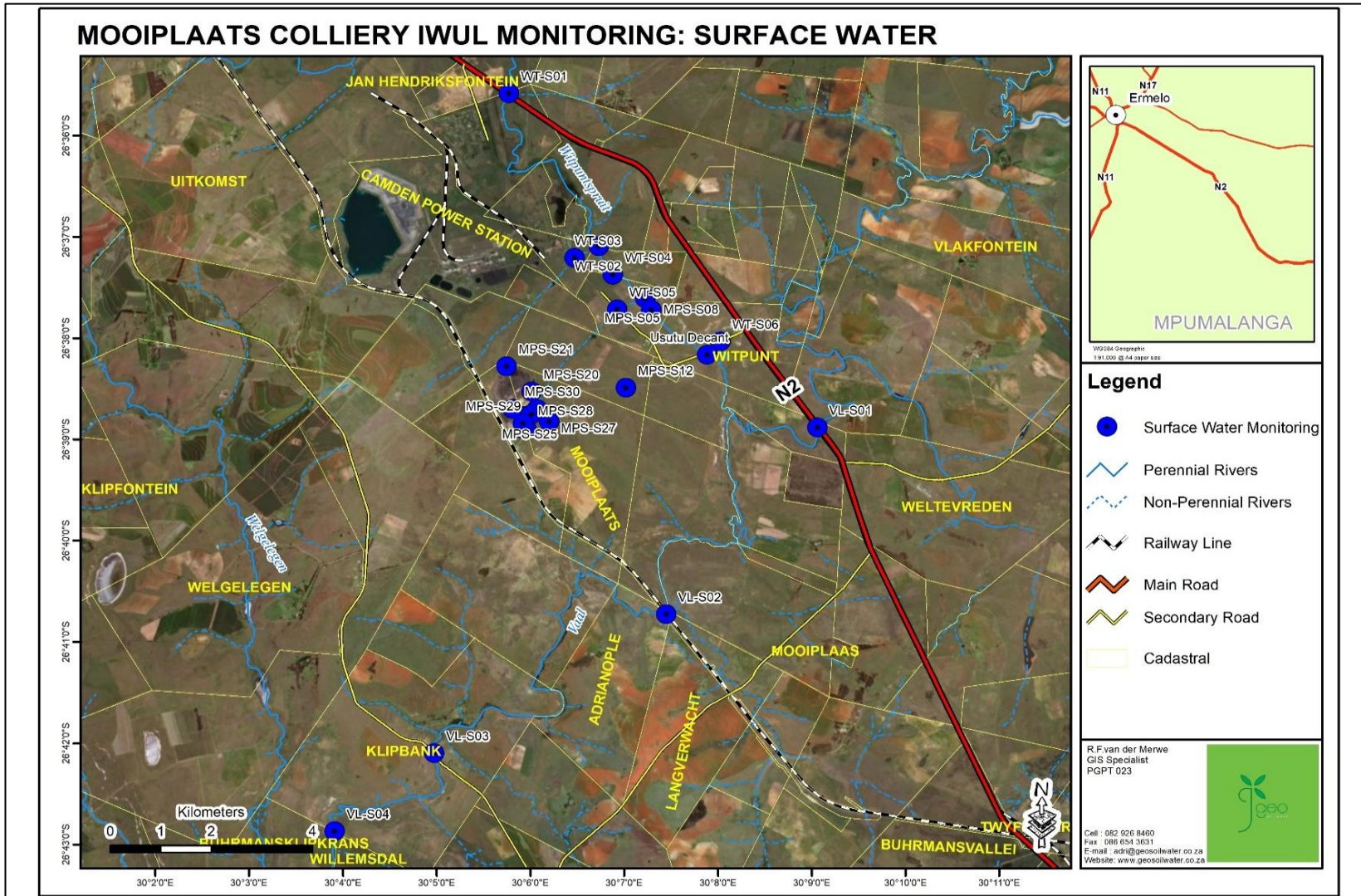


Figure 2 Location of surface water monitoring points.

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°	Ad Hoc
MPS-S12	Witpuntspruit Tributary @ Access Road	S26.64150° E30.11697°	Ad Hoc
MPS-S13	Runoff from Loading Area	S26.64837° E30.09888°	Ad Hoc
MPS-S14	Gen-sub PCD	S26.64616° E30.09890°	Monthly
MPS-S15	Stormwater trench @ Security	S26.64837° E30.09888°	Ad Hoc
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°	Ad Hoc
MPS-S27	Witpuntspruit Tributary entering MP	S26.64716° E30.10336°	Ad Hoc
MPS-S28	Confluence of MPS-S13 and MPS-S15	S26.64808° E30.09925°	Ad Hoc
MPS-S29	Storm water @ Offices	S26.64743° E30.09802	Ad Hoc
MPS-S30	Plant PCD	S26.64508° E30.09674°	Monthly
MPS-S31	Decant from Old Usutu Workings decanting into the Witpuntspruit Upstream of WT-06 – via surface .	S26.63611°E30.13139°	Ad Hoc
MPS-S32	Decant from Old Usutu Workings decanting into the Witpuntspruit Upstream of WT-06 – in cement sump	S26.63611°E30.13139°	Ad Hoc
	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



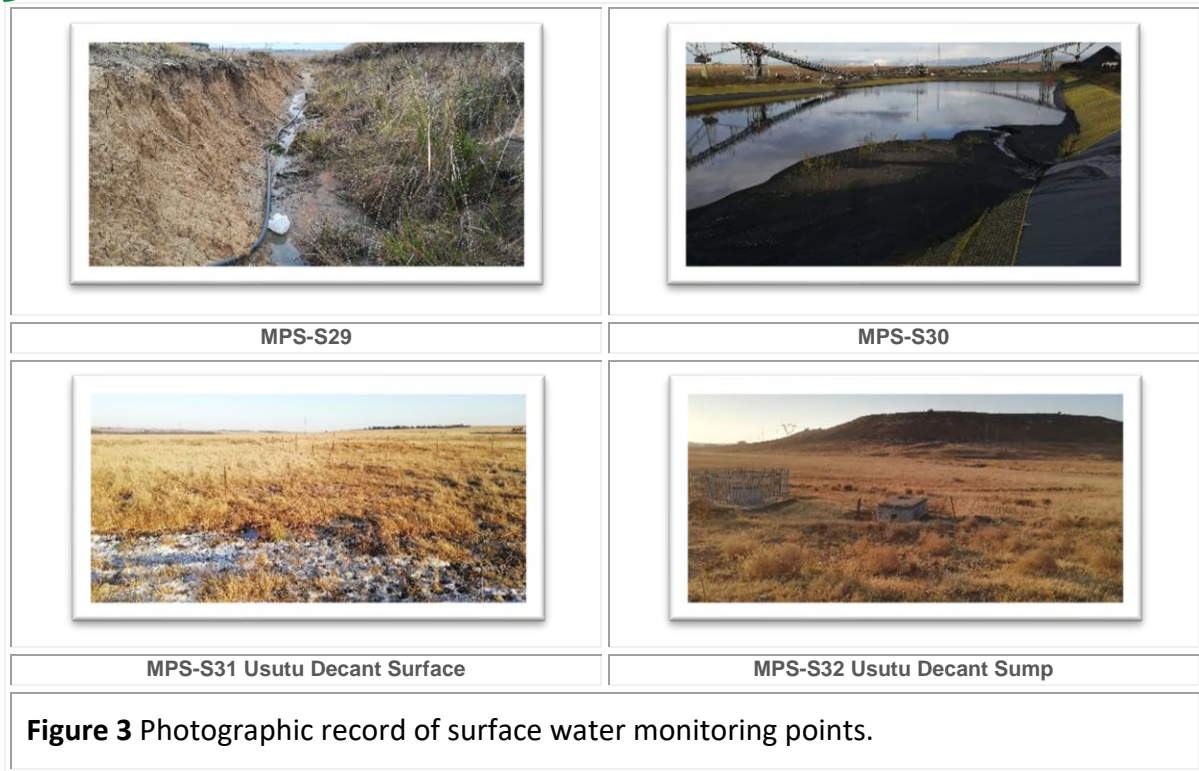
MPS-S25



MPS-S27



MPS-S28



4.3 Groundwater

Groundwater monitoring points are sampled on a quarterly (for levels and quality) basis, as prescribed in the IWUL. Refer to **Annexure A** for in-field sampling sheets.

Nine (9) IWUL groundwater monitoring points are included in the monitoring programme.

Figure 4 indicates the positions of the groundwater monitoring points relative to Mooiplaats and water resources.

Figure 5 displays 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.

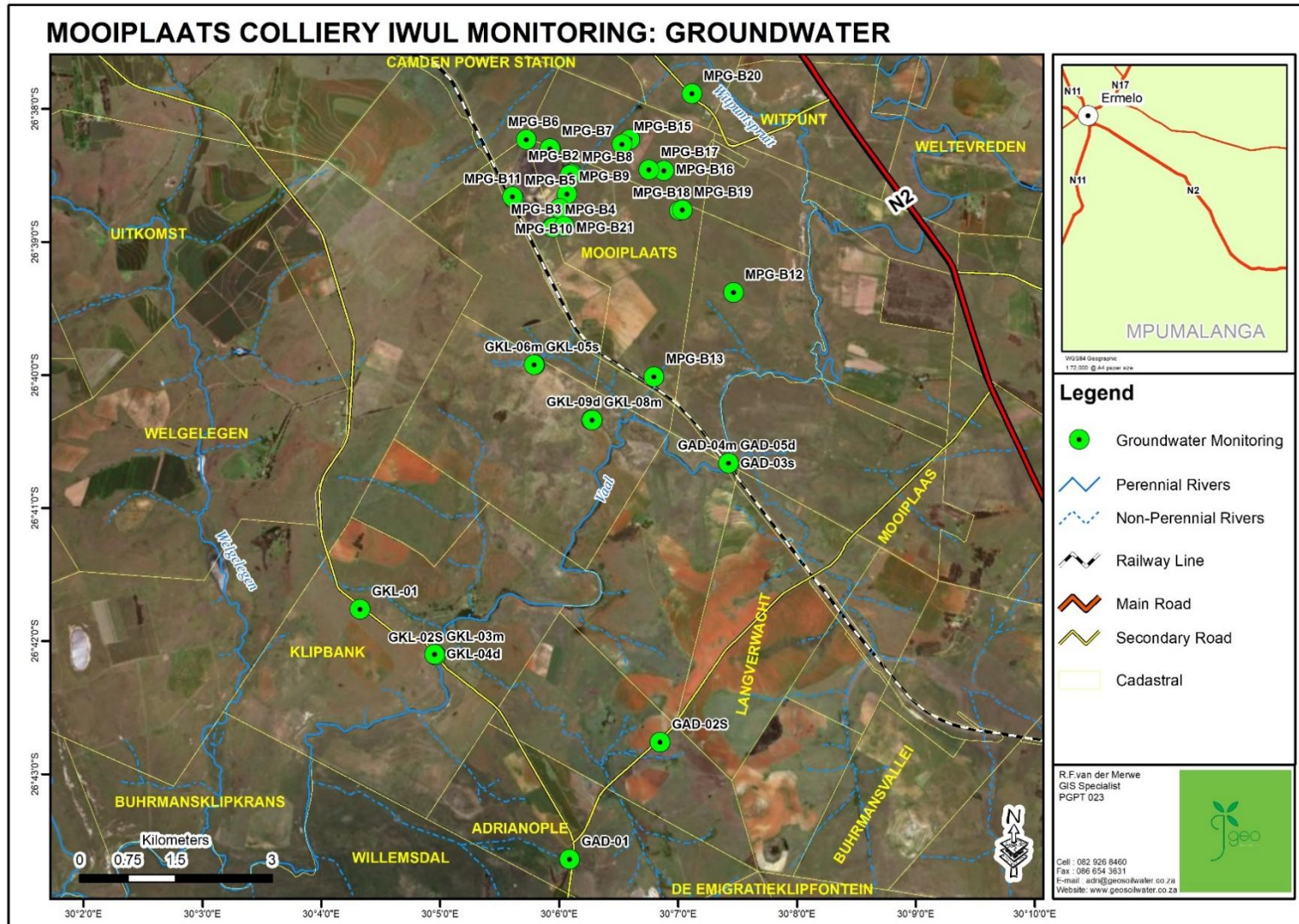


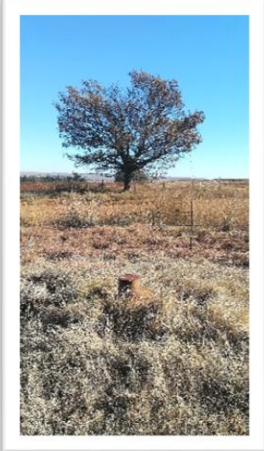



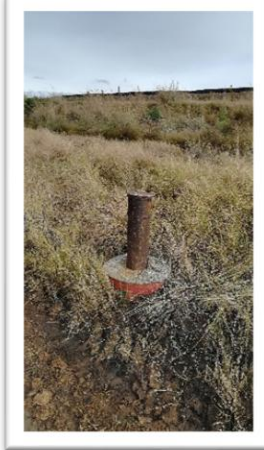




Figure 4 Location of groundwater monitoring points.


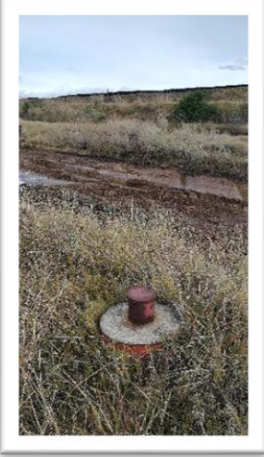







Table 2 Summary of groundwater monitoring points.

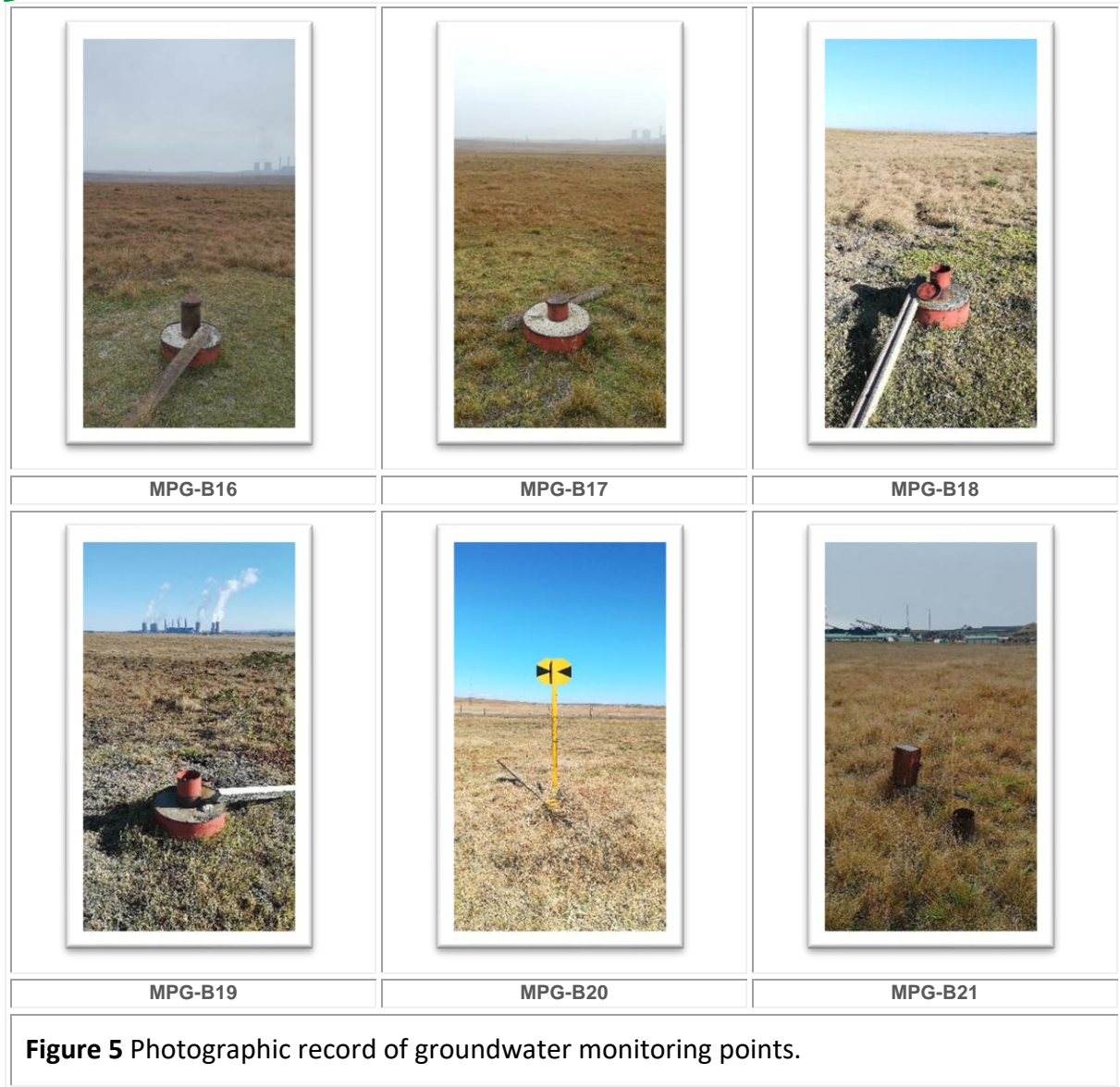
Mooiplaats Colliery Groundwater Monitoring Programme			
Groundwater Monitoring Points			
Locality	Locality Description	Coordinates WGS 84 ddd.ddddd	Monitoring Frequency
GKL-1	IWUL Borehole – Outer perimeter borehole	S26.69603° E30.07208°	Quarterly
GKL-4d	IWUL Borehole – Outer perimeter borehole	S26.70167° E30.08253°	Quarterly
GKL-3m	Borehole – Outer Perimeter borehole	S26.70178° E30.08269°	Ad Hoc
GKL-2s	IWUL Borehole – Outer perimeter borehole	S26.70178° E30.08269°	Quarterly
GAD-2s	IWUL Borehole – Outer perimeter borehole	S26.71269° E30.11414°	Quarterly
GAD-1	IWUL Borehole – Outer perimeter borehole	S26.72733° E30.10144°	Quarterly
GKL-9D	IWUL Borehole – Outer perimeter borehole	S26.67231° E30.10450°	Quarterly
GKL-8M	IWUL Borehole – Outer perimeter borehole	S26.67233° E30.10464°	Quarterly
GKL-5S	IWUL Borehole – Outer perimeter borehole	S26.66542° E30.09647°	Quarterly
GKL-6M	IWUL Borehole – Outer perimeter borehole	S26.66542° E30.09658°	Quarterly
GKL-7D	Outer perimeter borehole	S26.66542° E30.09658°	Ad Hoc
GAD-3s	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
GAD-4m	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
GAD-5d	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
MPG-B1	Down gradient (north) of the co-disposal facility.	S26.63843° E30.09878°	Ad Hoc
MPG-B2	Down gradient (east) of the lined Settling Dams and co-disposal.	S26.64143° E30.10175°	Ad Hoc
MPG-B3	Near the security gate.	S26.64816° E30.09905°	Ad Hoc
MPG-B4	Near the security gate.	S26.64819° E30.09910°	Ad Hoc
MPG-B5	Up-gradient (south-west) of the plant area next to the railway line.	S26.64457° E30.09363°	Ad Hoc
MPG-B6	Adjacent to the return water dam.	S26.63719° E30.09540°	Ad Hoc
MPG-B7	Down gradient (north) of the co-disposal facility.	S26.63832° E30.09870°	Ad Hoc
MPG-B8	Down gradient (east) of the lined Settling Dams.	S26.64160° E30.10155°	Ad Hoc
MPG-B9	Down gradient (east) of the plant area.	S26.64403° E30.10107°	Ad Hoc
MPG-B10	Down gradient (east) of the plant area.	S26.64581° E30.10007°	Ad Hoc
MPG-B11	Up-gradient (south-west) of the plant area next to the railway line.	S26.64435° E30.09344°	Ad Hoc
MPG-B12	At MPN Vunene extension	S26.65633° E30.12443°	Ad Hoc
MPG-B13	South of the mine next to the railway line.	S26.66689° E30.11329°	Ad Hoc
MPG-B14	Between Usutu/MPN	S26.63716° E30.10992°	Ad Hoc
MPG-B15	Between Usutu/MPN	S26.63778° E30.10881°	Ad Hoc
MPG-B16	Between Usutu/MPN	S26.64106° E30.11469°	Ad Hoc
MPG-B17	Between Usutu/MPN	S26.64095° E30.11259°	Ad Hoc
MPG-B18	Between Usutu/MPN	S26.64608° E30.11685°	Ad Hoc
MPG-B19	Between Usutu/MPN	S26.64600° E30.11725°	Ad Hoc
MPG-B20	Usutu UG. Borehole intersecting mine at 90 m	S26.63144° E30.11860°	Ad Hoc

Mooiplaats Colliery Groundwater Monitoring Programme			
Groundwater Monitoring Points			
Locality	Locality Description	Coordinates WGS 84 ddd.ddddd	Monitoring Frequency
	Additional Monitoring Points		
	IWUL Monitoring Points		

		
GKL-1	GKL-2s GKL-3m GKL-4d	GKL-5s GKL-6m GKL-7d
		
GKL-8m	GKL-9d	GAD-1

		
<p>GAD-2S</p>	<p>GAD-3S</p>	<p>GAD-4M</p>
		
<p>GAD-5D</p>	<p>MPG-B1</p>	<p>MPG-B2</p>
		
<p>MPG-B3</p>	<p>MPG-B4</p>	<p>MPG-B5</p>

		
<p>MPG-B6</p>	<p>MPG-B7</p>	<p>MPG-B8</p>
		
<p>MPG-B9</p>	<p>MPG-B10</p>	<p>MPG-B11</p>
		
<p>MPG-B13</p>	<p>MPG-B14</p>	<p>MPG-B15</p>



5. METHODOLOGY

The following is a description of the sampling protocol, analyses, and reporting of the Mooiplaats monitoring programme.

5.1 Sampling Protocol

GSW is responsible for the sampling of the monitoring points, the assessment evaluation and report writing. Yanka Laboratories (Pty) Ltd (Yanka) with SANAS Accreditation Number T0647 performs the physical and chemical analyses.



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 (BPGs) for water quality management in the South African mining industry. This series of BPGs forms a component of the overall source directed water policy for mining and related activities implemented by the DWAF. 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.

5.2 Surface water

For chemical analyses, a 1000 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 occurred at fourteen (14) IWUL water monitoring points and zero (0) additional points.

Monthly surface water samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity CaCO₃/L
- Ca mg/L



- Mg mg/L
- Na mg/L
- K mg/L
- F mg/L
- Cl mg/L
- SO₄ mg/L
- NO₃ mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH₃ mg/L

5.3 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 occurred at nine (9) groundwater monitoring points, nine (9) IWUL points on a quarterly basis and zero (0) additional points (during this reporting period).

Water levels were monitored on a quarterly basis.

Groundwater samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity CaCO₃/L
- Ca mg/L
- Mg mg/L
- Na mg/L



- K mg/L
- F mg/L
- Cl mg/L
- SO₄ mg/L
- NO₃ mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH₃ mg/L

5.4 Water levels

Groundwater levels at nine (9) monitoring points are recorded on a quarterly basis, using an electronic water level meter with a probe.

5.5 Water sample analyses

Both, surface - and groundwater samples are submitted to Yanka for physical and chemical analyses. Surface - and groundwater samples are analysed for variables as described in **Sections 5.2** and **5.3**.

5.6 Reporting

The quarterly, biannual, and / or annual surface - and groundwater assessments are compiled and evaluated by a registered Pr.Sci.Nat. Environmental Scientist and annual groundwater assessments are evaluated by a registered Pr.Sci.Nat. Geohydrologist.

Various types of reporting are included as required by the enquiry document:

- Quarterly Surface – and Groundwater Monitoring Reports; or
- Comprehensive Annual Water Quality Report.

Quarterly and Bi-annual Reports will include basic representation of data, evaluated against appropriate water quality guidelines with related discussions.

The *Annual Assessment Reports* will be more extensive and include a full evaluation of the results obtained during the year. The report will typically include, but is not limited to, the following functions:



- The Surface Water Report will include a statistical summary (temporal & spatial) of all the chemical variables for all the monitoring points, time-series graphs, linear trend determinations and compliance assessments, water quality thematic maps indicating pollution sources and impacts on the receiving water body as well as a discussion; and
- The Groundwater Report will be similar to the surface water section and will include a statistical summary (temporal & spatial) of all the chemical variables for all the monitoring boreholes, as well as time-series graphs and linear trend determinations.

Temporal trends are subject to a series of sampling frequencies.

6. RESULTS

Water monitoring according to IWUL, 2013 included in this report:

- **February to April 2025** - IWUL surface water monitoring,
- **April 2025** - IWUL groundwater monitoring,

Refer to **Annexure A** for:

- In-field Sampling Sheets: Tables portraying the name, descriptions, and status of the monitoring points.

Refer to **Annexure B** for:

- Test Reports: Laboratory results displaying variable concentrations for all monitoring points during the reporting period.

Water quality results will be described using the DWS Water Quality Guidelines: Domestic Use (Volume 01) 1996 in which summarised descriptions are given for pH (**Table 3**), salinity (**Table 4**) and hardness (**Table 5**).

Table 3 Summary of pH values.

pH Values used to indicate alkalinity or acidity of water	
pH: > 8.5	Alkaline/Basic
pH: 6.0- 8.5	Neutral
pH: < 6	Acidic

Table 4 Summary of TDS concentration.

TDS Concentrations to indicate the salinity of water	
TDS < 450 mg/l	Non-saline
TDS 450 - 1 000 mg/l	Saline
TDS 1 000 - 2 400 mg/l	Very saline
TDS 2 400 - 3 400 mg/l	Extremely saline

Table 5 Summary of Total Hardness concentrations.

Hardness concentrations to indicate softness or hardness of water	
Hardness < 50 mg/l	Soft
Hardness 50 – 100 mg/l	Moderately soft
Hardness 100 – 150 mg/l	Slightly hard
Hardness 150 – 200 mg/l	Moderately hard
Hardness 200 – 300 mg/l	Hard
Hardness 300 – 600 mg/l	Very hard
Hardness > 600mg/l	Extremely hard

Sections 6.1 to 6.6 are detailed discussions on water qualities associated with Mooiplaats – reporting period 01 February to 30 April 2025.

Section 6.1: Wastewater

Section 6.2: Witpuntspruit

Section 6.3: Vaal River

Section 6.4: Groundwater

Section 6.5: Groundwater Levels

Surface - and groundwater monitoring points will be compared to IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.



6.1 Wastewater

Table 6 indicates the average water quality for the wastewater monitoring points compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin.

Wastewater includes:

MPS-S14: Genset PCD

MPS-S20: Underground Erickson Dams.

MPS-S21: North Shaft Return Water Dam (NS RWD).

MPS-S30: Wash Plant PCD

Figure 6 illustrates variable concentration trends for wastewater monitoring points.

Figure 7 illustrates the average STIFF diagrams for wastewater monitoring points.



Table 6 Average water quality for wastewater monitoring points.

Average Wastewater Quality for Mooiplaats February 2025 - April 2025									
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	MPS-S14	MPS-S20	MPS-S21	MPS-S30
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	7.29	8.15	4.45	7.42
EC	mS/m	150	25	170	500	168.33	289.67	351.00	349.33
TDS	mg/L	1288	-	1200	3000	1297	2180	2982	2678
Total Hardness	mg/L	-	-	-	-	453	252	1125	738
Alkalinity	CaCO ₃ /L	-	75	-	-	286.667	843.000	5.933	439.333
Ca	mg/L	87	-	-	1000	115.533	40.933	219.083	162.333
Mg	mg/L	51.40	-	-	500	40.000	36.467	140.333	80.700
Na	mg/L	725	-	200	200	260.667	715.677	404.273	607.270
K	mg/L	-	-	-	-	8.833	11.500	13.910	20.967
F	mg/L	3.23	0.4	1.5	2	0.617	3.130	0.377	1.170
Cl	mg/L	116.66	20	300	3000	36.067	57.400	28.833	52.067
SO ₄	mg/L	740	30	500	1000	650.990	798.083	2109.330	1480.667
NO ₃	mg/L	-	0.5	11	-	2.653	1.333	0.630	2.117
NH ₃	mg/L	0.24	-	1.5	-	-0.450	-0.450	1.173	-0.450
Al	mg/L	0.09	-	0.3	5	-0.010	-0.010	23.230	0.063
Fe	mg/L	0.001	-	0.3	10	0.017	-0.010	12.480	0.010
Mn	mg/L	0.15	-	0.1	10	0.443	0.277	21.967	0.190

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-”Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

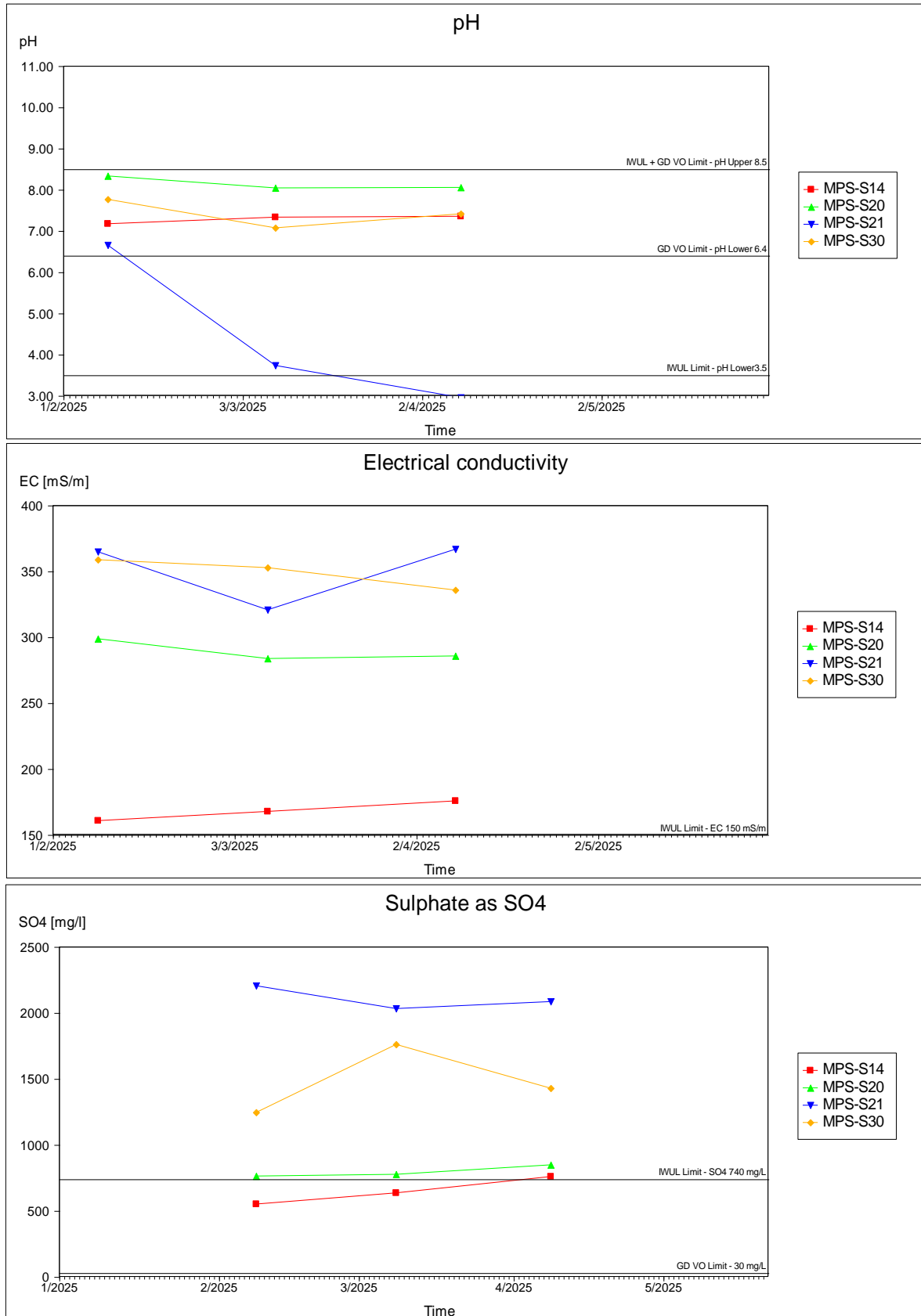
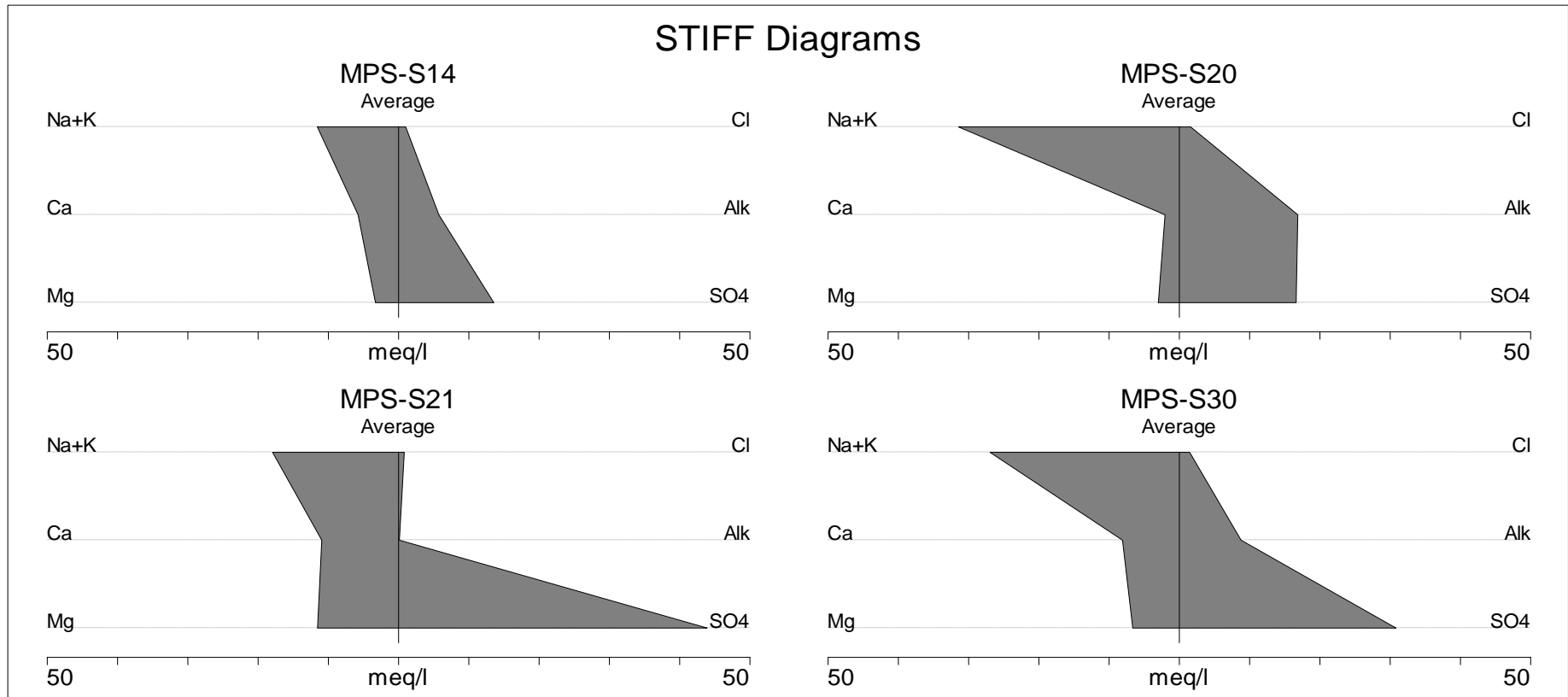


Figure 6 Wastewater variable concentration trends.



- STIFF Diagram
- A dominant Sulphate (SO_4) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO_3^-) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO_4)

Figure 7 Average wastewater STIFF diagrams.



From **Table 6**, **Figures 6** and **7** it is evident that wastewater qualities exceeded several IWUL limits and In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin.

Genset PCD (**MPS-S14**), NS RWD (**MPS-S21**), Wash Plant PCD (**MPS-S30**) and Settling Dam 3 (**MPS-S20**) are wastewater containment facilities, which reports to the co-disposal facility and again to the NS RWD (**MPS-S21**), from where it is distributed and circulated.

It is evident that the water compositions and concentrations (**Figure 7**) of wastewater remained high and stable in terms of the dominating cations and anions. However, the difference in water quality and composition can be ascribed to the different inflows into the waste facility before the water gets transferred to the next facility. Although water quality concentrations exceeded the IWUL limits, it must be noted that the containment facilities are HDPE lined or concreted. The improvement in water quality concentrations at wastewater facilities can be ascribed to rainfall / dilution entering the system during the reporting period.

SO₄ is the dominant anion in terms of composition (**Figure 7**), well in line with water exposed to coal handling activities. Low pH values will have negative effects on water infrastructure; therefore, process water should be managed to prevent low pH values.

6.2 Witpuntspruit Surface Water

Table 7 indicates the average surface water quality for the Witpuntspruit and associated tributaries. Water quality from these monitoring points is compared to the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin and IWUL Wastewater Limits. The DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards was included for comparative purposes.

Witpuntspruit and associated tributaries includes:

Witpuntspruit monitoring points include **WT-SW01** (Upstream), **WT-S02**, **WT-S04** (Midstream) and **WT-S06** (Downstream) where the adjoining tributaries include **WT-S03** and **WT-S05**.

Figure 8 illustrates variable concentration trends for the Witpuntspruit and associated tributaries. **Figure 9** illustrates the stream profile for the Witpuntspruit.

Figure 10 illustrates the average STIFF diagrams for the Witpuntspruit and associated tributaries.



Table 7 Average water quality for the Witpuntspruit and associated tributaries.

Average Witpuntspruit Water Quality for Mooiplaats February 2025 - April 2025											
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241: 2011	DWS Livestock Watering	WT-S01	WT-S03	WT-S02	WT-S04	WT-S05	WT-S06
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	6.78	6.89	6.86	6.93	5.18	6.48
EC	mS/m	150	25	170	500	46.07	51.87	39.47	40.00	256.00	51.80
TDS	mg/L	1288	-	1200	3000	292	331	250	251	2262	331
Total Hardness	mg/L	-	-	-	-	181	166	140	139	917	166
Alkalinity	CaCO ₃ /L	-	75	-	-	31.767	52.433	47.733	50.467	4.000	52.400
Ca	mg/L	87	-	-	1000	37.033	35.333	30.233	29.713	179.865	34.550
Mg	mg/L	51.40	-	-	500	21.500	18.867	15.733	15.767	113.650	19.275
Na	mg/L	725	-	200	200	19.233	41.267	22.033	23.533	341.500	38.680
K	mg/L	-	-	-	-	4.323	3.513	4.993	4.967	5.865	5.115
F	mg/L	3.23	0.4	1.5	2	0.167	0.163	0.190	0.187	0.255	0.175
Cl	mg/L	116.66	20	300	3000	16.900	12.250	16.567	16.233	19.550	16.100
SO ₄	mg/L	740	30	500	1000	171.733	187.000	129.133	129.333	1581.965	185.000
NO ₃	mg/L	-	0.5	11	-	-0.090	0.067	0.223	0.013	-0.350	-0.350
NH ₃	mg/L	0.240	-	1.5	-	-0.450	-0.450	-0.450	-0.087	-0.450	0.030
Al	mg/L	0.090	-	0.3	5	0.107	0.020	-0.010	-0.010	0.515	-0.010
Fe	mg/L	0.001	-	0.3	10	0.420	0.210	0.047	0.053	0.540	0.050
Mn	mg/L	0.15	-	0.1	10	0.907	0.030	0.037	0.023	15.485	0.120

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

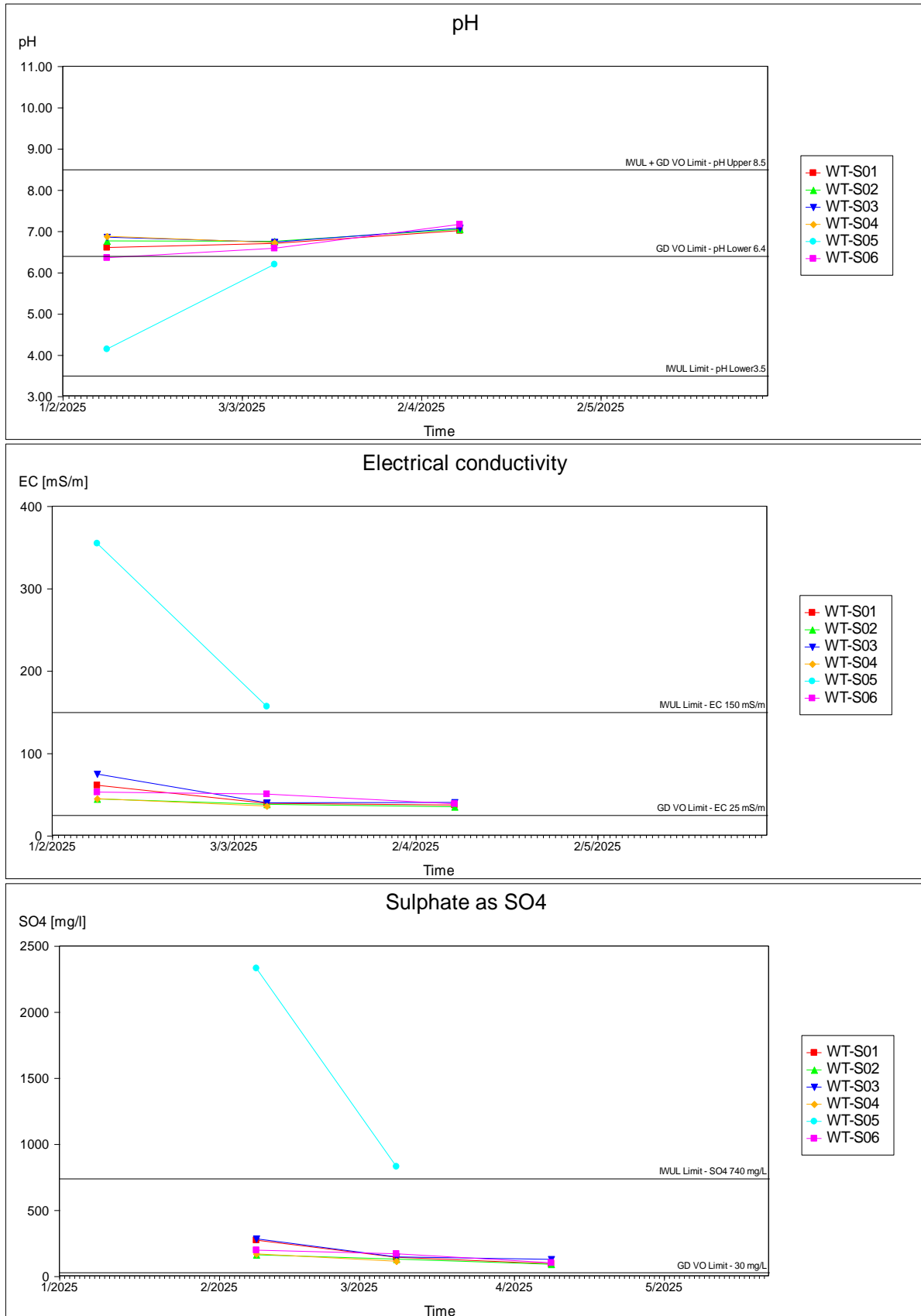


Figure 8 Variable concentration trends for the Witpuntspruit and associated tributaries.

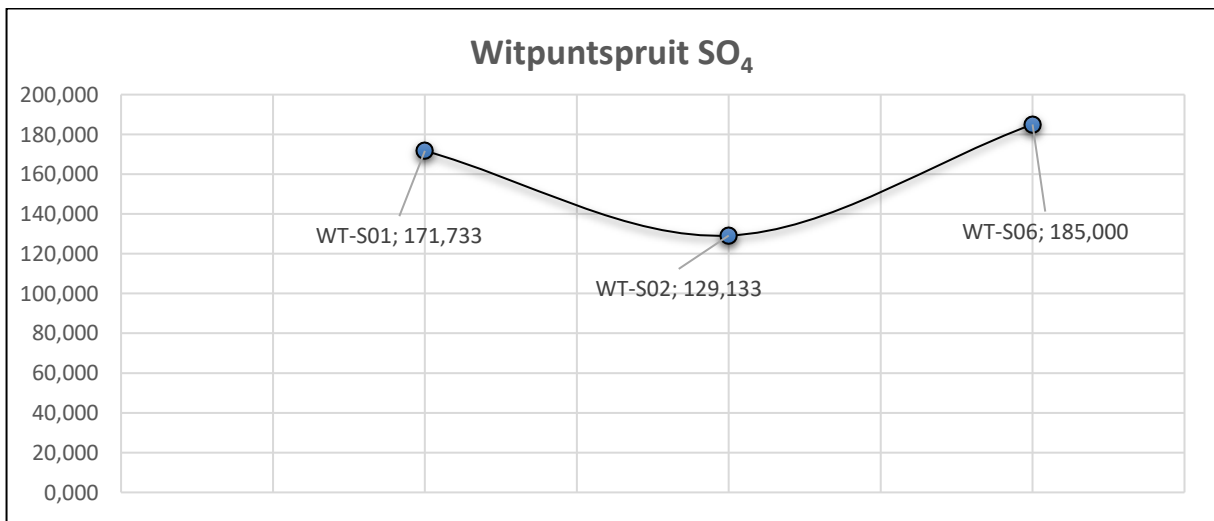
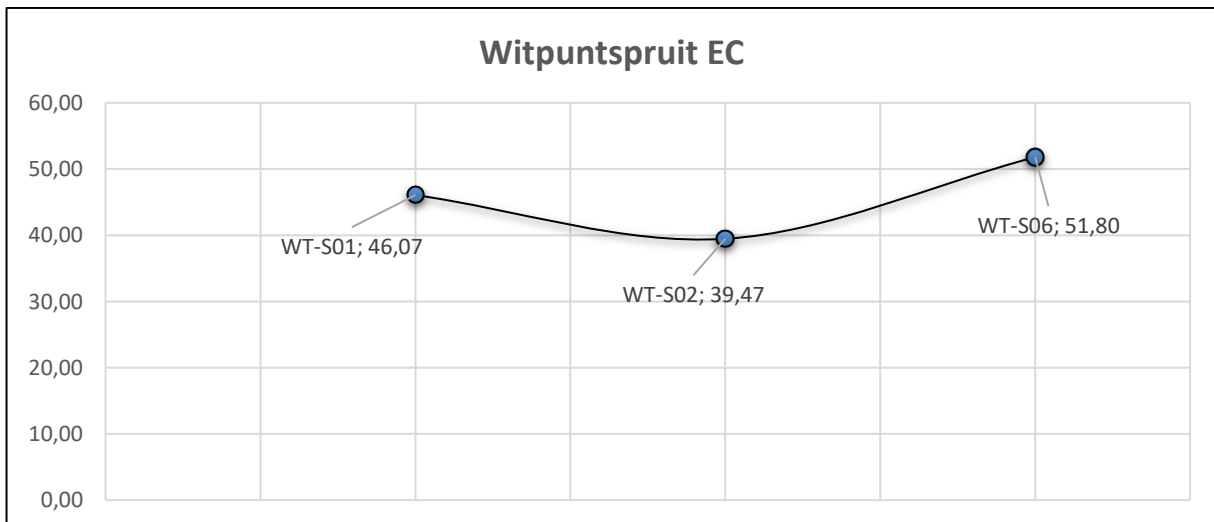
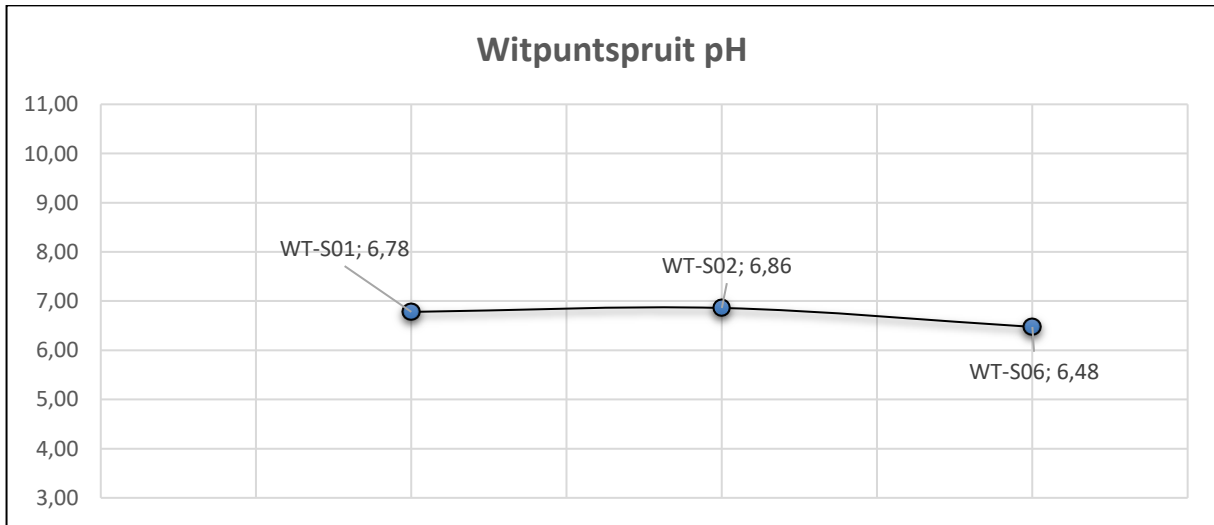
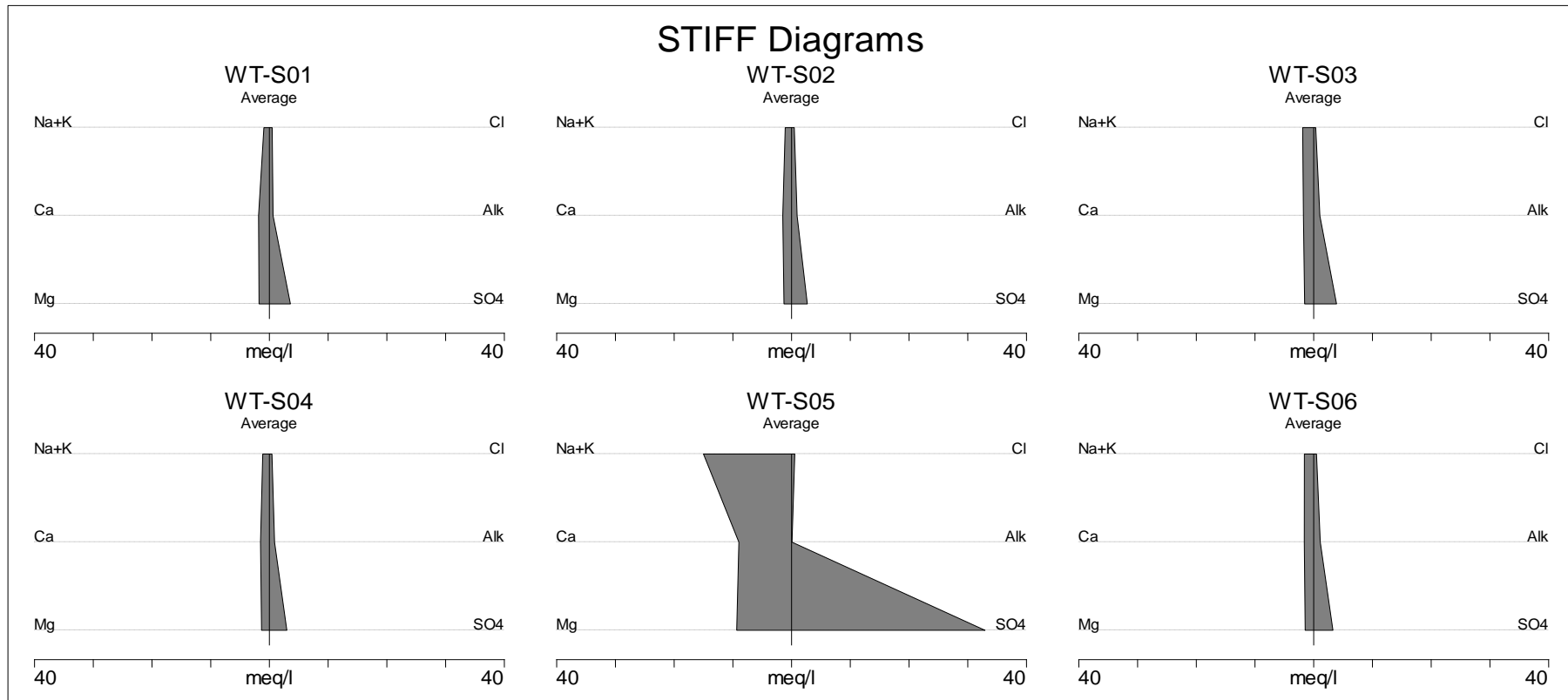


Figure 9 Stream profile for the Witpuntspruit - upstream left, downstream right.



- STIFF Diagram
- A dominant Sulphate (SO_4) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO_3^-) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO_4)

Figure 10 STIFF Diagrams for the Witpuntspruit surface water monitoring points.



From **Table 7, Figure 8, 9 and 10** it is evident that the Witpuntspruit are impacted on, from upstream (**WT-S01**) to downstream (**WT-S06**), before the confluence with the Vaal River, exceeding the Grootdraai Dam Guidelines for the Vaal origin sub-catchment.

From **Figures 8 and 9**, although the pH and several other variable concentrations were diluted / improved since the previous reporting period in the Witpuntspruit, the impact of **WT-S05** and the **historic Usuthu** decant is evident at **WT-S06** as the EC, CaCO₃, Na, SO₄ and Cl concentrations remained high.

WT-S05 tributary which receives water from Mooiplaats and farming activities in the sub-catchment recorded elevated concentrations which affect negatively on the Witpuntspruit.

The addition of the Alkalinity (from the Usuthu decant) to the Witpuntspruit and eventually the Vaal River is not necessary only a negative impact, but variables such as Na, Ca, Cl, and SO₄ in excessive concentrations over an extended period may have a detrimental effect on the receiving environment and Vaal River system.

6.3 Vaal River Surface Water

Table 8 indicates the average surface water quality for the Vaal River and associated tributaries compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards was included for comparative purposes.

Figure 11 illustrates variable concentration trends for the Vaal River.

Figure 12 illustrates the stream profile for the Vaal River.

Figure 13 illustrates the average STIFF diagrams for the Vaal River.



Table 8 Average water quality for the Vaal River.

Average Vaal River Water Quality for Mooiplaats February 2025 - April 2025								
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	VL-S01	VL-S02	VL-S03
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	7.060	6.993	7.063
EC	mS/m	150	25	170	500	14.033	16.600	16.967
TDS	mg/L	1288	-	1200	3000	78.344	94.180	95.914
Total Hardness	mg/L	-	-	-	-	50.638	61.184	61.393
Alkalinity	CaCO ₃ /L	-	75	-	-	40.500	38.333	40.800
Ca	mg/L	87	-	-	1000	10.170	12.733	12.333
Mg	mg/L	51.40	-	-	500	6.130	7.137	7.430
Na	mg/L	725	-	200	200	7.127	8.500	8.393
K	mg/L	-	-	-	-	2.407	2.613	2.593
F	mg/L	3.23	0.4	1.5	2	0.133	0.140	0.143
Cl	mg/L	116.66	20	300	3000	11.767	11.467	11.933
SO ₄	mg/L	740	30	500	1000	13.763	26.600	25.700
NO ₃	mg/L	-	0.5	11	-	-0.047	-0.063	0.180
NH ₃	mg/L	0.24	-	1.5	-	-0.450	-0.450	-0.450
Al	mg/L	0.09	-	0.3	5	0.567	0.470	0.507
Fe	mg/L	0.001	-	0.3	10	1.150	0.767	1.087
Mn	mg/L	0.15	-	0.1	10	-0.003	-0.010	-0.010

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-” Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

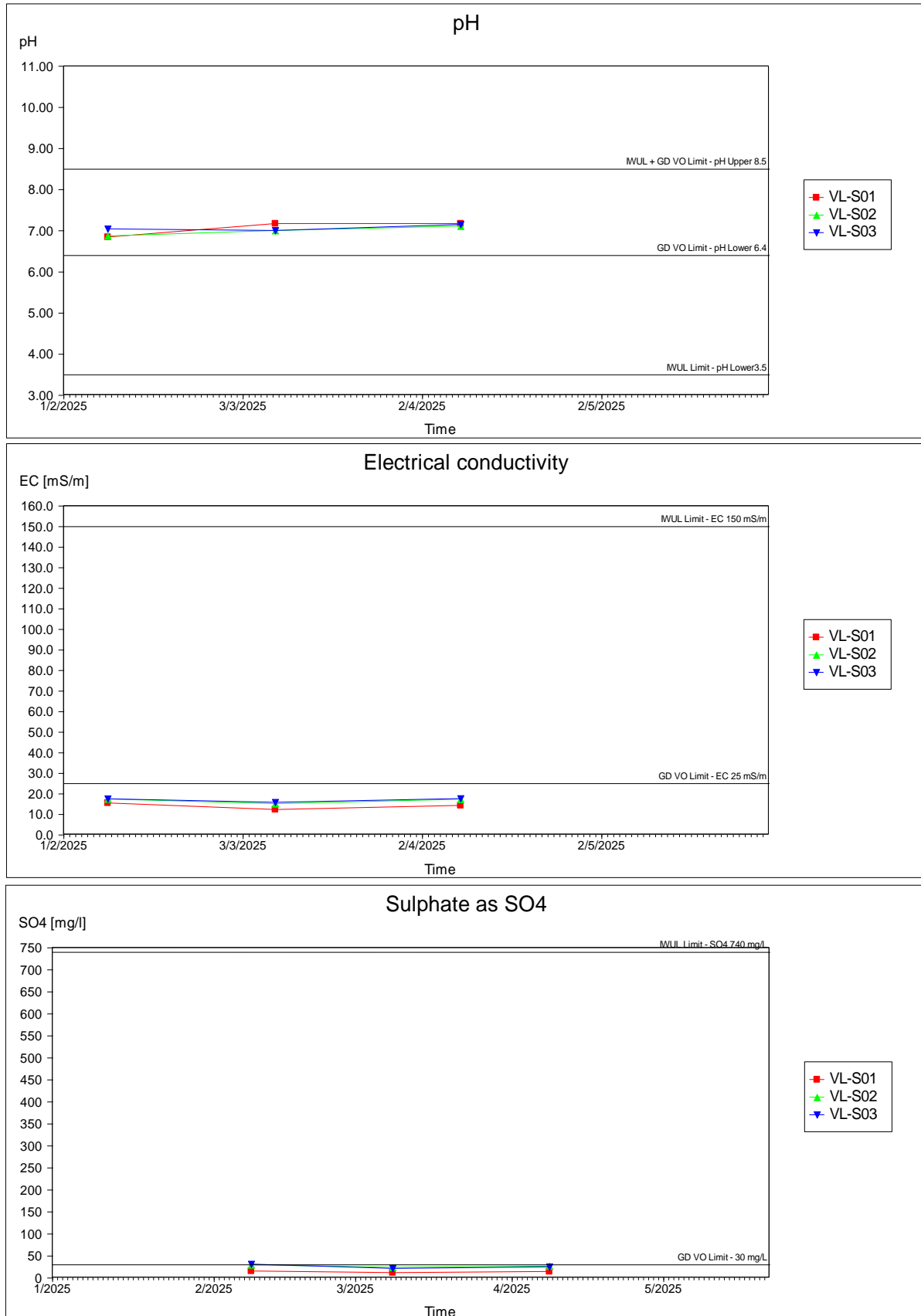


Figure 11 Variable concentration trends for the Vaal River.

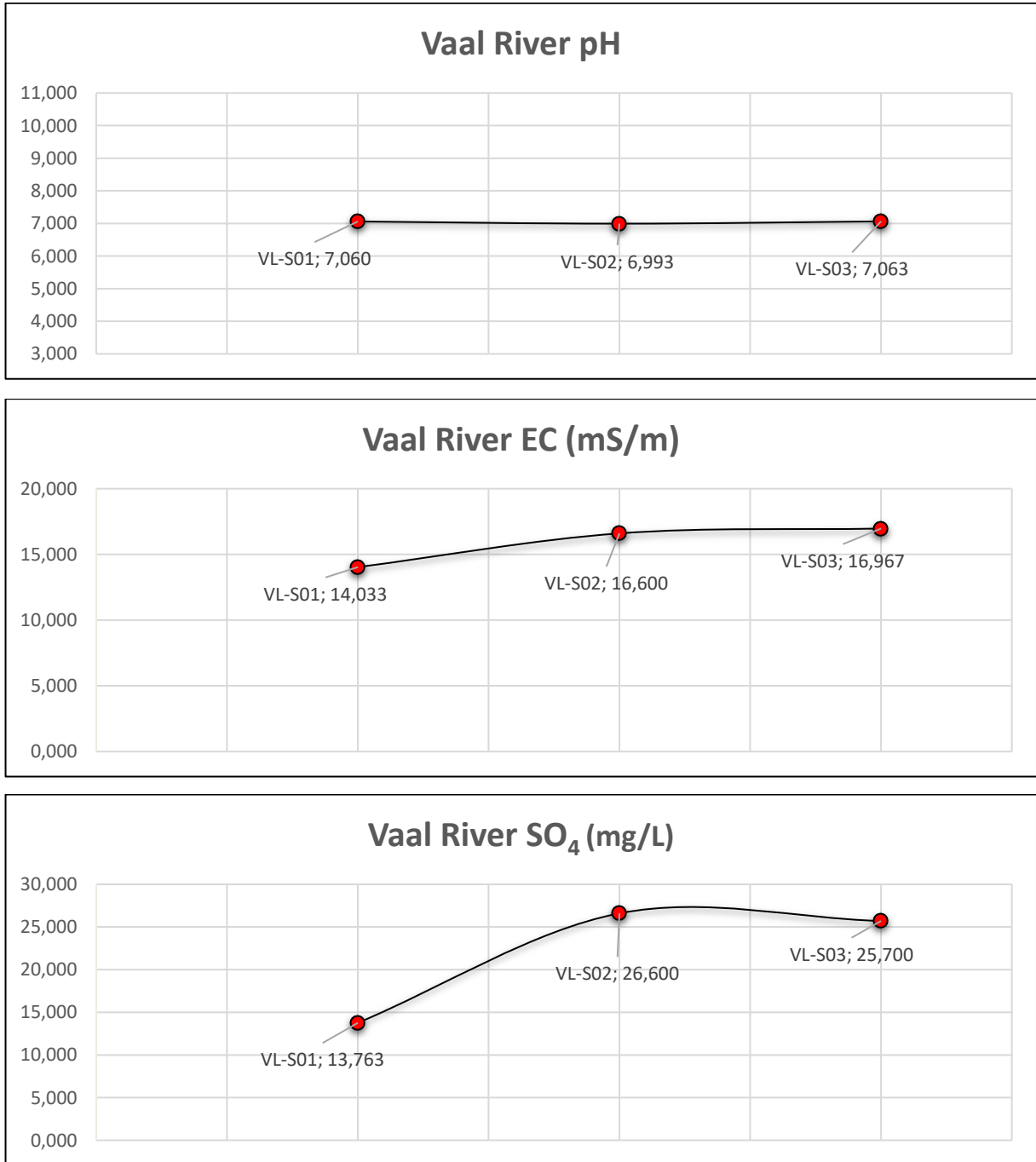
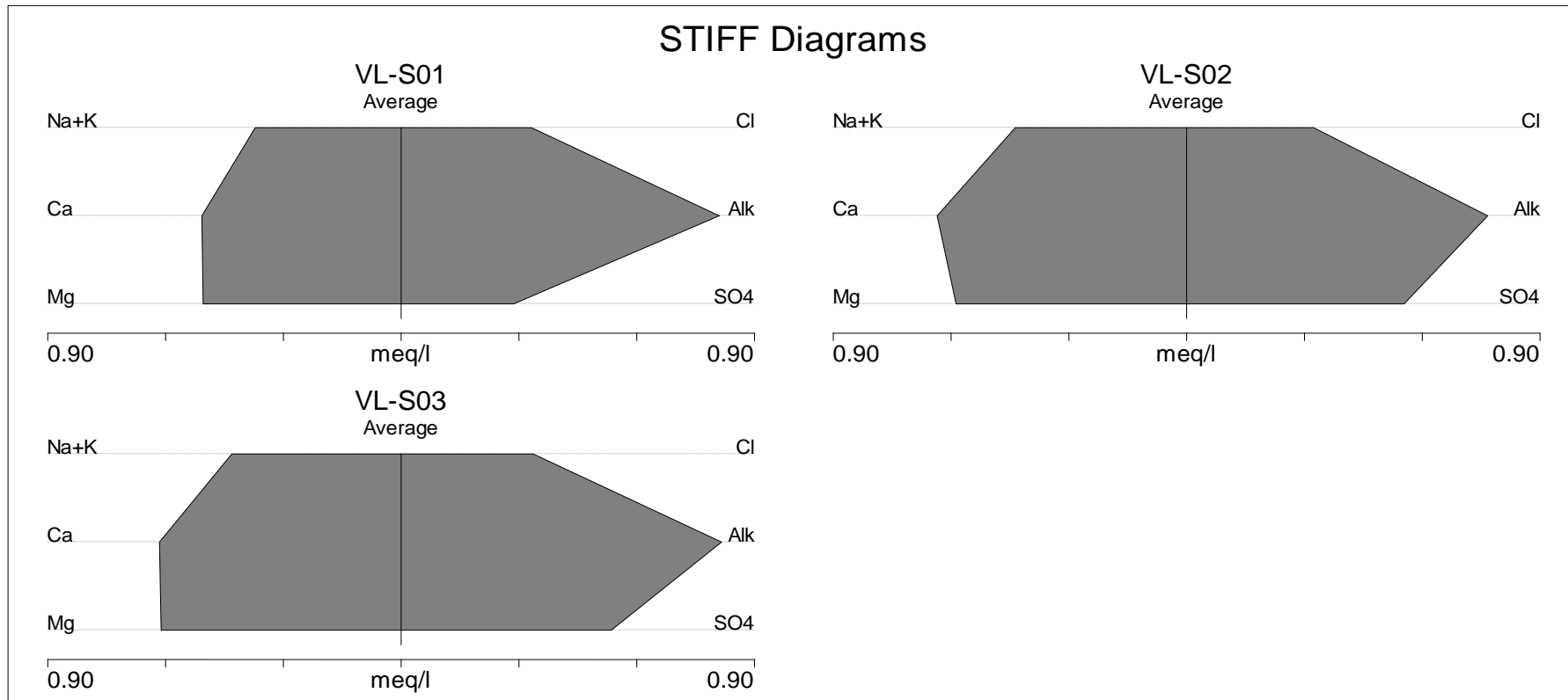


Figure 12 Vaal River stream profile - upstream left, downstream right.



- STIFF Diagram
- A dominant Sulphate (SO_4) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO_3^-) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO_4)

Figure 13 STIFF Diagrams for the Vaal River surface water monitoring points.



From **Table 8** and **Figures 11, 12** and **13** it is evident that water quality and composition of the Vaal River changed after the confluence with the Witpuntspruit (inflow between **VL-S01** and **VL-S02**).

The trend in water quality at **VL-S01** (upstream) can be ascribed to seasonal changes and possible upstream impacts where the addition of elevated variable concentrations from the Witpuntspruit (**WT-S06**) into the Vaal River system can be clearly observed in the difference of variable concentrations and composition as deterioration was recorded from **VL-S01** towards **VL-S02** (after confluence of Witpuntspruit).

From **VL-S02** to **VL-S03** the water quality remained relatively consistent indicated no additional impacts entering the Vaal river downstream of **VL-S02**.

Metals (Al and Fe) concentrations in the Vaal River exceeded the IWUL Limits from upstream to downstream with concentrations remaining relatively consistent or improving as water moves downstream.

Evidently, the Witpuntspruit has a negative impact on the Vaal River.

6.4 Groundwater

Table 9 indicates the average groundwater quality for Mooiplaats Colliery monitoring points compared to the IWUL limits, Grootdraai Dam Guidelines - Vaal Origin, DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards.

GKL-5s, GKL-6m, GKL-8m, and GKL-9d which is located on private property could not be monitored during the reporting period due to widespread flooding resulting from well-above average rainfall in the catchment.

Figure 14 illustrate the variable concentration trends for groundwater.

Figure 15 illustrates the composition of the groundwater water quality in STIFF Diagrams.



Table 9 Average water quality for Mooiplaats groundwater monitoring points.

Average Groundwater Quality for Mooiplaats February 2025 - April 2025										
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	GAD-1	GAD-2S	GKL-1	GKL-2S	GKL-4D
pH	-	8.78	6.4 – 8.5	5.0 - 9.5	-	7.04	7.09	7.09	7.24	8.52
EC	mS/m	150	25	170	500	26.40	14.60	37.10	48.30	216.00
TDS	mg/L	-	-	1200	3000	144	87	207	272	1229
Total Hardness	mg/L	-	-	-	-	110	62	162	233	12
Alkalinity	CaCO ₃ /L	-	75	-	-	128.000	43.800	200.000	235.000	579.270
Ca	mg/L	15.18	-	-	1000	28.000	13.520	41.300	50.700	3.120
Mg	mg/L	6.96	-	-	500	9.810	6.840	14.300	25.800	1.030
Na	mg/L	61.55	-	200	200	9.730	4.950	17.400	14.500	504.140
K	mg/L	-	-	-	-	2.900	0.800	1.280	1.920	5.370
F	mg/L	0.30	0.4	1.5	2	-0.090	0.100	-0.090	-0.090	3.520
Cl	mg/L	19.97	20	300	3000	9.850	10.400	6.390	6.770	334.000
SO ₄	mg/L	0.25	30	500	1000	3.390	2.440	3.370	28.700	11.400
NO ₃	mg/L	0.07	0.5	11	-	0.600	4.950	0.600	0.470	0.640
NH ₃	mg/L	-	-	1.5	-	-0.450	-0.450	-0.450	-0.450	0.800
Al	mg/L	-	-	0.3	5	-0.010	-0.010	-0.010	-0.010	0.120
Fe	mg/L	-	-	0.3	10	0.770	0.050	0.470	0.310	0.170
Mn	mg/L	-	-	0.1	10	0.210	0.040	0.020	0.250	0.010

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*”Indicate variables exceeding the IWUL limits and GD-VO Guidelines.

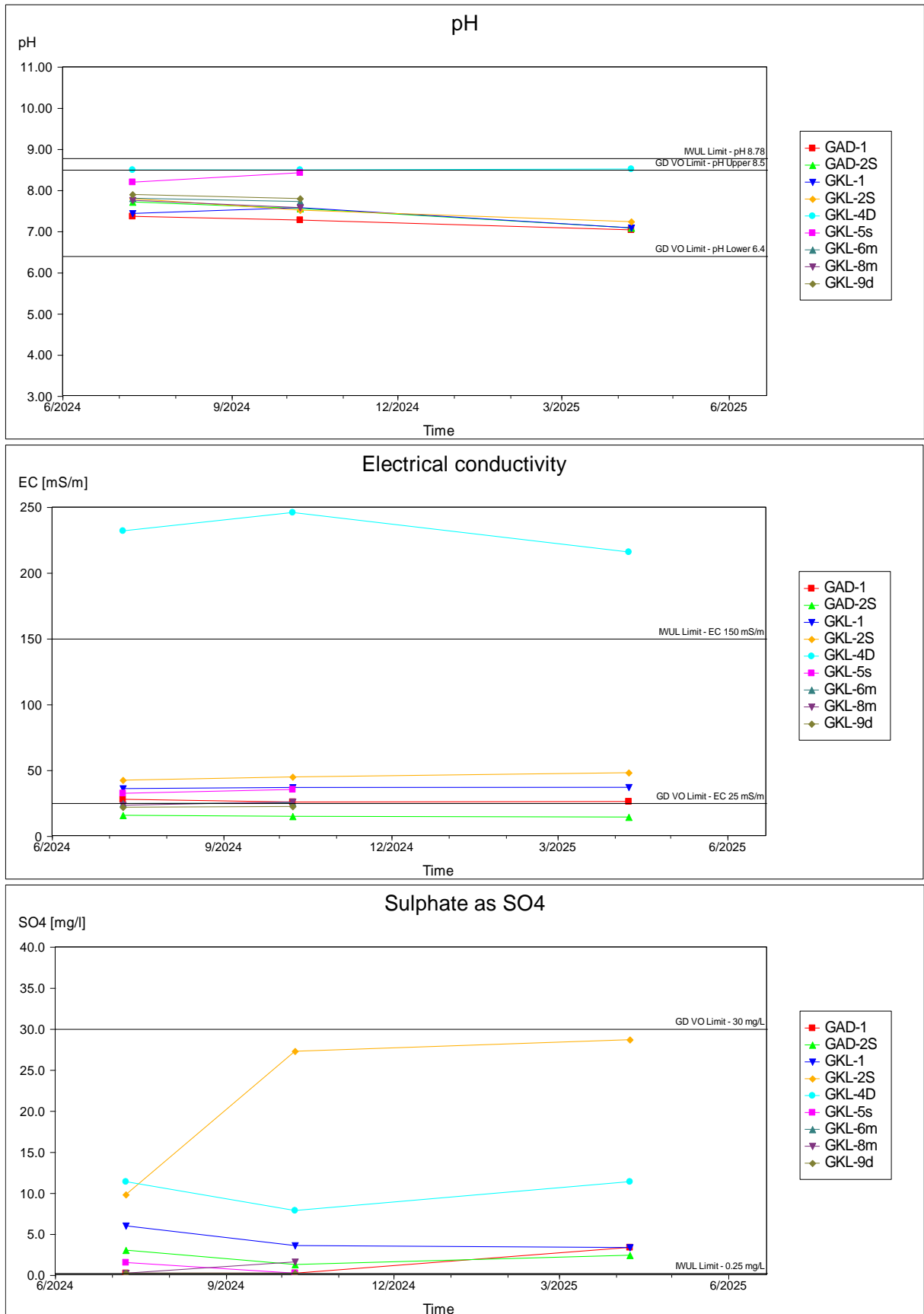
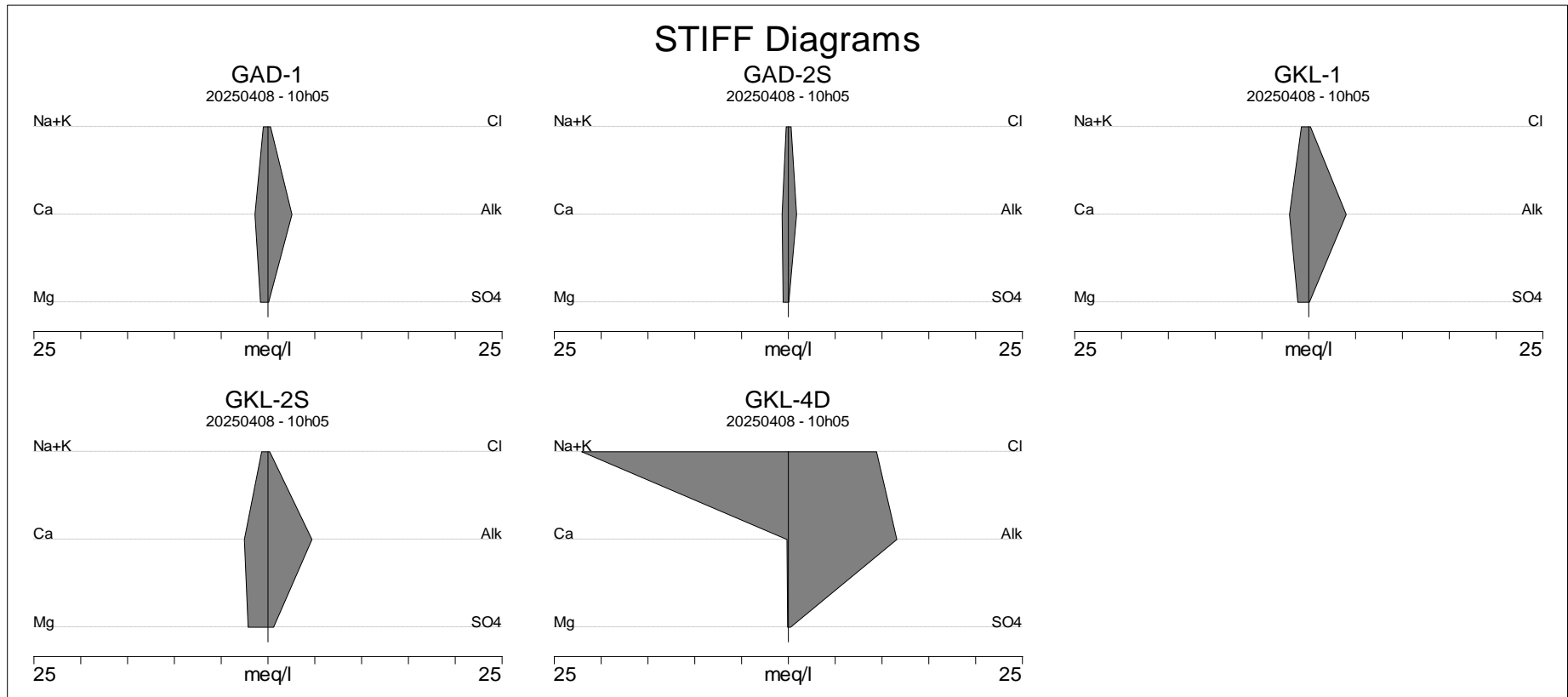


Figure 14 Variable concentration trends for groundwater monitoring points.



- STIFF Diagram
- A dominant Sulphate (SO_4) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO_3^-) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO_4)

Figure 15 STIFF Diagrams for Mooiplaats groundwater monitoring points.



From **Table 9** and **Figures 14** and **15** it is evident that groundwater quality outside the mining right area remained of good quality, with seasonal fluctuations, despite several Grootdraai dam Vaal Origin Guidelines and IWUL Limits being exceeded.

From **Figure 14**, the slight movement in variable concentrations are indicative of seasonal variation associated with geology and the consistent recharge of natural groundwater without mining impacts.

Furthermore, the SO_4 and NO_3 concentrations recorded during the reporting period remained low and in line with geological impacts despite the concentrations exceeding the IWUL Limits. The limit of 0.25 mg/L SO_4 and 0.07 mg/L NO_3 will be exceeded at most groundwater in its natural state.

Naturally high CaCO_3 and Ca concentrations (geological) resulted in elevated EC concentrations that exceeded the IWUL limits and Grootdraai Dam Guidelines - Vaal Origin for EC and CaCO_3 . Due to very low IWUL limits (SO_4 of 0.25mg/L, Ca of 15.18mg/L and Mg of 6.96 mg/L) variable concentrations in its natural state exceeded the limits.

GKL-4d is drilled to a depth of 80 meters. Naturally high CaCO_3 , Na and Cl concentrations (geological) elevated the EC concentrations, to exceed the IWUL Limit. Elevated CaCO_3 , Na, Ca, Mg, Cl and Fe concentrations can be ascribed to the deeper geology of the area, as illustrated in the STIFF Diagrams.

Alkalinity (CaCO_3) dominate in terms of dominating cations at all groundwater indicating fresh and recharged water without mining impacts.

No impact from Mooiplaats colliery was observed in the groundwater monitored.

6.5 Groundwater Levels

Groundwater levels are monitored on a quarterly basis to determine the possible impact of mining activities on the groundwater aquifer.

Table 10 indicates groundwater levels below ground level (MBGL).

Figure 16 illustrates groundwater level trends.

Table 10 Mooiplaats groundwater levels.

Mooiplaats IWUL Groundwater Levels									
Date	GAD-1	GAD-2S	GKL-1	GKL-2S	GKL-4D	GKL-5s	GKL-6m	GKL-8m	GKL-9d
Apr-24	-3.48	-8.08	-24.82	-4.17	-2.62	-1.53	-0.82	-4.58	-13.03
Jul-24	-4.28	-9.44	-24.98	-4.17	-2.61	-2.07	-1.63	-4.98	-13.19
Oct-24	-4.79	-10.02	-25.17	-2.68	-3.29	-2.3	-2.08	-5.21	-13.27
Apr-25	-1.93	-4.26	-25.13	-2.73	-2.55	NA	NA	NA	NA

Evident from **Table 10** and **Figure 16**, groundwater levels fluctuate according to drilled depth and season with no indication of water levels impacted by mining activities.

GKL-5s, **GKL-6m**, **GKL-8m**, and **GKL-9d** which is located on private property could not be monitored during the reporting period due to widespread flooding resulting from well-above average rainfall in the catchment.

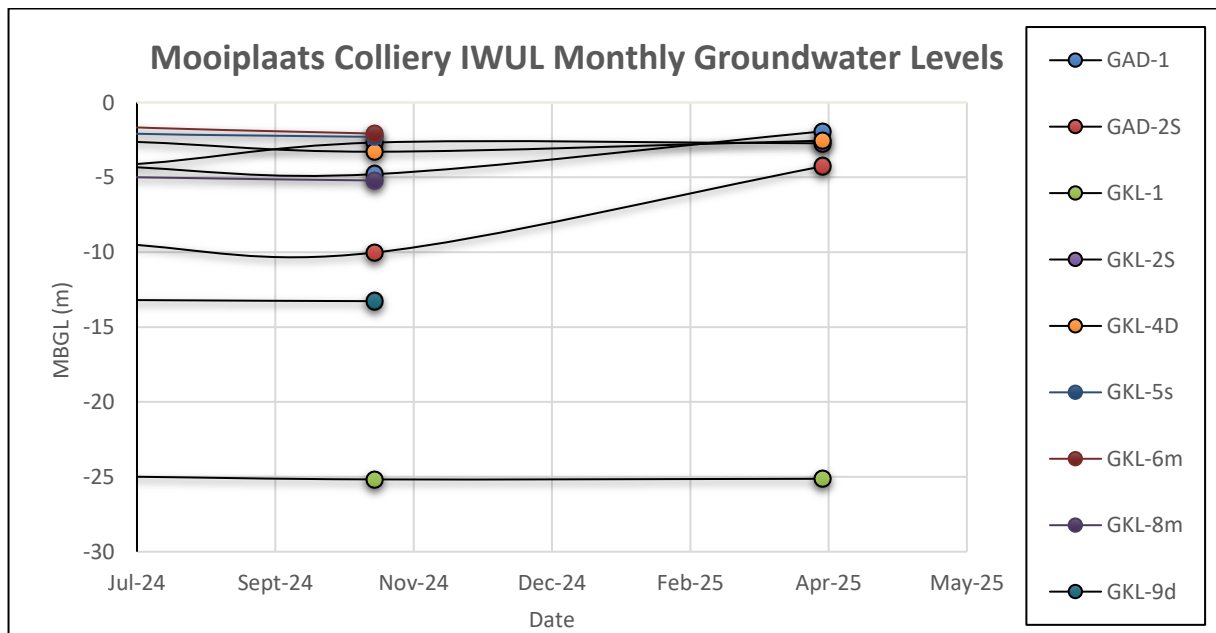


Figure 16 Mooiplaats groundwater level trends.



7. DISCUSSION AND CONCLUSION

The monitoring network provides information for risk-based decision making to Mooiplaats management with regard to effectiveness of pollution prevention measures and areas requiring management attention.

Note: Removing coal from underground / mining ceased on 31 December 2021. with only the coal washing plant being operational currently.

7.1 Surface water

Wastewater - Water quality from the mine water/pollution control dams exceeded limits in terms of EC, TDS, CaCO₃, Ca, Mg, Cl, SO₄, Fe, and Mn - typical of water associated with coal washing/mining activities. Wastewater is contained in storage facilities and circulated in a closed circuit. The pH of process / wastewater should be closely monitored and managed to prevent damage to water infrastructure.

Witpuntspruit – Although historic pollution from upstream of Mooiplaats is evident (at **WT-S01**), water quality recorded a general deterioration in terms of several variable concentrations towards downstream despite dilution from rainfall. With **WT-S05** and the **Usuthu decant** inflow between **WT-S04** and **WT-S06** the water quality deteriorated. From **WT-S01** to **WT-S06**, a net deterioration was recorded. However, current and historical activities have a detrimental effect on this Spruit, which will have a long-term negative effect on the downstream environment of the Vaal River system.

Vaal River – A continuous deterioration was recorded after the confluence of the Witpuntspruit with the Vaal River (between **VL-S01** and **VL-S02**). The increase / deterioration in variable concentrations during the reporting period can be ascribed to the addition of variables received from the Witpuntspruit drainage.

Although Al and Fe exceeded the IWUL limits, concentrations remained low, relative consistent, and in line with historical trends, from upstream to downstream indicating the presence might possibly be geological / natural.

7.2 Groundwater

Groundwater - Outside the mining right area, water quality remains mostly stable and of good quality, with slight seasonal fluctuations. Neutral to high neutral pH values, Alkalinity (CaCO₃), and Ca concentrations indicate geological conditions. The movement of pH values, EC concentrations and variables associated with geology indicate the consistent recharge of natural groundwater without mining impacts.



Groundwater levels continued to fluctuate according to seasonal factors and not due to mining impacts.

8. REFERENCES

- General Authorisations in terms of section 39 of the NWA. 1998 (Act No.36 of 1998). GG 36206 (4 March 2013). GNR 169. Section 21 (f) & (h).
- ISO 5667-1: 2006 Part 1: Guidance on the design of sampling programs and sampling techniques.
- ISO 5667-3: 2003 Part 3: Guidance on preservation and handling of samples.
- ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams.
- ISO 5667-11: 1993 Part 11: Guidance on sampling of groundwaters.
- Mineral and Petroleum Resources Development Act (Act No.28 of 2002).
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- South African Water Quality Guidelines (1996). Volume 1. Domestic Use. Department of Water Affairs and Forestry.
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- Mooiplaats North Colliery geology and groundwater study. Coal of Africa Limited. Report No. V1110001. J. Fourie. 2011.

— ANNEXURES

Refer to **Annexure A** for:

- In-field Sampling Sheets: Tables portraying the name, descriptions, and status of the monitoring points.

Refer to **Annexure B** for:

- Test Reports: Laboratory results displaying variable concentrations for all monitoring points during the reporting period.

ANNEXURE A





sanas
South African Institute
of Accredited Systems

T0647

Analyses Required

pH, Ec, P and M Alkalinity, Ca, Mg,
Na, K, F, Cl, SO4, NO3-N, Al, Fe, Mn,
NH3

Sent by:
L. Marais

Received by:

YANUKA KMOOS

Date

13/2/25



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154 Midas Ave, Olympia, Pretoria

Project: Mooiplaats IWUL Water Monitoring

Monitoring Month: Feb-25

Monitoring Occasion: Monthly Surface and Groundwater Monitoring

Date of Sampling: 12-Feb-25

Monitoring Point	Coordinates	Time	Sampled	Level	Description	Comment/Observations	Turbidity
Surface Water							
✓ VI-S01	S26.64616° E30.09890°	11:45	✓	W1	Vaal River 1 US	<i>Clear Brown</i>	1
✓ VI-S02	S26.64804° E30.15098°	10:45	✓	NH	Vaal River 2 DS	<i>Clear Brown</i>	2
✓ VI-S03	S26.67879° E30.12411°	11:05	✓	NH	Vaal River 3 DS	<i>Clear Brown</i>	2
✗ VI-S04	S26.70167° E30.08288°	10:57	✗		Vaal River 4 DS	<i>No Access</i>	-
✓ WT-S01	S26.71447° E30.06519°	11:26	✓	NH	Witpuntspuit 1 US	<i>Clear</i>	1
✓ WT-S02	S26.59307° E30.09617°	08:02	✓	NH	Witpuntspuit 2 MS	<i>Clear</i>	0
✓ WT-S03	S26.61826° E30.11211°	07:52	✓	NH	Witpunt Tributary North DS 1	<i>Clear</i>	1
✓ WT-S04	S26.62014° E30.10781°	08:14	✓	NH	Witpuntspuit 3 MS	<i>Clear</i>	0
✓ WT-S05	S26.62294° E30.11463°	08:24	✓	NH	Witpunt Tributary South DS 2	<i>Clear</i>	1
✓ WT-S06	S26.62863° E30.11539°	08:40	✓	NH	Witpuntspuit 6 MS	<i>Clear</i>	0
✓ MPS-S14	S26.64616° E30.09890°	09:18	✓	NH	Gaan-sub PCD	<i>Clear</i>	2
✓ MPS-S20	S26.64505° E30.10121°	09:35	✓	1m	Erickson Dams	<i>Clear</i>	0
✓ MPS-S21	S26.64198° E30.10059°	09:53	✓	H0	Main Holdings Dam	<i>Clear</i>	1
✓ MPS-S30	S26.64508° E30.09674°	09:25	✓	VH0	Plant PCD	<i>Clear - Black.</i>	2



10647



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 VAT No: 48202425586
 Postnet Suite C319 Private Bag X18 Lynwood Ridge 0040
 15A Midas Ave, Olympos, Pretoria

Project: Mooiplaats IWUL Water Monitoring
 Monitoring Month: Apr-25
 Monitoring Occasion: Quarterly Surface and Groundwater Monitoring
 Date of Sampling: 09-Apr-25

Analyses Required

pH, EC, Alkalinity, Ca, Mg, Na, K, F, Cl, SO4, NO3-N, Al, Fe, Mn, NH3

Sent By: Louis Marais

Received By: YANIKAB LMS

Date

10/4/25

Monitoring Point	Coordinates	Time	Sampled	Level	Medium	Comment/Observations	Turbidity
------------------	-------------	------	---------	-------	--------	----------------------	-----------

Surface Water

✓ VL-S01	S26.64616° E30.09890°	10:56	Yes	5	Vaal River 1 US	Clear	1
✓ VL-S02	S26.64804° E30.15098°	11:13	Yes	5	Vaal River 2 DS	Clear	1
✓ VL-S03	S26.67879° E30.12411°	12:18	Yes	5	Vaal River 3 DS	Clear	1
✓ VL-S04	S26.70167° E30.08288°				Vaal River 4 DS		
✓ WT-S01	S26.71447° E30.06519°	08:29	Yes	5	Witpuntspruit 1 US	Clear	1
✓ WT-S02	S26.59307° E30.09617°	08:10	Yes	5	Witpuntspruit 2 MS	Clear	0
✓ WT-S03	S26.61826° E30.11211°	07:56	Yes	4	Witpunt Tributary North DS 1	Clear	1
✓ WT-S04	S26.62014° E30.10781°	08:15	No		Witpuntspruit 3 MS	No Access	
✓ WT-S05	S26.62294° E30.11463°	08:15	No		Witpunt Tributary South DS 2	No Access	
✓ WT-S06	S26.62863° E30.11539°	08:57	Yes	5	Witpuntspruit 6 MS	Clear	1

Groundwater

✓ GAD-1	S26.72733° E30.10144°	11:42	Yes	1.95	IWUL Borehole	Clear	0
✓ GAD-2S	S26.71269° E30.11414°	11:31	Yes	4.26	IWUL Borehole	Clear	0
✓ GKL-1	S26.69603° E30.07208°	12:01	Yes	25.13	IWUL Borehole	Clear	1
✓ GKL-2S	S26.70178° E30.08269°	12:15	Yes	2.73	IWUL Borehole	Clear	1
✓ GKL-4d	S26.70167° E30.08253°	12:11	Yes	2.55	IWUL Borehole	Brown	4
✓ GKL-5S	S26.66542° E30.09647°				IWUL Borehole		
✓ GKL-6M	S26.66542° E30.09658°				IWUL Borehole		
✓ GKL-8M	S26.67233° E30.10464°				IWUL Borehole		
✓ GKL-9D	S26.67231° E30.10450°				IWUL Borehole		

Process Water

✓ MPS-S14	S26.64616° E30.09890°	09:50	Yes	3	Gen-aub PCD	Clear	0
✓ MPS-S20	S26.64505° E30.10121°	10:27	Yes	5	Erickson Dams	Clear	0
✓ MPS-S21	S26.64198° E30.10059°	10:04	Yes	5	Main Holdings Dam	Clear	0
✓ MPS-S30	S26.64508° E30.09674°	09:55	Yes	5	Plant PCD	Black	4



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Accreditation System

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Analyses Required

pH, EC, P and M Alkalinity, Ca, Mg,
Ni, K, F, Cl, SO4, NO3-N, Al, Fe, Mn,
NH3

Sent by:
L. Marais

Received by:

Yvonne Kumbas

Date

5/3/25



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154 Midas Ave, Olympia, Pretoria

Project: Moolplaats IWUL Water Monitoring
Monitoring Month: Mar-25
Monitoring Occasion: Monthly Surface and Groundwater Monitoring
Date of Sampling: 05-Mar-25

Monitoring Point	Coordinates	Time	Sampled	Level	Description	Comment/Observations	Turbidity
<input checked="" type="checkbox"/> VL-S01	S26.64616° E30.09890°	11:45	Yes	High	Vaal River 1 US	Clear	1
<input checked="" type="checkbox"/> VL-S02	S26.64804° E30.15098°	12:27	Yes	High	Vaal River 2 DS	Clear	1
<input checked="" type="checkbox"/> VL-S03	S26.67879° E30.12411°	12:06	Yes	High	Vaal River 3 DS	Clear	1
<input checked="" type="checkbox"/> VL-S04	S26.70167° E30.08288°	12:00	Yes	High	Vaal River 4 DS	Clear	1
<input checked="" type="checkbox"/> WT-S01	S26.71447° E30.06519°	09:34	Yes	High	Wimpunnspruit 1 US	Clear	1
<input checked="" type="checkbox"/> WT-S02	S26.59307° E30.09617°	08:10	Yes	High	Wimpunnspruit 2 MS	Clear	1
<input checked="" type="checkbox"/> WT-S03	S26.61826° E30.12111°	08:02	Yes	High	Wimpunnspruit 3 MS	Clear	6
<input checked="" type="checkbox"/> WT-S04	S26.62014° E30.10781°	09:16	Yes	High	Wimpunnspruit North DS 1	Clear	1
<input checked="" type="checkbox"/> WT-S05	S26.62394° E30.11463°	09:08	Yes	High	Wimpunnspruit South DS 2	Clear	0
<input checked="" type="checkbox"/> WT-S06	S26.62863° E30.11539°	09:41	Yes	High	Wimpunnspruit 6 MS	Clear	1
<input checked="" type="checkbox"/> MPS-S14	S26.64616° E30.09890°	10:09	Yes	High	Gen-sub PCD	Clear - D.I	1
<input checked="" type="checkbox"/> MPS-S20	S26.64505° E30.10121°	11:06	Yes	High	Etchison Dams	Clear	0
<input checked="" type="checkbox"/> MPS-S21	S26.64198° E30.10059°	10:43	Yes	High	Main Holdings Dam	Clear	0
<input checked="" type="checkbox"/> MPS-S30	S26.64508° E30.09674°	10:15	Yes	High	Plant PCD	Clear	5

Surface Water

ANNEXURE B





YANKA LABORATORIES

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Geo Soil and Water CC
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 0040

Job No: **E80963 - W25 _ 1249**
 Report Reference: **ER_GEO_2025-02-17_07125_001**
 Enquiries: **Rita Botha**
 Report Date: **2025/03/07**
RitaB@yanka.co.za
 Job Reference: **W25/1249 - Advice Note 2502W380**
 Job Description: **13 x Routine Analysis**

Project: **MOOPLAATS SURFACE & GW**

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & GW - 13 February 2025

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see

<http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 13 February 2025 - 2025/03/07

SANAS Certificate obtainable from the address below

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Results not marked with a Test Method YE####, as well as results marked "Subcontracted" or "Outsourced", in this report, are not included in the SANAS Schedule of Accreditation for this laboratory. However, outsourced results may be within the Schedule of Accreditation of the source laboratory.

Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.

Limits shown to the right of results are for information only and may need further interpretation, and is not suitable for conformance evaluation as shown.

Although reasonable precautions are taken to ensure accuracy, correctness, and applicability, it is emphasized that all results of analysis or any other notifications are provided on the explicit condition that YANKA LABORATORIES will accept no responsibility whatsoever, for any losses or costs that may result from faulty, incorrect, or inappropriate interpretation, use, or application of results.

Samples were tested as received, except where indicated otherwise. This report relates only to the specific sample(s) tested as identified herein and may not be reproduced in part without written permission from Laboratory Management.

CONFIDENTIALITY CAUTION

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ANALYSTS

Marné, Magda, Venna, Drieka, Sue, Rosemary, Vida, Elize, Petricia, Stefan, Nadine, Corlia, Lindie, Jolene, Audrey, Mariëtte, Nicolene



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 04	WT - S 05	WT - S 06
SAMPLE NUMBER			E80963-001	E80963-002	E80963-003	E80963-004	E80963-005	E80963-006	E80963-007	E80963-008	E80963-009
SAMPLED		Test Method **	2025/02/12 11:45	2025/02/12 10:45	2025/02/12 11:05	2025/02/12 11:26	2025/02/12 08:02	2025/02/12 07:52	2025/02/12 08:14	2025/02/12 08:24	2025/02/12 08:40
Remarks			Brownish	Brownish	Brownish	Clear	Yellowish	Yellowish	Yellowish	Yellowish	Yellowish
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	47,8	43,4	40,8	15,2	45,2	71,8	40,0	0,00	54,6
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	47,8	43,4	40,8	15,2	45,2	71,8	40,0	0,00	54,6
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	47,8	43,4	40,8	15,2	45,2	71,8	40,0	0,00	54,6
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	15,5	17,4	17,5	61,4	44,8	75,0	45,0	355	53,0
pH (Laboratory)		YE030pH	6,84	6,87	7,04	6,61	6,77	6,86	6,88	4,15	6,36
Total Hardness	mg CaCO ₃ /L	YE061H	58,2	67,7	67,8	261	164	229	164	1344	175
Calcium Hardness	mg CaCO ₃ /L	YE061H	30,0	35,7	35,2	130	91,1	123	89,2	693	94,1
Magnesium Hardness	mg CaCO ₃ /L	YE061H	28,2	32,0	32,6	131	73,3	105	74,9	651	81,3
Total Dissolved Solids (TDS)	mg/L	Calculation	85,5	102	103	411	295	491	297	3346	353
Temperature	°C	Thermometer	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	0,51
Calcium	mg Ca/L	YE060ICP	12,0	14,3	14,1	51,9	36,5	49,3	35,7	278	37,7
Chloride	mg Cl/L	YE070AK	10,5	11,3	11,5	15,5	17,4	12,3	17,3	24,3	17,6
Magnesium	mg Mg/L	YE060ICP	6,85	7,76	7,91	31,8	17,8	25,6	18,2	158	19,8
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	<0.35	0,41	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Potassium	mg K/L	YE060ICP	2,58	2,77	2,82	4,46	6,13	3,19	5,77	5,49	5,94
Sodium	mg Na/L	YE060ICP	8,31	8,67	8,23	22,2	25,3	72,8	25,7	523	39,0
Sulphate	mg SO ₄ /L	YE070AK	15,4	29,5	30,9	274	164	284	170	2332	199
Aluminium	mg Al/L	YE060ICP	0,47	0,54	0,58	<0.01	<0.01	<0.01	<0.01	1,04	<0.01
Fluoride	mg F/L	YE070AK	0,18	0,20	0,19	0,22	0,28	0,18	0,28	0,35	0,21
Iron	mg Fe/L	YE060ICP	0,57	0,72	0,68	0,17	0,02	0,07	<0.01	0,74	0,04
Manganese	mg Mn/L	YE060ICP	<0.01	<0.01	<0.01	2,09	0,06	<0.01	<0.01	23,1	0,21
Langelier Index (indicative, not SANS)	Calculation		-1,78	-1,72	-1,58	-1,93	-1,44	-1,05	-1,39	-17,72	-1,77
pHs (indicative, not SANS)	Calculation		8,62	8,59	8,62	8,54	8,21	7,91	8,27	21,87	8,13
Sodium Absorption Ratio (indicative)	Calculation		0,47	0,46	0,43	0,60	0,86	2,09	0,87	6,18	1,27
TDS to EC Ratio (indicative, not SANS)	Calculation		5,52	5,85	5,90	6,70	6,58	6,54	6,60	9,43	6,66
Corrosion Ratio (indicative, not SANS)	Calculation		0,79	1,09	1,19	12,26	2,97	2,54	3,43	128359791491,38	2,81
Ryznar Index (indicative, not SANS)	Calculation		10,39	10,31	10,21	10,47	9,66	8,95	9,67	39,58	9,89
Anion Sum			1,59	1,82	1,83	6,47	4,83	7,71	4,85	49,30	5,75
Cation Sum			1,68	1,91	1,90	6,41	4,57	7,85	4,57	50,93	5,42
Difference			0,10	0,09	0,07	-0,06	-0,26	0,14	-0,28	1,63	-0,33
% Difference			2,91%	2,48%	1,82%	-0,44%	-2,81%	0,87%	-2,99%	1,62%	-2,94%

Methods adapted to accommodate local laboratory conditions.

SM refers to the Standard Methods for the Examination of Water and Wastewater.

Unless analysis is indicated as "Total", tests are performed on filtered samples as per ISO 11885.

Ion balance is not used as QC check where pH<3.5.

** Methods Starting with YE are accredited, and based on ISO,

SANS, and/or other national or international standards,

please see <http://www.yanka.co.za/TestsAndStandards.htm>.

For ranges, uncertainties, etc., please contact us.



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11	SpGeo 12	SpGeo 13
SAMPLE DESCRIPTION			MPS - S 14	MPS - S 20	MPS - S 21	MPS - S 30
SAMPLE NUMBER			E80963-010	E80963-011	E80963-012	E80963-013
SAMPLED	Test Method **		2025/02/12 09:18	2025/02/12 09:35	2025/02/12 09:53	2025/02/12 09:25
Remarks			Greenish	Clear	Yellowish	Greyish
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	307	948	17,8	475
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	307	896	17,8	475
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	51,6	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	307	922	17,8	475
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	25,8	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	161	299	365	359
pH (Laboratory)		YE030pH	7,18	8,34	6,66	7,77
Total Hardness	mg CaCO ₃ /L	YE061H	355	194	1180	588
Calcium Hardness	mg CaCO ₃ /L	YE061H	229	71,7	670	287
Magnesium Hardness	mg CaCO ₃ /L	YE061H	126	122	511	301
Total Dissolved Solids (TDS)	mg/L	Calculation	1197	2285	3149	2439
Temperature	°C	Thermometer	25,0	25,0	25,0	25,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	0,87	<0.45
Calcium	mg Ca/L	YE060ICP	91,8	28,7	268	115
Chloride	mg Cl/L	YE070AK	33,2	62,8	39,6	59,9
Magnesium	mg Mg/L	YE060ICP	30,6	29,7	124	73,0
Nitrate and Nitrite (TON)	mg N/L	YE070AK	2,34	1,45	0,35	1,73
Potassium	mg K/L	YE060ICP	9,45	12,2	16,4	22,0
Sodium	mg Na/L	YE060ICP	283	806	462	626
Sulphate	mg SO ₄ /L	YE070AK	553	765	2207	1248
Aluminium	mg Al/L	YE060ICP	<0.01	<0.01	0,09	0,21
Fluoride	mg F/L	YE070AK	0,90	4,44	0,41	1,43
Iron	mg Fe/L	YE060ICP	<0.01	<0.01	0,24	0,05
Manganese	mg Mn/L	YE060ICP	<0.01	0,02	17,5	0,01
Langelier Index (indicative, not SANS)		Calculation	0,12	1,23	-1,19	0,97
pHs (indicative, not SANS)		Calculation	7,06	7,11	7,85	6,80
Sodium Absorption Ratio (indicative)		Calculation	6,51	25,08	5,83	11,20
TDS to EC Ratio (indicative, not SANS)		Calculation	7,43	7,64	8,63	6,79
Corrosion Ratio (indicative, not SANS)		Calculation	1,24	0,61	70,81	1,72
Ryznar Index (indicative, not SANS)		Calculation	6,93	5,88	9,04	5,84
Anion Sum			18,83	37,04	47,51	37,41
Cation Sum			19,69	39,29	44,99	39,66
Difference			0,86	2,25	-2,52	2,25
% Difference			2,24%	2,95%	-2,72%	2,92%

Methods adapted to accommodate local laboratory conditions.

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Unless analysis is indicated as "Total", tests are performed on filtered samples as per IST. Ion balance is not used as QC check where pH<3.5.

** Methods Starting with YE are accredited, and based on ISO, SANS, and/or other national or international standards, please see <http://www.yanka.co.za/TestsAndStandards.htm>. For ranges, uncertainties, etc., please contact us.



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Job No: **E81772 - W25 _ 2055**
 Report Reference: **ER_GEO_2025-03-11_07934_001**
 Enquiries: **Rita Botha**
 Report Date: **2025/03/25**
RitaB@yanka.co.za
 Job Reference: **W25/2055 - Advice Note 2503W368**
 Job Description: **13 x Routine Analysis**

Project: **MOOPLAATS SURFACE & GW**

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & GW - 06 March 2025

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see

<http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 6 March 2025 - 2025/03/25

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Samples were tested as received, except where indicated otherwise. This report relates only to the specific sample(s) tested as identified herein and may not be reproduced in part without written permission from Laboratory Management.

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ANALYSTS

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YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 04	WT - S 05	WT - S 06
SAMPLE NUMBER			E81772-001	E81772-002	E81772-003	E81772-004	E81772-005	E81772-006	E81772-007	E81772-008	E81772-009
SAMPLED	Test Method **		2025/03/05 11:45	2025/03/05 12:27	2025/03/05 12:06	2025/03/05 09:34	2025/03/05 08:10	2025/03/05 08:02	2025/03/05 09:16	2025/03/05 09:08	2025/03/05 09:41
Remarks			Brownish	Brownish	Brownish	Brownish	Brownish	Brownish	Brownish	Yellowish	Brownish
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	39,4	35,0	42,8	28,4	39,2	31,4	47,6	8,00	50,2
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	39,4	35,0	42,8	28,4	39,2	31,4	47,6	8,00	50,2
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	39,4	35,0	42,8	28,4	39,2	31,4	47,6	8,00	50,2
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	12,3	15,1	15,8	39,4	38,3	40,0	36,2	157	50,6
pH (Laboratory)		YE030pH	7,17	7,00	7,00	6,71	6,76	6,74	6,73	6,20	6,59
Total Hardness	mg CaCO ₃ /L	YE061H	41,1	51,4	56,0	148	131	119	123	490	156
Calcium Hardness	mg CaCO ₃ /L	YE061H	18,5	24,0	26,5	76,7	67,4	63,7	63,7	205	78,4
Magnesium Hardness	mg CaCO ₃ /L	YE061H	22,6	27,4	29,6	71,7	63,8	55,6	59,7	285	77,4
Total Dissolved Solids (TDS)	mg/L	Calculation	69,8	82,6	88,1	245	236	249	222	1177	309
Temperature	°C	Thermometer	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	0,64	<0.45	<0.45
Calcium	mg Ca/L	YE060ICP	7,41	9,62	10,6	30,7	27,0	25,5	25,5	82,0	31,4
Chloride	mg Cl/L	YE070AK	10,4	10,0	10,7	14,5	13,5	9,55	13,1	14,8	14,6
Magnesium	mg Mg/L	YE060ICP	5,48	6,65	7,18	17,4	15,5	13,5	14,5	69,3	18,8
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Potassium	mg K/L	YE060ICP	1,65	1,81	1,76	2,86	3,49	3,77	3,66	6,24	4,29
Sodium	mg Na/L	YE060ICP	6,89	8,71	8,60	16,3	22,1	29,7	21,1	160	38,4
Sulphate	mg SO ₄ /L	YE070AK	11,7	23,6	21,4	145	131	148	115	832	171
Aluminium	mg Al/L	YE060ICP	0,81	0,52	0,54	0,15	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	mg F/L	YE070AK	0,10	0,10	0,09	0,13	0,13	0,12	0,12	0,16	0,14
Iron	mg Fe/L	YE060ICP	1,70	0,54	1,51	0,34	0,08	0,19	0,04	0,34	0,06
Manganese	mg Mn/L	YE060ICP	<0.01	<0.01	<0.01	0,57	0,03	<0.01	<0.01	7,87	0,03
Langelier Index (indicative, not SANS)	Calculation		-1.73	-1.84	-1.72	-1.77	-1.63	-1.78	-1.60	-2.46	-1.65
pHs (indicative, not SANS)	Calculation		8.90	8.84	8.72	8.48	8.39	8.52	8.33	8.66	8.24
Sodium Absorption Ratio (indicative)	Calculation		0.47	0.53	0.50	0.58	0.84	1.18	0.82	3.13	1.33
TDS to EC Ratio (indicative, not SANS)	Calculation		5.67	5.47	5.57	6.22	6.17	6.23	6.14	7.50	6.10
Corrosion Ratio (indicative, not SANS)	Calculation		0.90	1.16	0.97	4.10	2.71	3.31	2.03	59.32	2.59
Ryznar Index (indicative, not SANS)	Calculation		10.63	10.69	10.44	10.25	10.03	10.29	9.94	11.13	9.88
Anion Sum			1.33	1.48	1.61	4.01	3.91	3.99	3.73	17.92	4.99
Cation Sum			1.35	1.55	1.69	3.82	3.70	3.80	3.54	17.30	4.92
Difference			0.02	0.06	0.08	-0.19	-0.21	-0.19	-0.19	-0.62	-0.07
% Difference			0.61%	2.13%	2.31%	-2.39%	-2.74%	-2.47%	-2.56%	-1.76%	-0.71%

Methods adapted to accommodate local laboratory conditions.

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SANS, and/or other national or international standards,

please see <http://www.yanka.co.za/TestsAndStandards.htm>.

For ranges, uncertainties, etc., please contact us.



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11	SpGeo 12	SpGeo 13
SAMPLE DESCRIPTION			MPS - S 14	MPS - S 20	MPS - S 21	MPS - S 30
SAMPLE NUMBER			E81772-010	E81772-011	E81772-012	E81772-013
SAMPLED	Test Method **		2025/03/05 10:09	2025/03/05 11:06	2025/03/05 10:43	2025/03/05 10:15
Remarks			Greyish	Clear	Greyish	Black
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	345	899	0,00	381
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	345	899	0,00	381
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	345	899	0,00	381
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	168	284	321	353
pH (Laboratory)		YE030pH	7,34	8,05	3,74	7,08
Total Hardness	mg CaCO ₃ /L	YE061H	380	204	1000	818
Calcium Hardness	mg CaCO ₃ /L	YE061H	249	80,2	489	464
Magnesium Hardness	mg CaCO ₃ /L	YE061H	131	124	511	354
Total Dissolved Solids (TDS)	mg/L	Calculation	1370	2211	2892	3026
Temperature	°C	Thermometer	25,0	25,0	25,0	25,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	1,44	<0.45
Calcium	mg Ca/L	YE060ICP	99,8	32,1	196	186
Chloride	mg Cl/L	YE070AK	38,5	59,7	29,3	50,7
Magnesium	mg Mg/L	YE060ICP	31,8	30,1	124	85,9
Nitrate and Nitrite (TON)	mg N/L	YE070AK	2,12	0,90	0,83	2,88
Potassium	mg K/L	YE060ICP	8,21	11,4	15,4	24,4
Sodium	mg Na/L	YE060ICP	337	753	446	673
Sulphate	mg SO ₄ /L	YE070AK	638	779	2034	1763
Aluminium	mg Al/L	YE060ICP	<0.01	<0.01	21,0	<0.01
Fluoride	mg F/L	YE070AK	0,60	2,48	0,81	0,76
Iron	mg Fe/L	YE060ICP	0,02	<0.01	0,40	<0.01
Manganese	mg Mn/L	YE060ICP	0,16	0,02	19,6	0,25
Langelier Index (indicative, not SANS)		Calculation	0,36	0,97	-18,27	0,38
pHs (indicative, not SANS)		Calculation	6,98	7,08	22,01	6,70
Sodium Absorption Ratio (indicative)		Calculation	7,50	22,84	6,12	10,20
TDS to EC Ratio (indicative, not SANS)		Calculation	8,16	7,79	9,01	8,57
Corrosion Ratio (indicative, not SANS)		Calculation	1,28	0,64	114230679166,71	2,78
Ryznar Index (indicative, not SANS)		Calculation	6,61	6,11	40,28	6,32
Anion Sum			21,47	36,11	43,31	46,04
Cation Sum			22,51	37,16	43,11	46,36
Difference			1,04	1,05	-0,20	0,32
% Difference			2,36%	1,43%	-0,24%	0,34%

Methods adapted to accommodate local laboratory conditions.

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For ranges, uncertainties, etc., please contact us.



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Job No: **E82857 - W25 _ 3138**
 Report Reference: **ER_GEO_2025-04-14_09016_001**
 Enquiries: **Rita Botha**
 Report Date: **2025/04/23**
RitaB@yanka.co.za
 Job Reference: **W25/3138 - Advice Note 2504W393**
 Job Description: **16 x Routine Analysis**

Project: MOOPLAATS SURFACE & GROUNDWATER

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & Groundwater - 10 April 2025

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see

<http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 10 April 2025 - 2025/04/23
 SANAS Certificate obtainable from the address below
<http://www.yanka.co.za/Services.htm>

Results not marked with a Test Method YE####, as well as results marked "Subcontracted" or "Outsourced", in this report, are not included in the SANAS Schedule of Accreditation for this laboratory. However, outsourced results may be within the Schedule of Accreditation of the source laboratory.

Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.

Limits shown to the right of results are for information only and may need further interpretation, and is not suitable for conformance evaluation as shown.

Although reasonable precautions are taken to ensure accuracy, correctness, and applicability, it is emphasized that all results of analysis or any other notifications are provided on the explicit condition that YANKA LABORATORIES will accept no responsibility whatsoever, for any losses or costs that may result from faulty, incorrect, or inappropriate interpretation, use, or application of results.

Samples were tested as received, except where indicated otherwise. This report relates only to the specific sample(s) tested as identified herein and may not be reproduced in part without written permission from Laboratory Management.

CONFIDENTIALITY CAUTION

If you have received this report in error, please note that it is confidential and intended for the addressee only. Please notify us telephonically or by e-mail.

ANALYSTS

Marné, Magda, Venna, Drieka, Sue, Rosemary, Vida, Elize, Petricia, Stefan, Nadine, Corlia, Lindie, Jolene, Audrey, Mariëtte, Nicolene



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 06	GAD-1	GAD-2s
SAMPLE NUMBER			E82857-001	E82857-002	E82857-003	E82857-004	E82857-005	E82857-006	E82857-007	E82857-008	E82857-009
SAMPLED		Test Method **	2025/04/09 10:56	2025/04/09 11:13	2025/04/09 12:18	2025/04/09 08:29	2025/04/09 08:10	2025/04/09 07:56	2025/04/09 08:37	2025/04/09 11:42	2025/04/09 11:31
Remarks			Brownish	Brownish	Brownish	Brownish	Yellowish	Yellowish	Yellowish	Brownish	Brownish
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	34,3	36,6	38,8	51,7	58,8	54,1	63,8	128	43,8
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	34,3	36,6	38,8	51,7	58,8	54,1	63,8	128	43,8
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	34,3	36,6	38,8	51,7	58,8	54,1	63,8	128	43,8
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	14,3	17,3	17,6	37,4	35,3	40,6	38,8	26,4	14,6
pH (Laboratory)		YE030pH	7,17	7,11	7,15	7,02	7,05	7,08	7,17	7,04	7,09
Total Hardness	mg CaCO ₃ /L	YE061H	52,7	64,5	60,4	134	125	150	130	110	61,9
Calcium Hardness	mg CaCO ₃ /L	YE061H	27,7	35,7	30,7	71,2	67,9	77,9	69,7	69,9	33,8
Magnesium Hardness	mg CaCO ₃ /L	YE061H	25,0	28,8	29,6	63,0	57,2	72,1	60,1	40,4	28,2
Total Dissolved Solids (TDS)	mg/L	Calculation	79,7	98,2	96,5	220	218	255	235	144	87,3
Temperature	°C	Thermometer	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45
Calcium	mg Ca/L	YE060ICP	11,1	14,3	12,3	28,5	27,2	31,2	27,9	28,0	13,5
Chloride	mg Cl/L	YE070AK	14,4	13,1	13,6	20,7	18,8	14,9	18,3	9,85	10,4
Magnesium	mg Mg/L	YE060ICP	6,06	7,00	7,20	15,3	13,9	17,5	14,6	9,81	6,84
Nitrate and Nitrite (TON)	mg N/L	YE070AK	0,56	0,51	0,48	0,43	1,37	0,90	0,74	0,60	4,95
Potassium	mg K/L	YE060ICP	2,99	3,26	3,20	5,65	5,36	3,58	5,47	2,90	0,80
Sodium	mg Na/L	YE060ICP	6,18	8,12	8,35	19,2	18,7	21,3	23,8	9,73	4,95
Sulphate	mg SO ₄ /L	YE070AK	14,2	26,7	24,8	96,2	92,4	129	103	3,39	2,44
Aluminium	mg Al/L	YE060ICP	0,42	0,35	0,40	0,18	<0.01	0,08	<0.01	<0.01	<0.01
Fluoride	mg F/L	YE070AK	0,12	0,12	0,15	0,15	0,16	0,19	0,16	<0.09	0,10
Iron	mg Fe/L	YE060ICP	1,18	1,04	1,07	0,75	0,04	0,37	0,13	0,77	0,05
Manganese	mg Mn/L	YE060ICP	0,01	<0.01	<0.01	0,06	0,02	0,11	0,09	0,21	0,04
Langelier Index (indicative, not SANS)	Calculation		-1.62	-1.55	-1.55	-1.23	-1.16	-1.12	-1.00	-0.81	-1.51
pHs (indicative, not SANS)	Calculation		8,79	8,66	8,70	8,25	8,21	8,20	8,17	7,85	8,60
Sodium Absorption Ratio (indicative)	Calculation		0,37	0,44	0,47	0,72	0,72	0,75	0,91	0,40	0,27
TDS to EC Ratio (indicative, not SANS)	Calculation		5,57	5,68	5,48	5,87	6,17	6,27	6,06	5,46	5,98
Corrosion Ratio (indicative, not SANS)	Calculation		1,40	1,39	1,32	2,10	1,72	2,02	1,65	0,23	0,70
Ryznar Index (indicative, not SANS)	Calculation		10,41	10,21	10,25	9,48	9,38	9,31	9,17	8,66	10,12
Anion Sum			1,44	1,71	1,72	3,67	3,74	4,27	4,01	2,95	1,58
Cation Sum			1,52	1,83	1,76	3,74	3,47	4,07	3,80	2,76	1,49
Difference			0,08	0,12	0,04	0,07	-0,27	-0,20	-0,21	-0,19	-0,10
% Difference			2,58%	3,49%	1,11%	1,00%	-3,78%	-2,40%	-2,68%	-3,34%	-3,16%

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YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11	SpGeo 12	SpGeo 13	SpGeo 14	SpGeo 15	SpGeo 16
SAMPLE DESCRIPTION			GKL-1	GKL-2s	GKL-4d	MPS - S 14	MPS - S 20	MPS - S 21	MPS - S 30
SAMPLE NUMBER			E82857-010	E82857-011	E82857-012	E82857-013	E82857-014	E82857-015	E82857-016
SAMPLED	Test Method **		2025/04/09 12:01	2025/04/09 12:15	2025/04/09 12:11	2025/04/09 09:50	2025/04/09 10:27	2025/04/09 10:04	2025/04/09 09:55
Remarks			Rusty	Yellowish	Brown	Greyish	Yellowish	Yellowish	Black
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	200	235	604	208	708	0,00	462
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	200	235	554	208	708	0,00	462
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	49,8	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	200	235	579	208	708	0,00	462
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	24,9	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	37,1	48,3	216	176	286	367	336
pH (Laboratory)		YE030pH	7,09	7,24	8,52	7,36	8,06	2,96	7,42
Total Hardness	mg CaCO ₃ /L	YE061H	162	233	12,0	624	359	1194	807
Calcium Hardness	mg CaCO ₃ /L	YE061H	103	127	7,79	387	155	482	464
Magnesium Hardness	mg CaCO ₃ /L	YE061H	58,9	106	4,24	237	204	712	343
Total Dissolved Solids (TDS)	mg/L	Calculation	207	272	1229	1324	2045	2903	2571
Temperature	°C	Thermometer	25,0	25,0	25,0	25,0	25,0	25,0	25,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	0,80	<0.45	<0.45	1,21	<0.45
Calcium	mg Ca/L	YE060ICP	41,3	50,7	3,12	155	62,0	193	186
Chloride	mg Cl/L	YE070AK	6,39	6,77	334	36,5	49,7	17,6	45,6
Magnesium	mg Mg/L	YE060ICP	14,3	25,8	1,03	57,6	49,6	173	83,2
Nitrate and Nitrite (TON)	mg N/L	YE070AK	0,60	0,47	0,64	3,50	1,65	0,71	1,74
Potassium	mg K/L	YE060ICP	1,28	1,92	5,37	8,84	10,9	9,93	16,5
Sodium	mg Na/L	YE060ICP	17,4	14,5	504	162	587	304	522
Sulphate	mg SO ₄ /L	YE070AK	3,37	28,7	11,4	762	850	2087	1431
Aluminium	mg Al/L	YE060ICP	<0.01	<0.01	0,12	<0.01	<0.01	48,6	<0.01
Fluoride	mg F/L	YE070AK	<0.09	<0.09	3,52	0,35	2,47	<0.09	1,32
Iron	mg Fe/L	YE060ICP	0,47	0,31	0,17	0,04	<0.01	36,8	<0.01
Manganese	mg Mn/L	YE060ICP	0,02	0,25	0,01	1,18	0,79	28,8	0,31
Langelier Index (indicative, not SANS)		Calculation	-0.42	-0.12	0.28	0.36	1.17	-19.06	0.81
pHs (indicative, not SANS)		Calculation	7.51	7.36	8.24	7.00	6.89	22.02	6.61
Sodium Absorption Ratio (indicative)		Calculation	0.59	0.41	63.03	2.81	13.43	3.81	7.97
TDS to EC Ratio (indicative, not SANS)		Calculation	5.58	5.63	5.69	7.52	7.15	7.91	7.65
Corrosion Ratio (indicative, not SANS)		Calculation	0.10	0.14	1.57	2.40	0.82	113688641766.59	1.89
Ryznar Index (indicative, not SANS)		Calculation	7.92	7.48	7.95	6.64	5.73	41.07	5.80
Anion Sum			4.30	5.52	22.09	21.35	33.54	44.03	40.55
Cation Sum			4.07	5.39	22.38	19.87	33.07	46.05	39.38
Difference			-0.22	-0.13	0.28	-1.48	-0.46	2.02	-1.17
% Difference			-2.67%	-1.23%	0.64%	-3.59%	-0.69%	2.24%	-1.47%

Methods adapted to accommodate local laboratory conditions.

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1.

QUARTERLY WATER QUALITY REPORT 3-2024

01 AUGUST 2024 TO 31 OCTOBER 2024

**IWUL: Licence No. 08/C11B/AGJ/2141,
File No. 16/2/7/C112/C155, 2013**

Mooiplaats Colliery (Pty) Ltd

NOVEMBER 2024



DOCUMENT CONTROL

PROJECT	NAME	Mooiplaats Colliery (Pty) Ltd. IWUL Surface and Groundwater Monitoring
REPORT	TITLE	Quarterly Water Quality Report 3-2024 01 August 2024 - 31 October 2024 Mooiplaats Colliery (Pty) Ltd. November 2024
REPORT STATUS		FINAL
DATE		November 2024
REFERENCE NUMBER		MC-QWQR 3-2024
PROJECT TEAM		Louis Marais
REVIEWER		Adri Joubert
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ABBREVIATIONS

AMD	Acid Mine Drainage
Ag	Silver
Al	Aluminium
As	Arsenic
AWQR	Annual Water Quality Report
BDL	Below detection limit
BH	Borehole
BPG	Best Practice Guideline
Ca	Calcium
Cd	Cadmium
Cl	Chloride
CoC	Chain of Custody
COD	Chemical Oxygen Demand
Co	Cobalt
Cr6+	Hexavalent Chrome
CSIR	Council for Scientific and Industrial Research
Cu	Copper
DEA	Department of Environmental Affairs
DMRE	Department of Mineral Resources and Energy
DRO	Diesel Range Organics
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
F	Fluoride
Fe	Iron
GC-MS	Gas Chromatography Mass Spectrometer



GD-VO	Grootdraai Dam Guidelines - Vaal Origin Catchment
GPS	Global Positioning System
GRO	Gasoline Range Organics
GSW	Geo Soil & Water (Pty) Ltd GSW
GW	Groundwater
HCO ₃ ⁻	Bicarbonate
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
IWUL	Integrated Water Use License
K	Potassium
mamsl	metres above mean sea level
mbgl	metres below ground level
Mg	Magnesium
mg/l	milligram per litre
Mn	Manganese
mg/L	Milligrams per Liter
MPN	Mooiplaats Colliery North
MPS	Mooiplaats Colliery South
Na	Sodium
NEMA	National Environmental Management Act (Act No. 107 of 1998)
Ni	Nickel
NO ₃ ⁻	Nitrate
NWA	National Water Act (Act No. 36 of 1998)
ORP	Oxidation Reduction Potential
Pb	Lead
QWQR	Quarterly Water Quality Report
RQO	Resource Quality Objective
SANAS	South African National Accreditation System
SANS	South African National Standard
SAR	Sodium Absorption Ratio
Se	Selenium



SO₄

Sulphate

TDS

Total Dissolved Solids

WGS 84

World Geodetic System 1984

WUL

Water Use License

Zn

Zinc



DEFINITIONS

Acid Mine Drainage

Acid Mine Drainage (AMD) refers to the outflow of acidic water from metal or coal mines due to the oxidation of sulphide minerals.

Anions

Ions with a net negative charge. Examples: OH⁻, O²⁻, SO₄²⁻, Alk (HCO₃⁻), Cl⁻, etc. The Bicarbonate (HCO₃⁻) ion is the largest component of Alkalinity.

Artesian borehole

Boreholes that penetrate confined aquifers, in which the piezometric surface is above ground level, so that the boreholes spontaneously discharge water without being pumped.

Aquifer vulnerability

Tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer.

Borehole

Includes a well, excavation, or any other artificially constructed or improved underground cavity which can be used for the purpose of intercepting, collecting, or storing water in or removing water from an aquifer; observing and collecting data and information on water in an aquifer; or recharging an aquifer. Source: National Water Act (Act No. 36 of 1998).

Cations

Ions with a net positive charge. Examples: Ca⁺, Mg⁺, Na⁺, K⁺, Fe²⁺.

Compliance monitoring

Monitoring done in compliance with permit or license conditions.

Contamination

Substances that make it impure and unfit for consumption or an intended use and can cause harm to human health or the environment. Contaminants can be naturally occurring or caused by humans.

Data interpretation

The analysis of data to obtain information concerning the groundwater system which in turn can be used to manage/remediate the system.



Data management

The effective use of the data while ensuring its integrity and providing a centralized repository for storage.

Drawdown

The distance between the static water level and the surface of the cone of depression.

Environment

The external circumstances, conditions and objects that affect the existence and development of an individual, organism, or group. These circumstances include biophysical, social, economic, historical, cultural, and political aspects. 'Environment' is described as the surroundings within which humans exist and is made up of:

- the land, water, and atmosphere of the earth,
- micro-organisms, plant, and animal life,
- any part or combination of (i) and (ii) and the interrelationships among and between them; and
- the physical, chemical, aesthetic, and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Groundwater Flow

The movement of water through openings in sediment and rock; occurs in the zone of saturation in the direction of the hydraulic gradient.

Groundwater modelling

Numerical representation of a groundwater flow system that attempts to mimic the natural processes in nature. It is a simplified version of a natural system, compiled with geological, hydrogeological, hydrological, and meteorological data, which utilises a governing equation to incorporate all this data to simulate the hydraulic properties of the groundwater system.

Hydrocensus

Gathering of hydrogeological information through field measurements.

Hydrogeology

The study of the interrelationships of geologic materials and processes with water, especially groundwater.



Impact Assessment

A formal process used to predict the environmental consequences (positive or negative) of a plan, policy, program, or project prior the implementation decision, it proposes measures to adjust impacts to acceptable levels or to investigate new technological solution.

Infiltration

The downward movement of water from the atmosphere into the ground.

Leaching

The process by which soluble materials in the soil, such as salts, nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

Monitoring Programme

A programme for taking regular measurements of the quantity and/or quality of a water resource, waste, or wastewater discharge at specified intervals and at specific locations to determine the chemical, physical and biological nature of the water resource, waste, or wastewater discharge.

Piezometric surface

An imaginary or hypothetical surface of the piezometric pressure or hydraulic head throughout all or part of a confined or semi-confined aquifer; analogous to the water table of an unconfined aquifer.

Plume

An underground pattern of contaminant concentrations in groundwater created by the movement of groundwater beneath a contaminant source. Contaminants spread mostly laterally in the direction of groundwater movement. The source site has the highest concentration, and the concentration decreases away from the source.

Recharge

Water added to a groundwater aquifer. For example, when rainwater seeps into the ground. Recharge may occur naturally through precipitation or surface water or artificially through injection wells or by spreading water over groundwater reservoirs. See also infiltration.



Reserve

The quantity and quality of water required to supply basic needs of people to be supplied with water from that resource, and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of water resources. This is a unique water resource management requirement of South African legislation.

Resource Quality Objectives

Used to put a Classification and Reserve into practice by specifying conditions that will ensure that the Class is not compromised, and the Reserve can be met. Resource quality may relate to critical flows, groundwater levels and quality that must be maintained.

Sampling and monitoring controls: Control measures to demonstrate the accuracy (how close to the real result you are) and precision (how reproducible your results are) of your monitoring.

STIFF Diagram

A graphical representation or fingerprint of chemical analyses displaying the major ion composition of a water sample. A polygonal shape is created from three parallel horizontal axes extending on either side of a vertical zero axis. Cations are plotted in mill equivalents per liter on the left side of the zero axis, one to each horizontal axis, and anions are plotted on the right side. Stiff patterns are useful in making a rapid visual comparison between water from different sources.

Transmissivity

The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is expressed as the product of the average hydraulic conductivity and thickness of the saturated portion of an aquifer.

Water Quality

The physical, chemical, toxicological, biological (including microbiological) and aesthetic properties of water that determine sustained (1) healthy functioning of aquatic ecosystems and (2) fitness for use (e.g., domestic, recreational, agricultural, and industrial). Water quality is therefore reflected in (a) concentrations or loads of substances (either dissolved or suspended) or micro-organisms, (b) physico-chemical attributes (e.g., temperature) and (c) certain biological responses to those concentrations, loads or physico-chemical attributes.



Water Resource

A water resource includes any watercourse, surface water, estuary, or aquifer. Watercourses include rivers, springs, and natural perennial and non-perennial channels, wetlands, lakes, dams, or any collection identified as such by the Minister in the Government Gazette.

Water Use License

An authorisation from the Department of Water and Sanitation to a designated water user to use water. The authorisation will provide details on the timeframes and conditions for the designated water use.



EXECUTIVE SUMMARY

Mooiplaats Colliery (Pty) Ltd (Mooiplaats) appointed Geo Soil & Water (Pty) Ltd (GSW) to conduct water sampling, water quality analyses and water quality reporting at Mooiplaats in accordance with the requirements of the 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).

The reporting period is from 01 August 2024 to 31 October 2024.

Water qualities were compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.

The monitoring network provides information for risk-based decision making to Mooiplaats management with regard to effectiveness of pollution prevention measures and areas requiring management attention.

The following is a summary of the results:

Note: Removing coal from underground / mining ceased on 31 December 2021, with only the coal washing plant being operational currently.

Wastewater - Water quality from the mine water/pollution control dams exceeded limits in terms of EC, TDS, CaCO₃, Ca, Mg, Cl, SO₄, Fe, and Mn - typical of water associated with coal washing/mining activities. Wastewater is contained in storage facilities and circulated in a closed circuit. The pH of process / wastewater should be closely monitored and managed to prevent damage to water infrastructure.

Witpuntspruit – Although historic pollution from upstream of Mooiplaats is evident (at **WT-S01**), water quality recorded a general improvement in terms of several variable concentrations towards downstream. However, with the **Usuthu decant** inflow between **WT-S04** and **WT-S06** the water quality deteriorate again. From **WT-S01** to **WT-S06**, a slight net improvement was recorded. However, current and historical activities have a detrimental effect on this Spruit, which will have a long-term negative effect on the downstream environment of the Vaal River system.



Vaal River – A continuous deterioration was recorded after the confluence of the Witpuntspruit with the Vaal River (between **VL-S01** and **VL-S02**). The increase / variation in variable concentrations during the reporting period can be ascribed to the addition of variables from the Witpuntspruit drainage.

Although Fe exceeded the IWUL limits, concentrations remained low, relative consistent, and in line with historical trends, from upstream to downstream indicating the presence might possibly be geological / natural.

Groundwater - Outside the mining right area, water quality remains mostly stable and of good quality, with slight seasonal fluctuations. Neutral to high neutral pH values, Alkalinity (CaCO_3), and Ca concentrations indicate geological conditions. The movement of pH values, EC concentrations and variables associated with geology indicate the consistent recharge of natural groundwater without mining impacts. However, water quality at **GKL-2s** should be closely monitored.

Groundwater levels continued to fluctuate according to seasonal factors and not due to mining impacts.



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DISCLAIMER

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1. INTRODUCTION

1.1 Scope of Work

Mooiplaats Colliery (Pty) Ltd (Mooiplaats) appointed Geo Soil & Water (Pty) Ltd to conduct water sampling, water quality analyses and water quality reporting at Mooiplaats in accordance with the requirements of the 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).

Various activities of an anthropogenic nature take place in South Africa's riverine environments. As custodian of the natural water resources, it is an integral function of the Department of Water and Sanitation (DWS) to manage the effects of these activities on the country's water resources.

Water quality monitoring is a mandatory requirement, stipulated in the National Water Act (1998) and forms an integral part of the auditing requirements in terms of the Mineral and Petroleum Resources Development Act (2002) (MPRDA). The MPRDA, Section 39 (1) (2) (3) stipulates that each mine in possession of a mining right must conduct an Environmental Impact Assessment (EIA) and prepare an Environmental Management Program (EMP) of which a monitoring and report auditing process is an integral part of.

The NWA provides for the development of regulations to, amongst others:

- Require that the use of water from a water resource be monitored, measured, and recorded,



- Regulate or prohibit any activity in order to protect a water resource or in-stream or riparian habitat, and
- Prescribe the outcome or effect, which must be achieved through management practices for the treatment of waste, or any class of waste before it is discharged into or allowed to enter a water resource.

In order to reach the above-mentioned objectives monitoring systems need to be established, according to Section 137 (2) and implemented to assess, among others:

- Quality of water resources,
- Use and rehabilitation of water resources,
- Compliance to resource water quality objectives, and
- Health of aquatic ecosystems.

1.2 Purpose of Monitoring Report

As part of the commitments made in the Environmental Management Programme Report (EMPR) and conditions set out in the IWUL, surface - and groundwater monitoring will be implemented and quarterly reports, reflecting the results, submitted to the DWS.

GSW was commissioned by Mooiplaats to implement and conduct surface - and groundwater monitoring as prescribed in the IWUL, 2013. Surface and groundwater water monitoring points are sampled on a monthly and quarterly basis.

The results of the monitoring report are used to inform Mooiplaats management of the impact from mining activities on water resources, the effectiveness of mitigation measures and the potential need to improve water resource impact prevention measures.

With regular and accurate monitoring of resources a comprehensive management system interprets and assists in pollution prevention, pollution management, the determination, improvement, or deterioration of the receiving and surrounding resources.

1.3 Approach to Study

This report investigates and provides summarised information of the monitoring system and various monitoring points at Mooiplaats Colliery. The work done during the monitoring period of the contract included:



Routine monitoring:

- **August 2024 to October 2024** - **IWUL water monitoring:**
- Monthly Surface water monitoring,
- Quarterly Groundwater Monitoring, and
- Quarterly Groundwater Level Monitoring.

2. PROJECT BACKGROUND INFORMATION

Mooiplaats operates an underground mine on Portions 1 and 9 of the Farm Mooiplaats 290IT, approximately 20 km east of Ermelo in the Mpumalanga Province, South Africa. The relevant infrastructure consists of a wash plant, pollution control dams, co-disposal dump, offices, workshops, weighbridge, diesel bowsers, coal stockpiles, overburden stockpiles, etc. Wastewater is contained in storage facilities and circulated in a closed circuit.

Mooiplaats received a Mining Right MP 30/5/1/2/2/68 MP, 2007 (MR) and was granted an Integrated Water Use Licence No. 08/C11B/AGJ/2141, File No: 16/2/7/C112/C155 dated 02 May 2013 (IWUL), from the Department of Water and Sanitation in accordance with the National Water Act, 1998 (NWA).

2.1 Location

Mooiplaats is situated on Portions 1 and 9 of the Farm Mooiplaats 290IT, in the magisterial district of Ermelo, within the Msukaligwa Local Municipality, situated in the Gert Sibande District Municipality. Refer to **Figure 1**.

2.2 Catchment, Rainfall Supply and Use and Surrounding Activities

Mooiplaats is situated in the Upper Vaal Catchment Management Area (WMA), within the C11B quaternary catchment. Several streams, wetlands and springs are located in the area which drains south and east towards the Witpuntspruit and Vaal River, within the Grootdraai Dam / Upper Vaal Catchment.

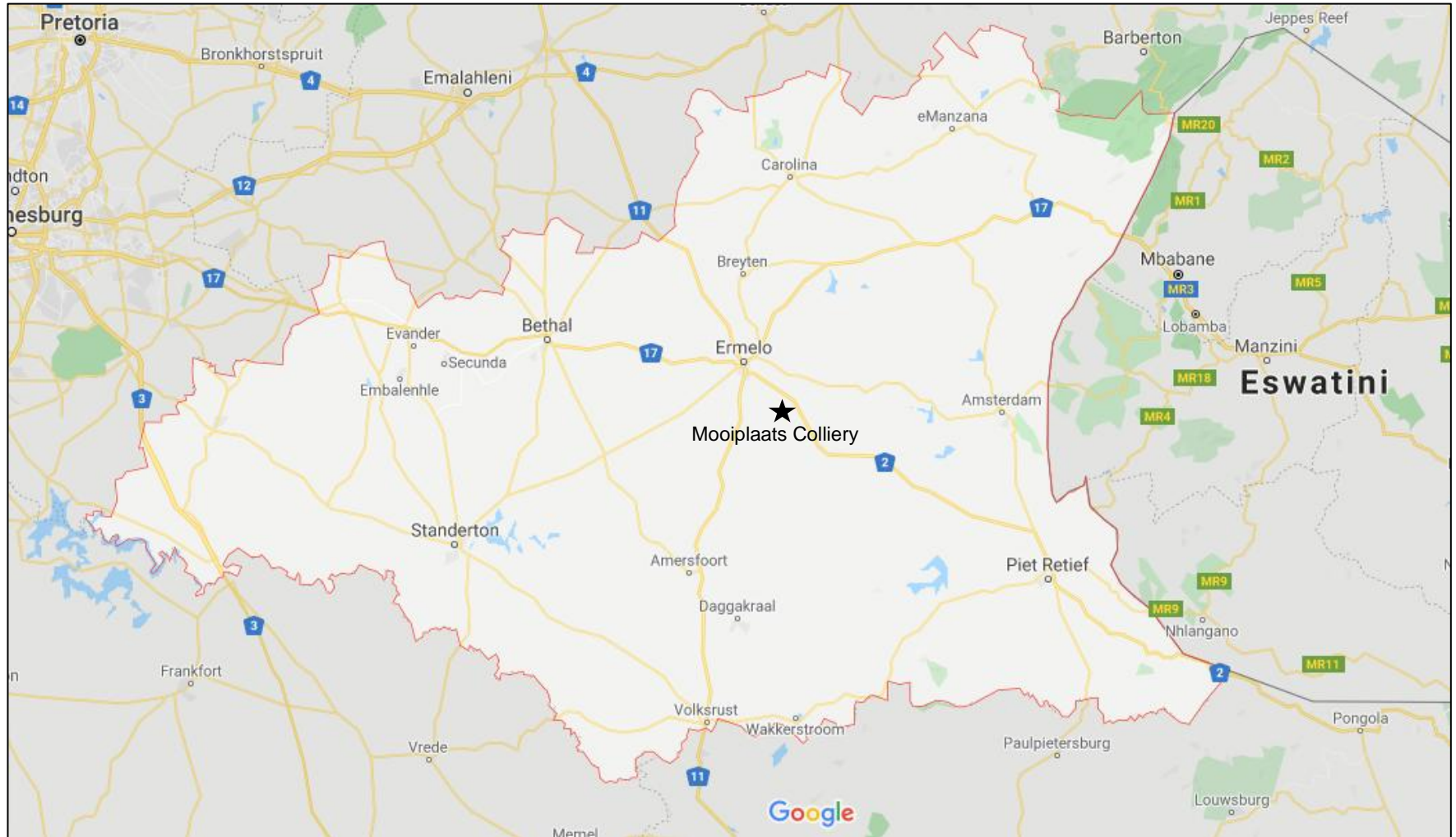


Figure 1: Locality map.



The Witpuntspruit is heavily modified due to the impact of previous and current mining activities. Well known decant water enters the Humanspruit, which enters the Witpuntspruit and eventually, the Vaal River which may have a detrimental effect on downstream users. The Witpuntspruit passes Mooiplaats and joins the Vaal River.

“The Upper Vaal water management area lies in the eastern interior of South Africa. From a water resources management perspective, it is a pivotal water management area in the country. Large quantities of water are transferred into the area from two neighbouring areas, as well as water sourced from the Upper Orange River via Lesotho. Similarly, large quantities of water are transferred out to three other water management areas, which are dependent on water from the Upper Vaal water management area to meet much of their requirements.

Extensive urbanisation and mining and industrial activity, which relate to the rich gold and coal deposits in the area, occur in the northern part of the water management area. Economic activity in the remainder of the Upper Vaal water management area mainly relates to livestock farming and rain fed cultivation.

Because of the high level of urbanisation and economic activity in the area and its pivotal role as a water transfer point to other water management areas, water resources in the area are highly developed and regulated, and only marginal potential for further development remains. The total yield transferred into the catchment is in excess of 120 per cent of the yield from local surface resources, while virtually the same quantity of water is again transferred out of the area. Groundwater is mainly used for rural domestic needs and for stock watering, while a substantial quantity of water is also abstracted from dolomitic aquifers for urban use.

The Upper Vaal water management area is highly developed and impacted upon by human activity. The quantities of water transferred into and out of the area are largely dictated by the population needs and economic activity in this as well as similar needs in other recipient water management areas.

Water quality in the Vaal River and in some tributaries downstream of Vaal Dam is seriously affected by urban and industrial and mining return flows and the intensive mining activity. The water resources are therefore carefully managed to maintain acceptable water quality standards. Particular attention is also to be given to the impacts that closure of mines may have on both surface and groundwater.” DWS, 2004.



2.3 Summary of Previous Studies

Several studies have been and are being conducted as part of impact determination in terms of the water resources. Studies include:

- Surface and Groundwater Monitoring,
- Groundwater Study, 2011.
- Mooiplaats Annual Water Quality Report 2019. GSW 2019,
- Mooiplaats Annual Water Quality Report 2020. GSW 2020,
- Mooiplaats Annual Water Quality Report 2021. GSW 2022.
- Mooiplaats Annual Water Quality Report 2022. GSW 2023.

Abstract from “Mooiplaats North Colliery geology and groundwater study.” Fourie, 2011.

Geology baseline

The B Upper seam is well developed throughout the succession and is the only seam which is considered to be economically viable. Because of the depth of this reserve only underground mining methods are proposed.

Within the mine layout the thickness of the seam range between 1.5 - 2.9 m, averaging at 2.1 m. The depth of the coal seam roof within the mine layout ranges between 40 - 165 meters below surface (mbs), averaging at 115 mbs.

Several dolerite dykes and sills have been identified in the area. A major dyke is present between MPN and the old Usutu underground workings. A sill breakthrough also occurs between MPN and MPS. This has resulted in the compartmentalisation of the MPN underground workings as the dolerite will form no-flow boundaries with relation to inter-mine flow. Drilling has been performed in order to target the dolerite between MPN and Usutu. The drilling results were incorporated into the groundwater study.

The geophysical survey confirmed the presence of a dyke between the Usutu and MPN underground mines, as well as the approximate depth of the dyke. The dyke was targeted with 6 boreholes. These boreholes will monitor the groundwater level and quality between the two mines, as well as any potential impact (on the aquifer) caused by pumping of the Usutu mine water by MPN. MBV-2A is the closest to the pumped borehole MS-B7 and shows a slight depletion in groundwater level.



Groundwater baseline

Geohydrological drilling and groundwater field work was completed in April 2011. Field work included measurements of the water levels, as well as slug testing of all monitoring boreholes. A hydro-census within at least 1 km buffer zone around MPN was performed in order to identify the presence and status of existing boreholes and fountains, as well as groundwater use in the area. A total of 10 external users' boreholes were surveyed that are located around MPN, near homesteads, or present in the farming field. Of the 10 boreholes only 2 external user boreholes (WT-B1 and MS-B4) are currently in use for domestic (for a guesthouse) and stock watering purposes, respectively. This indicates the low level of groundwater use in the area. A total of 3 fountains were included in the survey. Two of them (WT-F1 and F2) are used for domestic and stock watering purposes, respectively.

Hydro-chemical samples were taken from all monitoring boreholes and several external users' boreholes and fountains. Overall, the groundwater in the area is of good quality with only 1) the Usutu monitoring borehole that has non-compliant concentration of Na and F, as well as marginally elevated SO₄, and 2) a slightly elevated SO₄ in one plant monitoring borehole. The background groundwater could be classified as Na(Ca)-CO₃ dominated water. Groundwater with SO₄ contamination could be distinguished from the background groundwater as SO₄ becomes the dominant anion. Any future mining impact could therefore easily be identified.

The hydraulic conductivity for the shallow weathered aquifer, the deep fractured aquifer and alluvium/soils were determined from slug tests at Mooiplaats North and Mooiplaats South. The chosen hydraulic conductivity used for groundwater modelling is taken as 0.03 m/d, 0.007m/d and 4 m/d, respectively.

The Karoo Formation aquifer of the Mooiplaats area can in general be classified as a low yielding aquifer. It does have a viable exploitation potential for domestic and stock-watering application and as such is the main water resource for these applications to the farming communities in the area. The aquifers will however not support formal irrigation application over any extensive area (> 10 ha). The shallow weathered aquifer can therefore be classified as a minor aquifer system in terms of aquifer management.

Groundwater impact assessment

The impact on the geohydrology has been assessed by means of a numerical groundwater model for the MPN area.



The objective of the groundwater flow and transport model was to quantify the impact of mining on the following aspects:

- Influx of groundwater into mine workings,*
- Inter-mine flow between adjacent mines,*
- Impact on external users' boreholes,*
- Impact on fountains and stream base flow,*
- Impact of pumping/groundwater use,*
- Development of pollution plume in aquifer down-gradient of the plant area.*

No significant impact will be presented by the bord-and-pillar mine towards the adjacent mining as the MPN is significantly compartmentalised by sills.

The MPN will also have a negligible impact on external users' boreholes and base flow to streams and fountains. As a worst case the mine may have a small impact on MS-B4 (windpump of Mr Klopper). The depth of this borehole was however not available, and the impact is uncertain.

Pumping of Usutu East by MPN will have no adverse effect for Usutu both in terms of the mine water quality and quantity. With respect to both the pumping may actually have a beneficial effect as decanting of Usutu is prolonged and the mine water quality will probably improve.

The most significant impact of MPN relates to the potential plume development down-gradient of the co-disposal facility after closure. The plume will eventually reach the Witpuntspruit tributary. The following comments relate to the seepage water quality:

- The co-disposal will show an increase in the total dissolved solids with SO_4 as the dominant anion and will most likely acidify after closure; and*
- Significant elevation of Al, Fe and Mn will occur. Other metals such as Cd, Sb and Se may also be present in seepage but most probably not at non-compliant concentrations.*

From the model it was calculated that the contamination plume will not develop further than about 100 - 200 m horizontally from the mine boundary within one hundred years after closure. The following relates to the mine water quality:

- The underground mine water will show an increase in the total dissolved solids with SO_4 as the dominant anion but will most likely not acidify; and*



- *No significant elevation of metals will occur in the near-neutral mine water.*

An important management measure during the operational and post-closure phase is the establishment of a groundwater monitoring system in order to detect any impact on the groundwater environment.

Monitoring of the impact on the groundwater relates to the following:

- *Development of cones of depression around the mine.*
- *Influxes of groundwater into the underground mine workings.*
- *Possible impact on the water levels and yields of external users' boreholes and fountains for at least a 1 km buffer zone around any old or active mine working.*
- *Possible depletion of groundwater base flow towards streams.*
- *Mine water levels in the underground mine."*

2.4 Information and Knowledge Gaps

The following are areas of uncertainty:

- The design of some of the monitoring boreholes and drill information (e.g., casing depth, perforated casing depth, drill water strike depth, lithology, and slug test results),
- Complete geophysical information on preferred flow paths; and
- The effect of local farming and associated contaminants.
- All possible pollution sources caused by current and historical mining. The extent / presence of informal historical mining in the catchment.
- Pre-mining / Baseline water quality.
- The impact from current upstream mining activities and industries.

3. OBJECTIVES OF THE MONITORING PROGRAMME

3.1 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.

4. TERMS OF REFERENCE

Water qualities were compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.

4.1 Changes/Additions in/to Monitoring Network.

Fourteen (14) surface water monitoring points and nine (9) groundwater monitoring points are included in the IWUL.

Several additional surface and groundwater monitoring points are sampled on an ad hoc, monthly, and / or quarterly basis, depending on need/request.

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

At surface water, Total Hardness, Alkalinity, Potassium and Nitrate are analysed additionally and at the groundwaters, Total Dissolved Solids, Total Hardness, Alkalinity, Potassium, Ammonia, Aluminium, Iron and Manganese are analysed additionally.

4.2 Surface Water

Surface water monitoring points are sampled on a monthly basis for quality, as prescribed in the IWUL. Refer to **Annexure A** for in-field sampling sheets.



Fourteen (14) IWUL surface water monitoring points are included in the water monitoring programme.

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

Figure 3 displays 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.

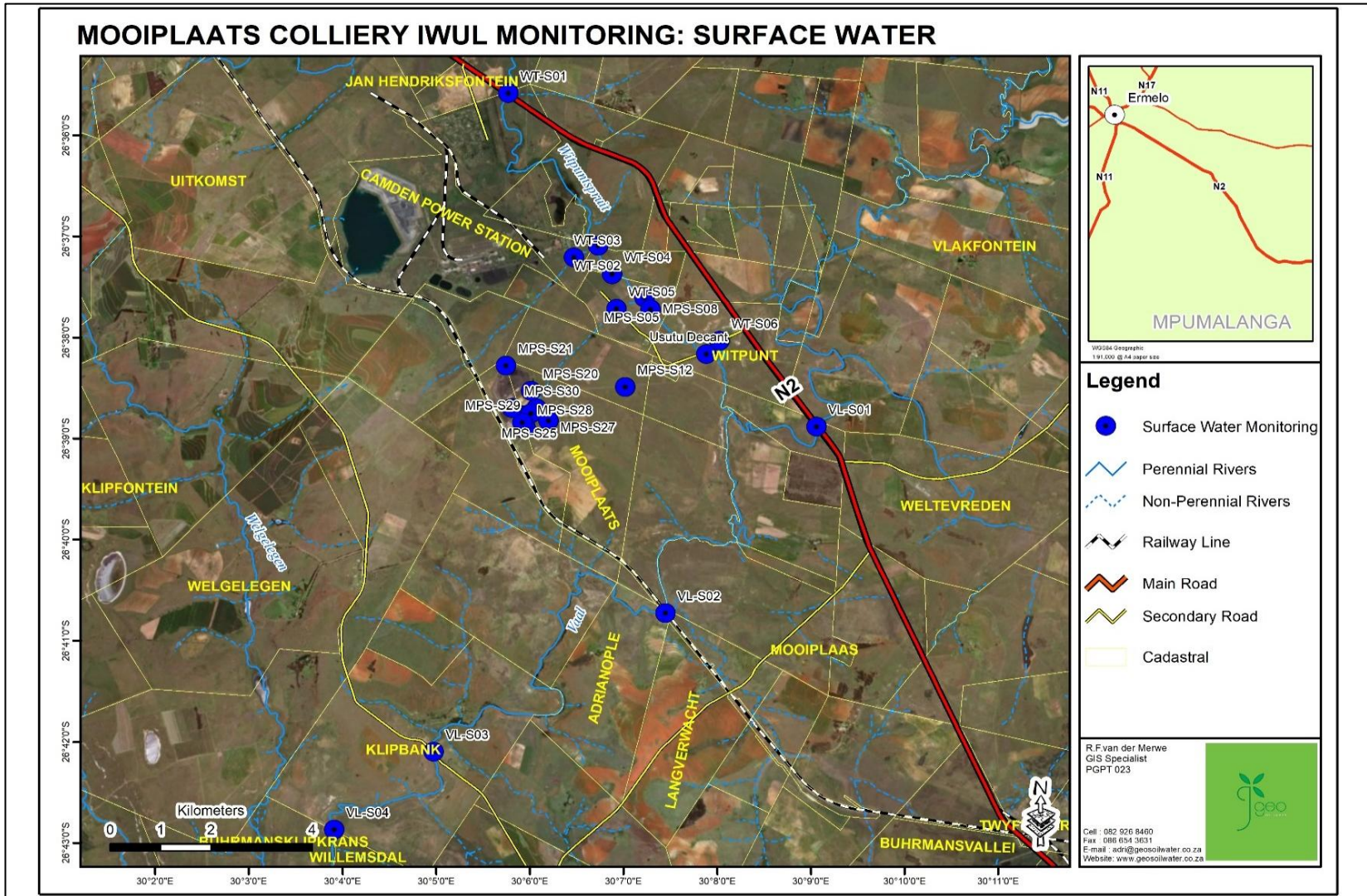


Figure 2 Location of surface water monitoring points.

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°	Ad Hoc
MPS-S12	Witpuntspruit Tributary @ Access Road	S26.64150° E30.11697°	Ad Hoc
MPS-S13	Runoff from Loading Area	S26.64837° E30.09888°	Ad Hoc
MPS-S14	Gen-sub PCD	S26.64616° E30.09890°	Monthly
MPS-S15	Stormwater trench @ Security	S26.64837° E30.09888°	Ad Hoc
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°	Ad Hoc
MPS-S27	Witpuntspruit Tributary entering MP	S26.64716° E30.10336°	Ad Hoc
MPS-S28	Confluence of MPS-S13 and MPS-S15	S26.64808° E30.09925°	Ad Hoc
MPS-S29	Storm water @ Offices	S26.64743° E30.09802	Ad Hoc
MPS-S30	Plant PCD	S26.64508° E30.09674°	Monthly
MPS-S31	Decant from Old Usutu Workings decanting into the Witpuntspruit Upstream of WT-06 – via surface .	S26.63611°E30.13139°	Ad Hoc
MPS-S32	Decant from Old Usutu Workings decanting into the Witpuntspruit Upstream of WT-06 – in cement sump	S26.63611°E30.13139°	Ad Hoc
	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



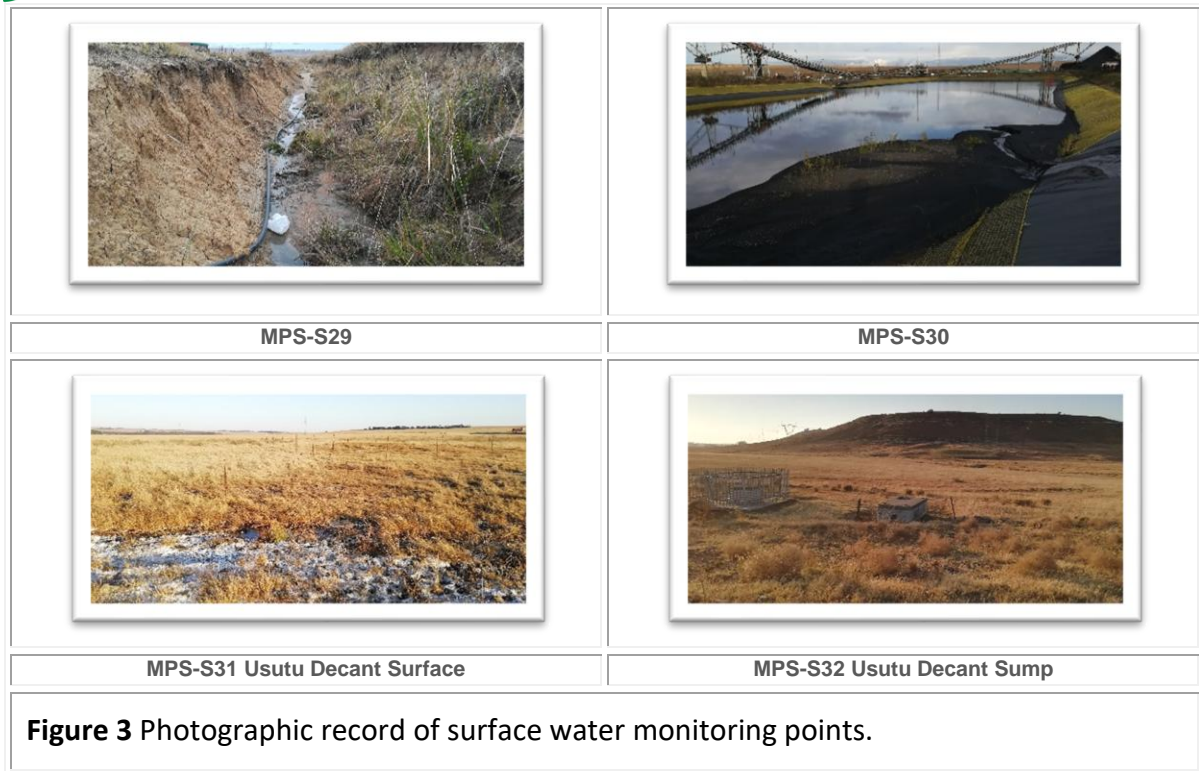
MPS-S25



MPS-S27



MPS-S28



4.3 Groundwater

Groundwater monitoring points are sampled on a quarterly (for levels and quality) basis, as prescribed in the IWUL. Refer to **Annexure A** for in-field sampling sheets.

Nine (9) IWUL groundwater monitoring points are included in the monitoring programme.

Figure 4 indicates the positions of the groundwater monitoring points relative to Mooiplaats and water resources.

Figure 5 displays 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.

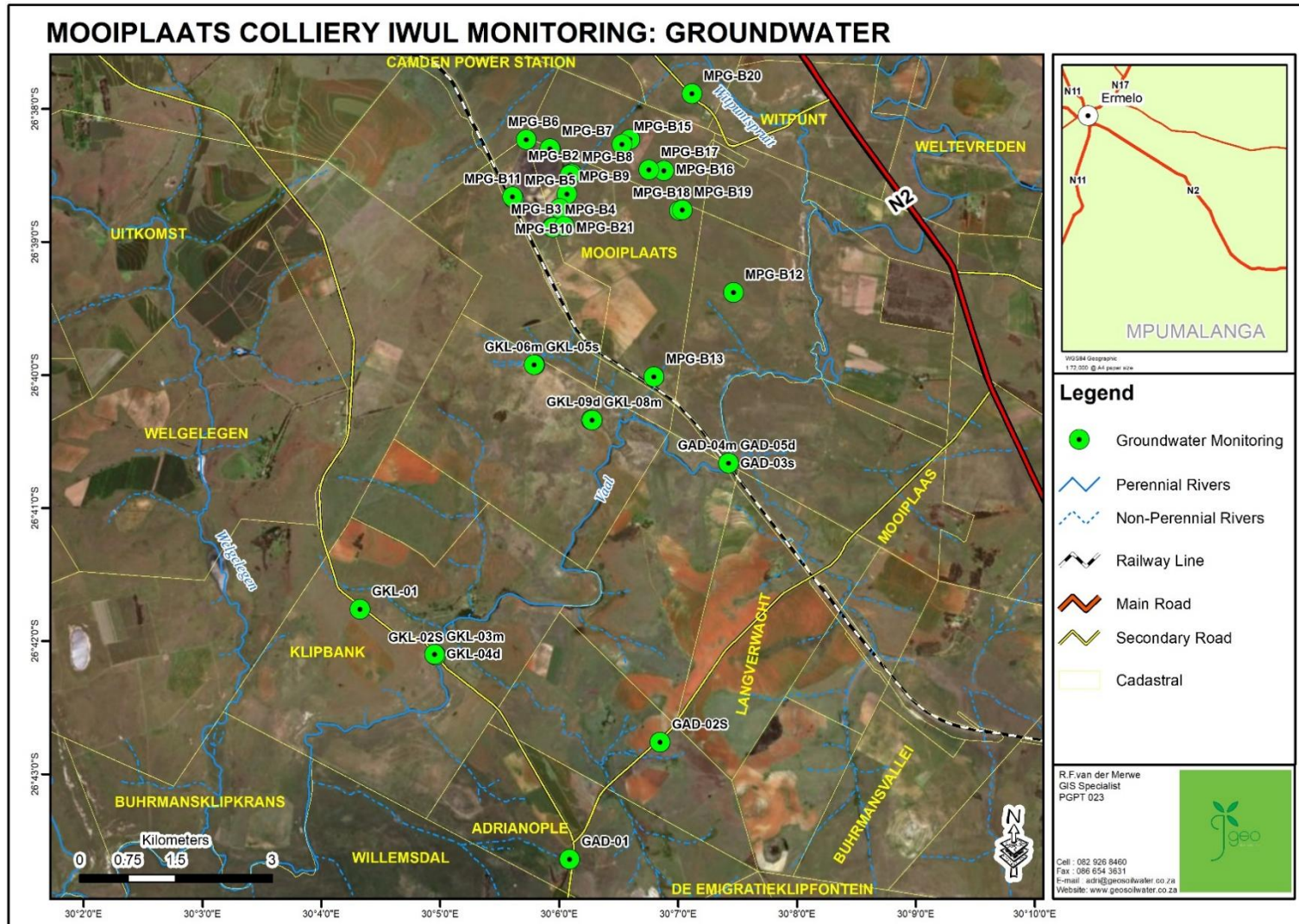


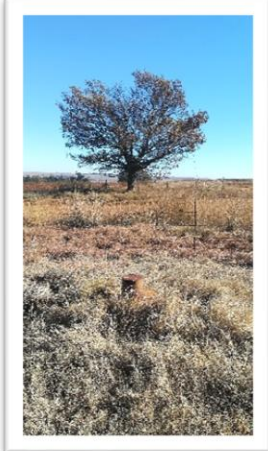







Figure 4 Location of groundwater monitoring points.










Table 2 Summary of groundwater monitoring points.

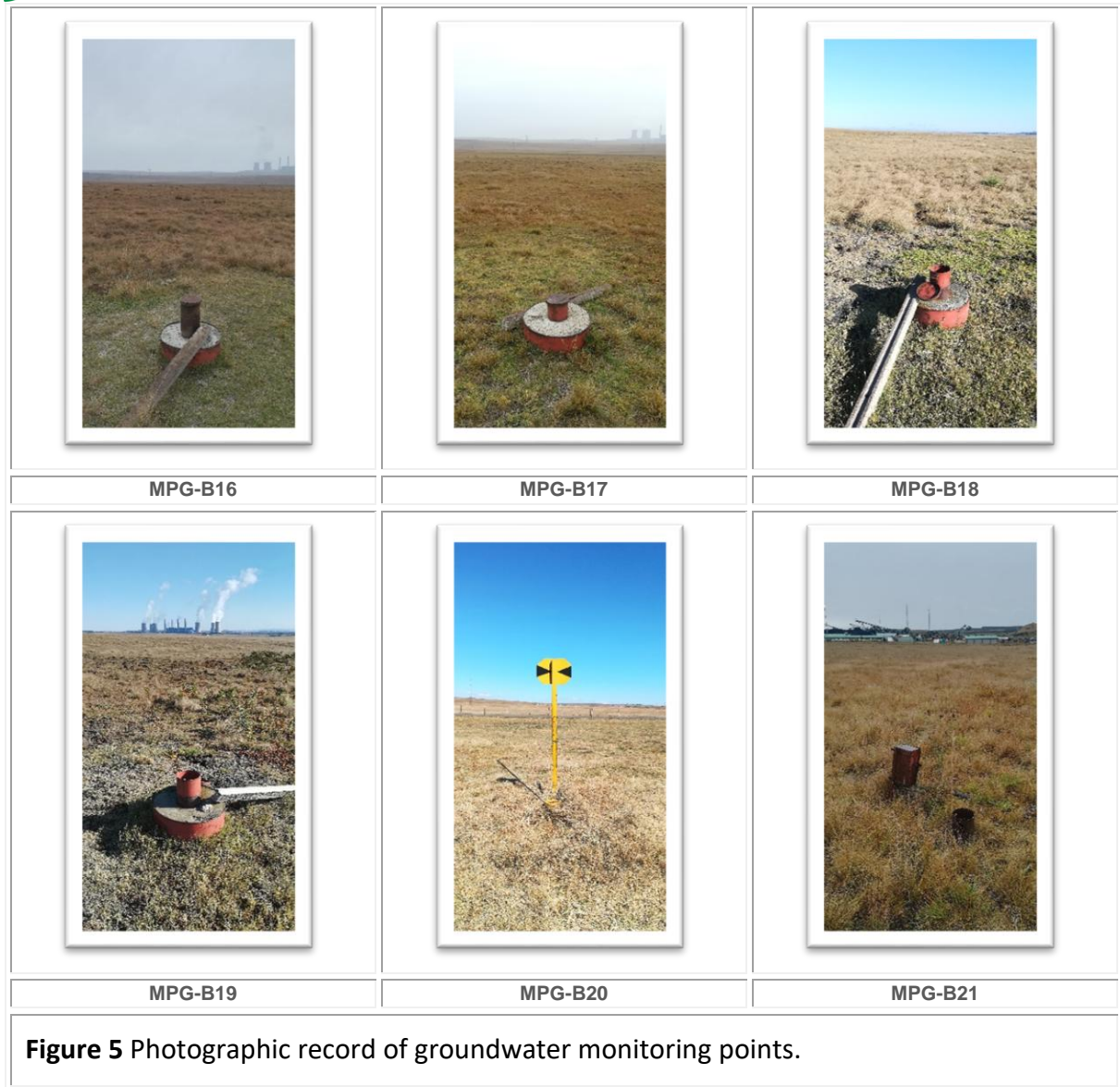
Mooiplaats Colliery Groundwater Monitoring Programme			
Groundwater Monitoring Points			
Locality	Locality Description	Coordinates WGS 84 ddd.ddddd	Monitoring Frequency
GKL-1	IWUL Borehole – Outer perimeter borehole	S26.69603° E30.07208°	Quarterly
GKL-4d	IWUL Borehole – Outer perimeter borehole	S26.70167° E30.08253°	Quarterly
GKL-3m	Borehole – Outer Perimeter borehole	S26.70178° E30.08269°	Ad Hoc
GKL-2s	IWUL Borehole – Outer perimeter borehole	S26.70178° E30.08269°	Quarterly
GAD-2s	IWUL Borehole – Outer perimeter borehole	S26.71269° E30.11414°	Quarterly
GAD-1	IWUL Borehole – Outer perimeter borehole	S26.72733° E30.10144°	Quarterly
GKL-9D	IWUL Borehole – Outer perimeter borehole	S26.67231° E30.10450°	Quarterly
GKL-8M	IWUL Borehole – Outer perimeter borehole	S26.67233° E30.10464°	Quarterly
GKL-5S	IWUL Borehole – Outer perimeter borehole	S26.66542° E30.09647°	Quarterly
GKL-6M	IWUL Borehole – Outer perimeter borehole	S26.66542° E30.09658°	Quarterly
GKL-7D	Outer perimeter borehole	S26.66542° E30.09658°	Ad Hoc
GAD-3s	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
GAD-4m	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
GAD-5d	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
MPG-B1	Down gradient (north) of the co-disposal facility.	S26.63843° E30.09878°	Ad Hoc
MPG-B2	Down gradient (east) of the lined Settling Dams and co-disposal.	S26.64143° E30.10175°	Ad Hoc
MPG-B3	Near the security gate.	S26.64816° E30.09905°	Ad Hoc
MPG-B4	Near the security gate.	S26.64819° E30.09910°	Ad Hoc
MPG-B5	Up-gradient (south-west) of the plant area next to the railway line.	S26.64457° E30.09363°	Ad Hoc
MPG-B6	Adjacent to the return water dam.	S26.63719° E30.09540°	Ad Hoc
MPG-B7	Down gradient (north) of the co-disposal facility.	S26.63832° E30.09870°	Ad Hoc
MPG-B8	Down gradient (east) of the lined Settling Dams.	S26.64160° E30.10155°	Ad Hoc
MPG-B9	Down gradient (east) of the plant area.	S26.64403° E30.10107°	Ad Hoc
MPG-B10	Down gradient (east) of the plant area.	S26.64581° E30.10007°	Ad Hoc
MPG-B11	Up-gradient (south-west) of the plant area next to the railway line.	S26.64435° E30.09344°	Ad Hoc
MPG-B12	At MPN Vunene extension	S26.65633° E30.12443°	Ad Hoc
MPG-B13	South of the mine next to the railway line.	S26.66689° E30.11329°	Ad Hoc
MPG-B14	Between Usutu/MPN	S26.63716° E30.10992°	Ad Hoc
MPG-B15	Between Usutu/MPN	S26.63778° E30.10881°	Ad Hoc
MPG-B16	Between Usutu/MPN	S26.64106° E30.11469°	Ad Hoc
MPG-B17	Between Usutu/MPN	S26.64095° E30.11259°	Ad Hoc
MPG-B18	Between Usutu/MPN	S26.64608° E30.11685°	Ad Hoc
MPG-B19	Between Usutu/MPN	S26.64600° E30.11725°	Ad Hoc
MPG-B20	Usutu UG. Borehole intersecting mine at 90 m	S26.63144° E30.11860°	Ad Hoc

Mooiplaats Colliery Groundwater Monitoring Programme			
Groundwater Monitoring Points			
Locality	Locality Description	Coordinates WGS 84 ddd.ddddd	Monitoring Frequency
	Additional Monitoring Points		
	IWUL Monitoring Points		

		
GKL-1	GKL-2s GKL-3m GKL-4d	GKL-5s GKL-6m GKL-7d
		
GKL-8m	GKL-9d	GAD-1

		
<p>GAD-2S</p>	<p>GAD-3S</p>	<p>GAD-4M</p>
		
<p>GAD-5D</p>	<p>MPG-B1</p>	<p>MPG-B2</p>
		
<p>MPG-B3</p>	<p>MPG-B4</p>	<p>MPG-B5</p>

		
<p>MPG-B6</p>	<p>MPG-B7</p>	<p>MPG-B8</p>
		
<p>MPG-B9</p>	<p>MPG-B10</p>	<p>MPG-B11</p>
		
<p>MPG-B13</p>	<p>MPG-B14</p>	<p>MPG-B15</p>



5. METHODOLOGY

The following is a description of the sampling protocol, analyses, and reporting of the Mooiplaats monitoring programme.

5.1 Sampling Protocol

GSW is responsible for the sampling of the monitoring points, the assessment evaluation and report writing. Yanka Laboratories (Pty) Ltd (Yanka) with SANAS Accreditation Number T0647 performs the physical and chemical analyses.



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 (BPGs) for water quality management in the South African mining industry. This series of BPGs forms a component of the overall source directed water policy for mining and related activities implemented by the DWAF. 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.

5.2 Surface water

For chemical analyses, a 1000 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 occurred at fourteen (14) IWUL water monitoring points and zero (0) additional points.

Monthly surface water samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity CaCO₃/L
- Ca mg/L



- Mg mg/L
- Na mg/L
- K mg/L
- F mg/L
- Cl mg/L
- SO₄ mg/L
- NO₃ mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH₃ mg/L

5.3 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 occurred at nine (9) groundwater monitoring points, nine (9) IWUL points on a quarterly basis and zero (0) additional points (during this reporting period).

Water levels were monitored on a quarterly basis.

Groundwater samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity CaCO₃/L
- Ca mg/L
- Mg mg/L
- Na mg/L



- K mg/L
- F mg/L
- Cl mg/L
- SO₄ mg/L
- NO₃ mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH₃ mg/L

5.4 Water levels

Groundwater levels at nine (9) monitoring points are recorded on a quarterly basis, using an electronic water level meter with a probe.

5.5 Water sample analyses

Both, surface - and groundwater samples are submitted to Yanka for physical and chemical analyses. Surface - and groundwater samples are analysed for variables as described in **Sections 5.2** and **5.3**.

5.6 Reporting

The quarterly, biannual, and / or annual surface - and groundwater assessments are compiled and evaluated by a registered Pr.Sci.Nat. Environmental Scientist and annual groundwater assessments are evaluated by a registered Pr.Sci.Nat. Geohydrologist.

Various types of reporting are included as required by the enquiry document:

- Quarterly Surface – and Groundwater Monitoring Reports; or
- Comprehensive Annual Water Quality Report.

Quarterly and Bi-annual Reports will include basic representation of data, evaluated against appropriate water quality guidelines with related discussions.

The *Annual Assessment Reports* will be more extensive and include a full evaluation of the results obtained during the year. The report will typically include, but is not limited to, the following functions:



- The Surface Water Report will include a statistical summary (temporal & spatial) of all the chemical variables for all the monitoring points, time-series graphs, linear trend determinations and compliance assessments, water quality thematic maps indicating pollution sources and impacts on the receiving water body as well as a discussion; and
- The Groundwater Report will be similar to the surface water section and will include a statistical summary (temporal & spatial) of all the chemical variables for all the monitoring boreholes, as well as time-series graphs and linear trend determinations.

Temporal trends are subject to a series of sampling frequencies.

6. RESULTS

Water monitoring according to IWUL, 2013 included in this report:

- **August to October 2024** - IWUL surface water monitoring,
- **October 2024** - IWUL groundwater monitoring,

Refer to **Annexure A** for:

- In-field Sampling Sheets: Tables portraying the name, descriptions, and status of the monitoring points.

Refer to **Annexure B** for:

- Test Reports: Laboratory results displaying variable concentrations for all monitoring points during the reporting period.

Water quality results will be described using the DWS Water Quality Guidelines: Domestic Use (Volume 01) 1996 in which summarised descriptions are given for pH (**Table 3**), salinity (**Table 4**) and hardness (**Table 5**).

Table 3 Summary of pH values.

pH Values used to indicate alkalinity or acidity of water	
pH: > 8.5	Alkaline/Basic
pH: 6.0- 8.5	Neutral
pH: < 6	Acidic

Table 4 Summary of TDS concentration.

TDS Concentrations to indicate the salinity of water	
TDS < 450 mg/l	Non-saline
TDS 450 - 1 000 mg/l	Saline
TDS 1 000 - 2 400 mg/l	Very saline
TDS 2 400 - 3 400 mg/l	Extremely saline

Table 5 Summary of Total Hardness concentrations.

Hardness concentrations to indicate softness or hardness of water	
Hardness < 50 mg/l	Soft
Hardness 50 – 100 mg/l	Moderately soft
Hardness 100 – 150 mg/l	Slightly hard
Hardness 150 – 200 mg/l	Moderately hard
Hardness 200 – 300 mg/l	Hard
Hardness 300 – 600 mg/l	Very hard
Hardness > 600mg/l	Extremely hard

Sections 6.1 to 6.6 are detailed discussions on water qualities associated with Mooiplaats – reporting period 01 August 2024 to 31 October 2024.

Section 6.1: Wastewater

Section 6.2: Witpuntspruit

Section 6.3: Vaal River

Section 6.4: Groundwater

Section 6.5: Groundwater Levels

Surface - and groundwater monitoring points will be compared to IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.



6.1 Wastewater

Table 6 indicates the average water quality for the wastewater monitoring points compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin.

Wastewater includes:

MPS-S14: Genset PCD

MPS-S20: Underground Erickson Dams.

MPS-S21: North Shaft Return Water Dam (NS RWD).

MPS-S30: Wash Plant PCD

Figure 6 illustrates variable concentration trends for wastewater monitoring points.

Figure 7 illustrates the average STIFF diagrams for wastewater monitoring points.



Table 6 Average water quality for wastewater monitoring points.

Average Wastewater Quality for Mooiplaats August 2024 - October 2024									
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	MPS-S14	MPS-S20	MPS-S21	MPS-S30
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	7,910	8,073	6,377	7,717
EC	mS/m	150	25	170	500	*304,333	*355,333	*720,000	*491,333
TDS	mg/L	1288	-	1200	3000	2165,240	2570,982	7228,751	3853,911
Total Hardness	mg/L	-	-	-	-	171,585	291,070	2599,083	906,841
Alkalinity	CaCO ₃ /L	-	75	-	-	1106,333	1041,133	56,333	463,667
Ca	mg/L	87	-	-	1000	37,767	48,567	522,523	200,233
Mg	mg/L	51.40	-	-	500	18,767	41,233	314,313	98,800
Na	mg/L	725	-	200	200	791,297	835,590	1224,730	880,887
K	mg/L	-	-	-	-	10,807	11,767	27,867	20,167
F	mg/L	3.23	0.4	1.5	2	3,313	3,183	0,333	1,620
Cl	mg/L	116.66	20	300	3000	68,200	69,167	70,200	76,633
SO ₄	mg/L	740	30	500	1000	566,993	*919,370	*4994,937	*2289,340
NO ₃	mg/L	-	0.5	11	-	0,437	0,603	0,067	0,330
NH ₃	mg/L	0.24	-	1.5	-	1,633	0,223	2,580	0,400
Al	mg/L	0.09	-	0.3	5	-0,010	0,067	6,493	0,033
Fe	mg/L	0.001	-	0.3	10	0,040	0,027	0,197	0,007
Mn	mg/L	0.15	-	0.1	10	0,013	0,060	26,700	0,123

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

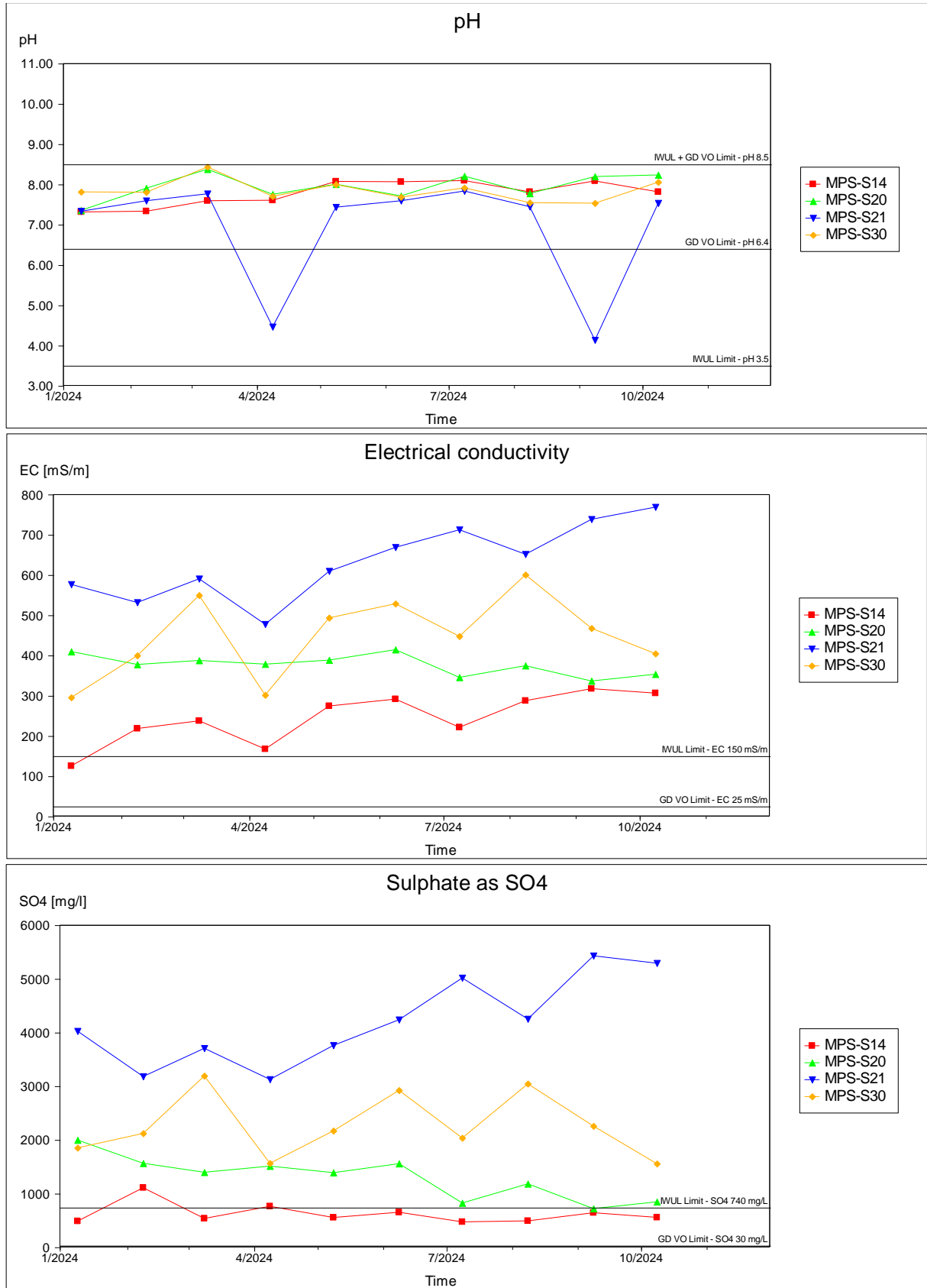
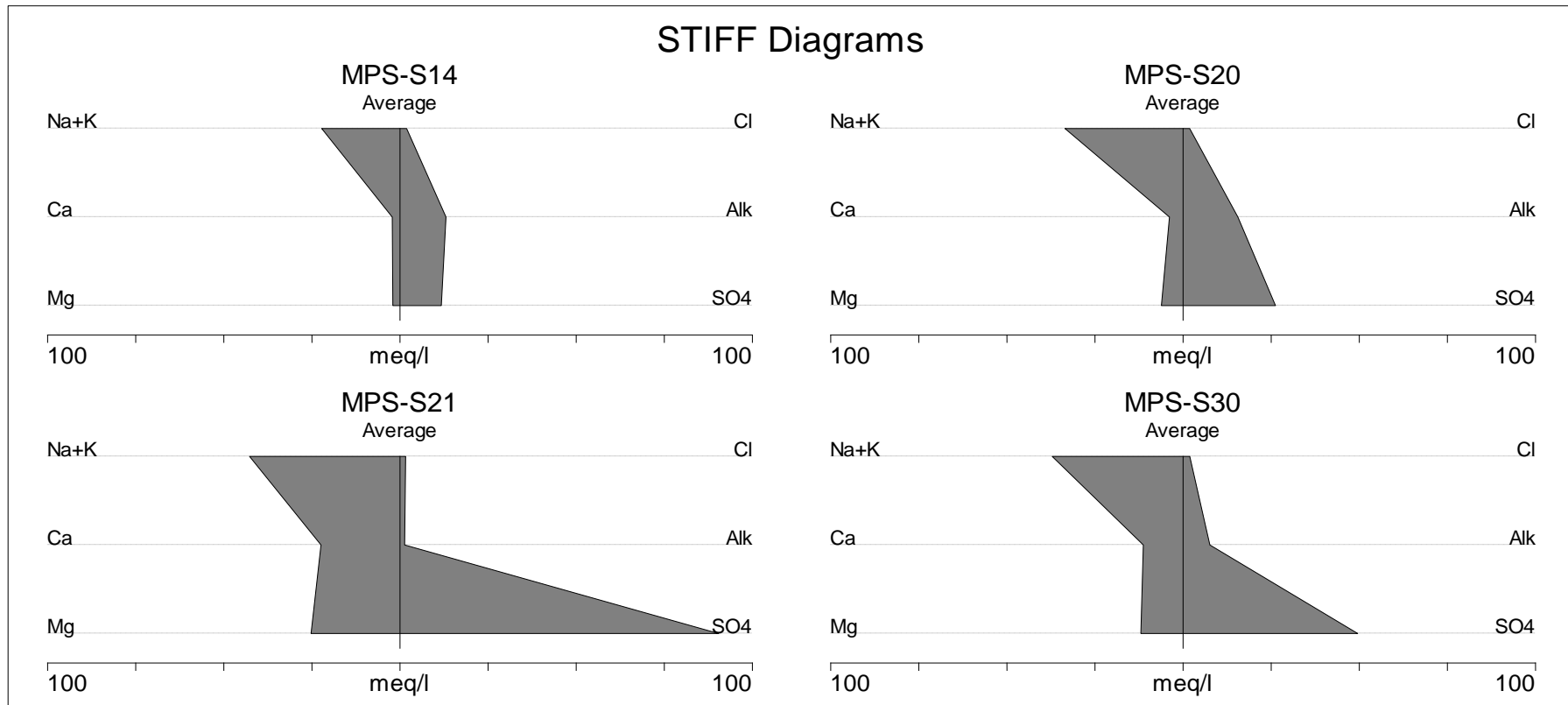


Figure 6 Wastewater variable concentration trends.



- STIFF Diagram
- A dominant Sulphate (SO₄) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO₃⁻) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO₄)

Figure 7 Average wastewater STIFF diagrams.



From **Table 6**, **Figures 6** and **7** it is evident that wastewater qualities exceeded several IWUL limits and In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin.

Genset PCD (**MPS-S14**), NS RWD (**MPS-S21**), Wash Plant PCD (**MPS-S30**) and Underground Erickson Dams / Settling Dam 3 (**MPS-S20**) are wastewater containment facilities, which reports to the co-disposal facility and again to the NS RWD (**MPS-S21**), from where it is distributed.

It is evident that the water compositions and concentrations (**Figure 7**) of wastewater remained high and stable in terms of the dominating cations and anions. However, the difference in water quality and composition can be ascribed to the different inflows into the waste facility before the water gets transferred to the next facility. Although water quality concentrations exceeded the IWUL limits, it must be noted that the containment facilities are HDPE lined or concreted. The increase in concentrations at **MPS-S21** can be ascribed to less / no rainfall entering the system during the reporting period.

SO₄ is the dominant anion in terms of composition (**Figure 7**), well in line with water exposed to coal handling activities. Low pH values will have negative effects on water infrastructure; therefore, process water should be managed to prevent low pH values.

6.2 Witpuntspruit Surface Water

Table 7 indicates the average surface water quality for the Witpuntspruit and associated tributaries. Water quality from these monitoring points is compared to the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin and IWUL Wastewater Limits. The DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards was included for comparative purposes.

Witpuntspruit and associated tributaries includes:

Witpuntspruit monitoring points include **WT-SW01** (Upstream), **WT-S02**, **WT-S04** (Midstream) and **WT-S06** (Downstream) where the adjoining tributaries include **WT-S03** and **WT-S05**.

Figure 8 illustrates variable concentration trends for the Witpuntspruit and associated tributaries. **Figure 9** illustrates the stream profile for the Witpuntspruit.

Figure 10 illustrates the average STIFF diagrams for the Witpuntspruit and associated tributaries.



Table 7 Average water quality for the Witpuntspruit and associated tributaries.

Average Witpuntspruit Water Quality for Mooiplaats August 2024 - October 2024											
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241: 2011	DWS Livestock Watering	WT-S01	WT-S03	WT-S02	WT-S04	WT-S05	WT-S06
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	4,053	6,655	6,583	No Access	No access / Dry	8,370
EC	mS/m	150	25	170	500	*249,333	57,450	100,167			*259,667
TDS	mg/L	1288	-	1200	3000	2405,437	371,130	665,473			1620,943
Total Hardness	mg/L	-	-	-	-	1549,372	194,655	321,730			94,581
Alkalinity	CaCO ₃ /L	-	75	-	-	0,000	120,000	162,000			1056,200
Ca	mg/L	87	-	-	1000	319,243	48,600	68,267			23,200
Mg	mg/L	51.40	-	-	500	182,667	17,800	36,733			8,900
Na	mg/L	725	-	200	200	66,833	48,350	99,800			594,767
K	mg/L	-	-	-	-	19,333	3,530	7,707			6,907
F	mg/L	3.23	0.4	1.5	2	-0,090	0,020	0,217			2,783
Cl	mg/L	116.66	20	300	3000	31,533	12,950	28,767			73,133
SO ₄	mg/L	740	30	500	1000	*1737,517	167,500	326,667			268,107
NO ₃	mg/L	-	0.5	11	-	-0,010	-0,010	-0,010			-0,003
NH ₃	mg/L	0.240	-	1.5	-	-0,450	-0,450	-0,450			-0,450
Al	mg/L	0.090	-	0.3	5	24,967	0,080	0,090			0,893
Fe	mg/L	0.001	-	0.3	10	0,243	0,165	-0,010			0,403
Mn	mg/L	0.15	-	0.1	10	23,100	0,090	0,023	0,050		

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

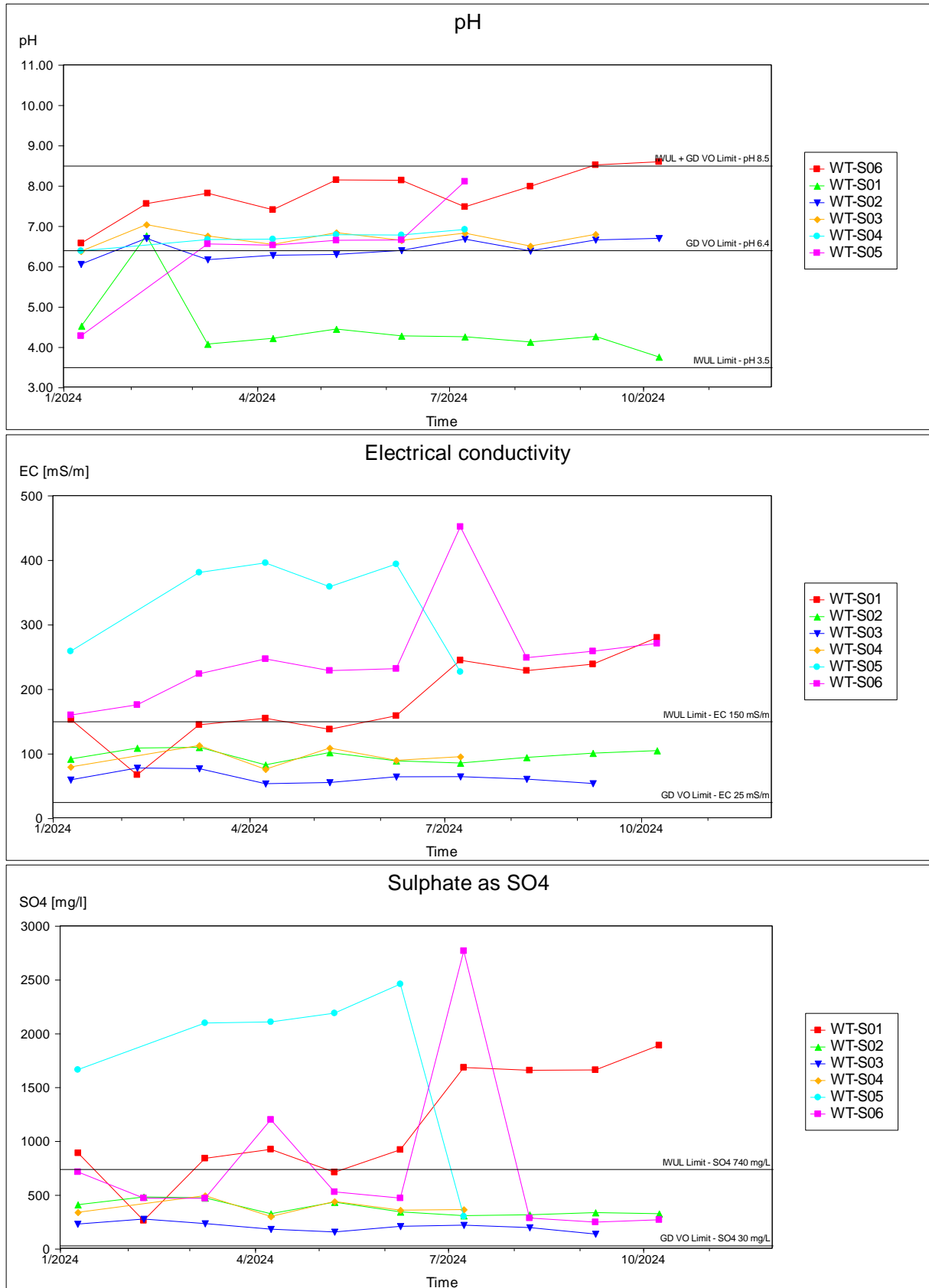


Figure 8 Variable concentration trends for the Witpuntspruit and associated tributaries.

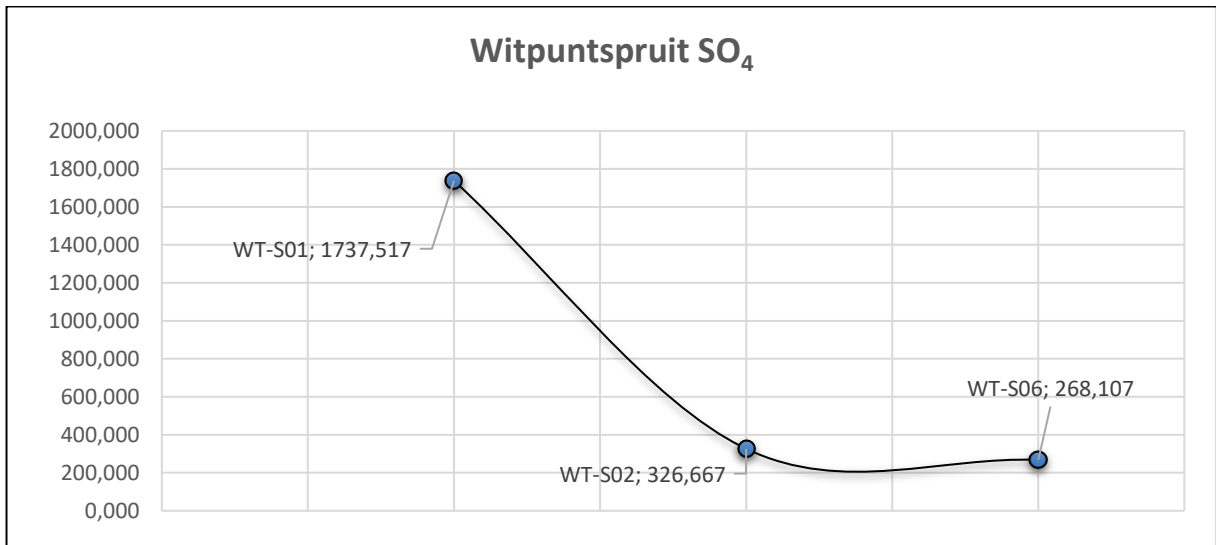
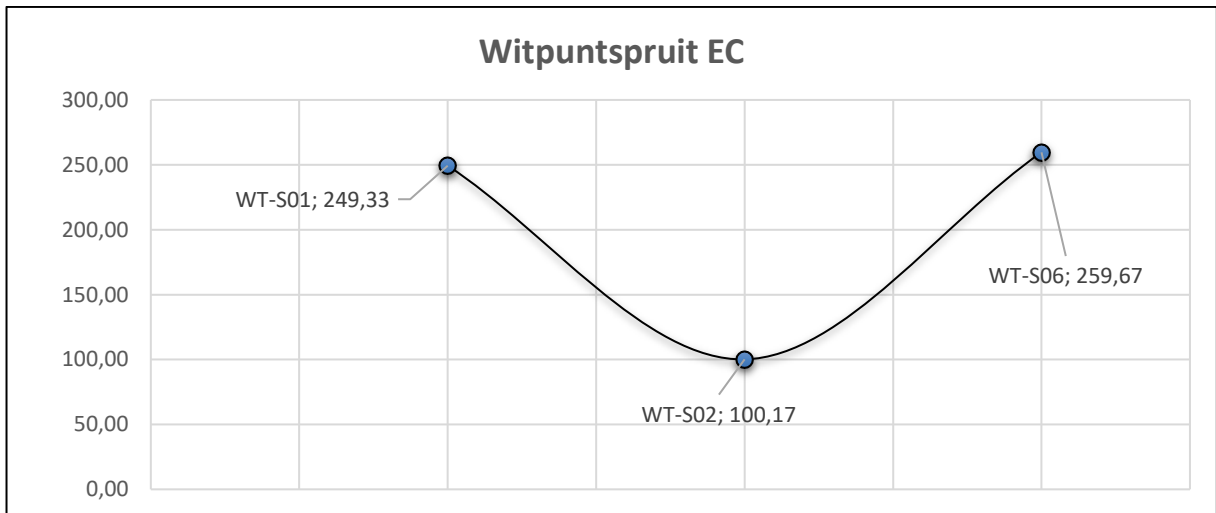
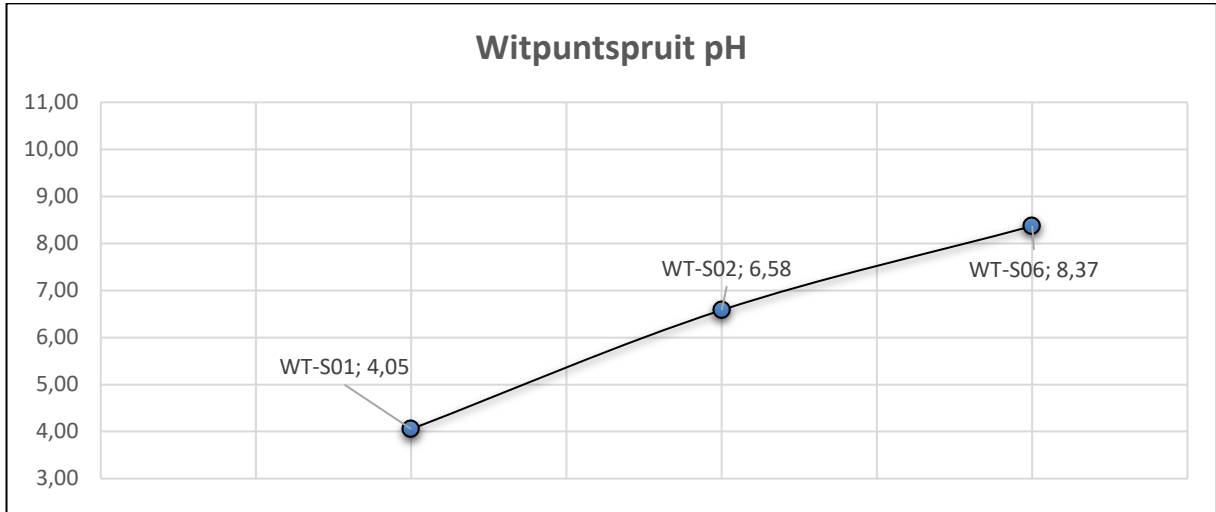
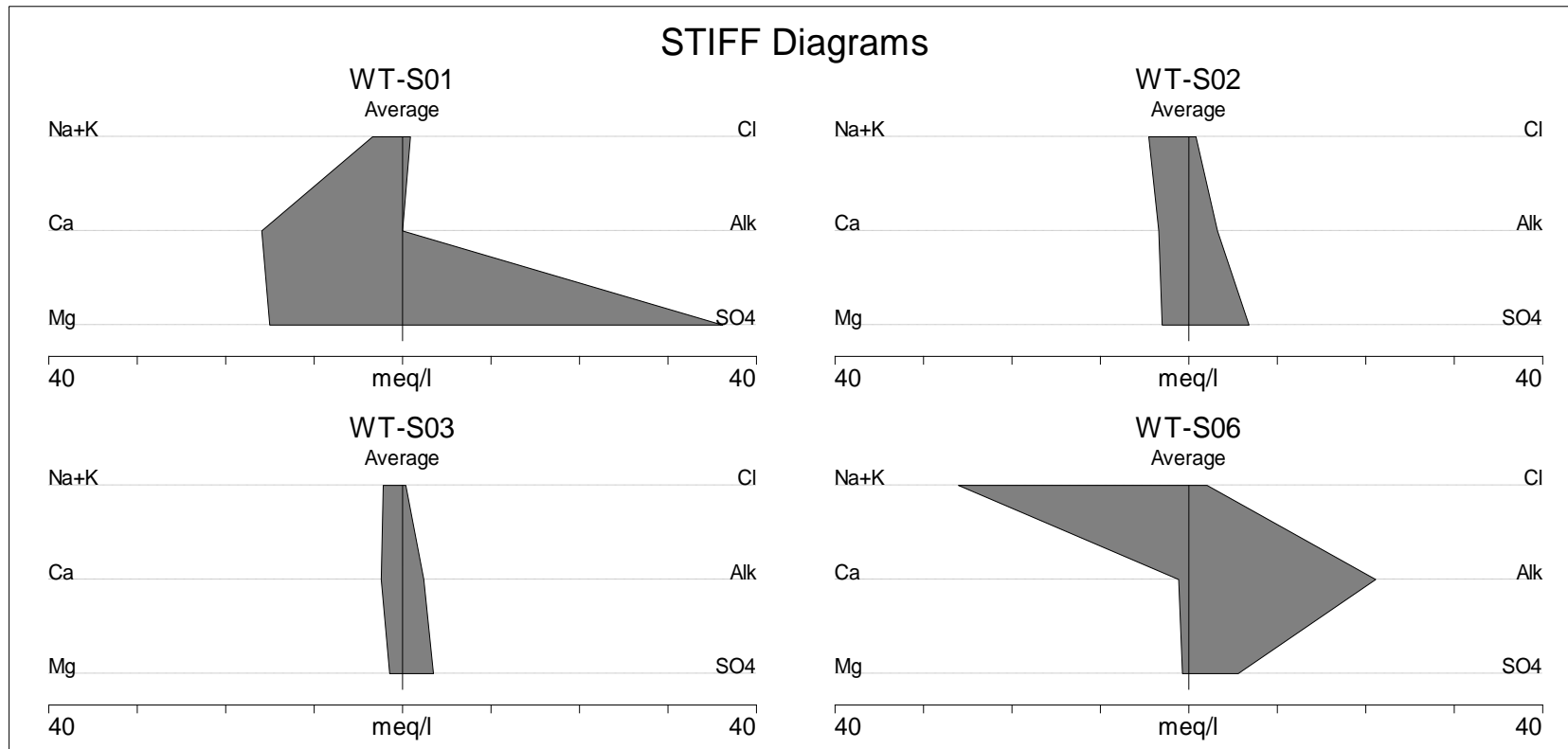


Figure 9 Stream profile for the Witpuntspruit - upstream left, downstream right.



- STIFF Diagram
- A dominant Sulphate (SO₄) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO₃⁻) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO₄)

Figure 10 STIFF Diagrams for the Witpuntspruit surface water monitoring points.



From **Table 7, Figure 8, 9 and 10** it is evident that the Witpuntspruit are impacted on, from upstream (**WT-S01**) to downstream (**WT-S06**), before the confluence with the Vaal River, exceeding the Grootdraai Dam Guidelines for the Vaal origin sub-catchment.

Note: Although no access was possible to **WT-S04** and **WT-S05** during the reporting period, **WT-S05** was probably dry as no flow or water was observed upstream in the tributary.

From **Figures 8 and 9**, although the pH and several other variable concentrations recovers / improve from **WT-S01** to **WT-S06**, the impact from the **historic Usuthu** decant is evident at **WT-S06** as the EC, CaCO₃, Na, and Cl concentrations remained high. With **WT-S05** having no direct impact on the Witpuntspruit during the reporting period (due to dry conditions) it is evident that the water quality at **WT-S06** improved in terms of the SO₄ anion.

Furthermore, although very low to no fresh rainwater entered the system during the reporting period which could have diluted the water quality downstream in the Witpuntspruit, the dry conditions at **WT-S05**, had a net positive effect downstream. Generally, **WT-S06** recorded improvement in comparison with the upstream **WT-S01**.

The **WT -S03** tributary receives water from neighbouring industrial activities, as well as from a small portion of Mooiplaats. However, the **WT-S05** tributary receives water from Mooiplaats and farming activities in the sub-catchment.

The addition of the Alkalinity (from the Usuthu decant) to the Witpuntspruit and eventually the Vaal River is not necessary only a negative impact, but variables such as Na, Ca, Cl, and SO₄ in excessive concentrations over an extended period will have a detrimental effect on the receiving environment and Vaal River system.

6.3 Vaal River Surface Water

Table 8 indicates the average surface water quality for the Vaal River and associated tributaries compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards was included for comparative purposes.

Figure 11 illustrates variable concentration trends for the Vaal River.

Figure 12 illustrates the stream profile for the Vaal River.

Figure 13 illustrates the average STIFF diagrams for the Vaal River.



Table 8 Average water quality for the Vaal River.

Average Vaal River Water Quality for Mooiplaats August 2024 - October 2024								
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	VL-S01	VL-S02	VL-S03
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	6,787	7,427	8,013
EC	mS/m	150	25	170	500	28,733	47,600	48,567
TDS	mg/L	1288	-	1200	3000	157,393	271,073	280,050
Total Hardness	mg/L	-	-	-	-	121,107	123,351	134,045
Alkalinity	CaCO ₃ /L	-	75	-	-	102,300	160,000	148,333
Ca	mg/L	87	-	-	1000	21,240	22,133	24,767
Mg	mg/L	51.40	-	-	500	16,530	16,533	17,533
Na	mg/L	725	-	200	200	11,500	54,600	52,433
K	mg/L	-	-	-	-	2,413	3,617	4,073
F	mg/L	3.23	0.4	1.5	2	-0,030	0,293	0,257
Cl	mg/L	116.66	20	300	3000	16,800	22,067	22,933
SO ₄	mg/L	740	30	500	1000	26,867	55,567	66,167
NO ₃	mg/L	-	0.5	11	-	-0,010	-0,010	-0,010
NH ₃	mg/L	0.24	-	1.5	-	-0,450	-0,450	-0,450
Al	mg/L	0.09	-	0.3	5	-0,003	0,143	0,013
Fe	mg/L	0.001	-	0.3	10	0,063	0,103	0,063
Mn	mg/L	0.15	-	0.1	10	0,020	0,013	-0,003

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

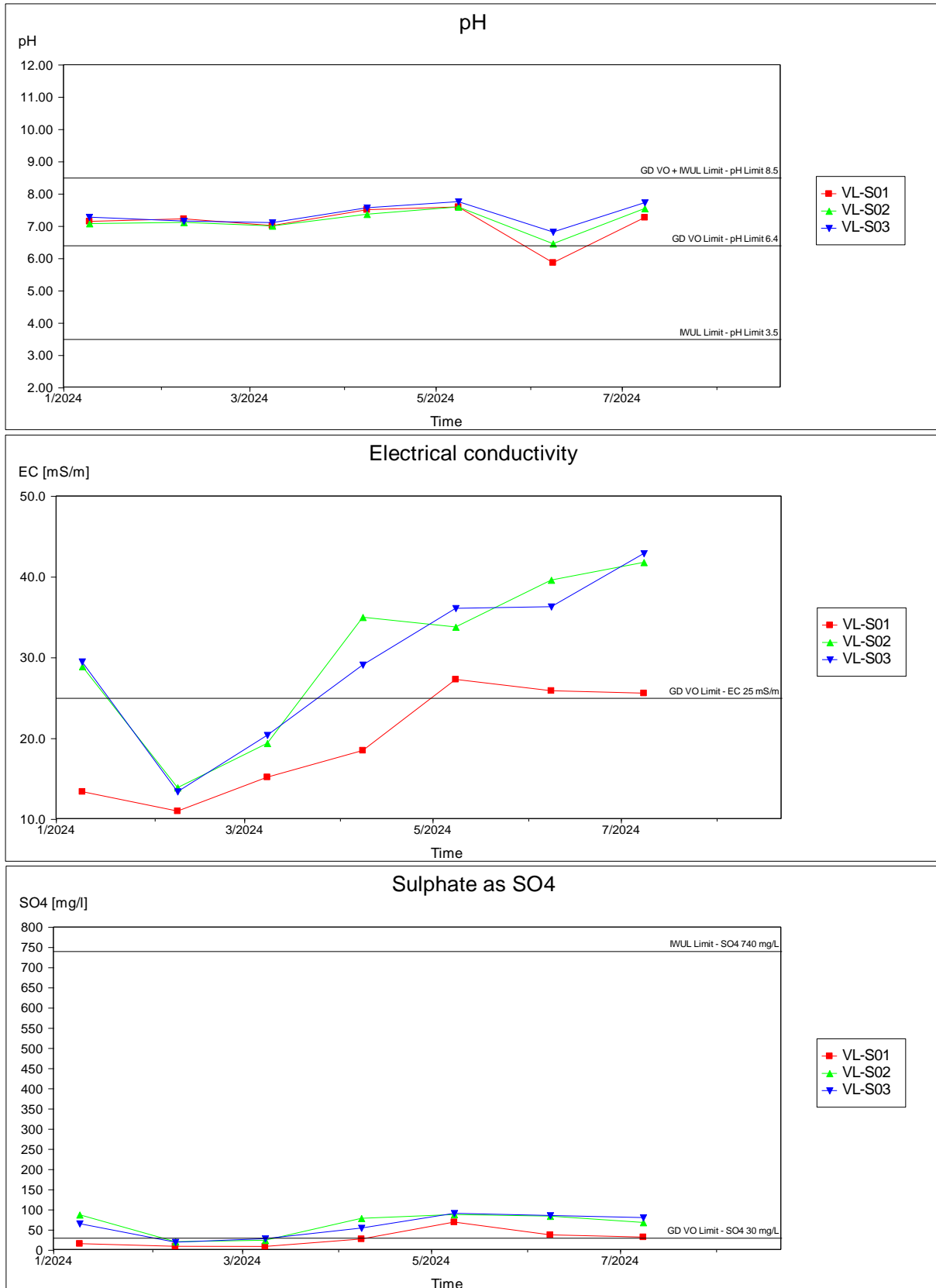


Figure 11 Variable concentration trends for the Vaal River.

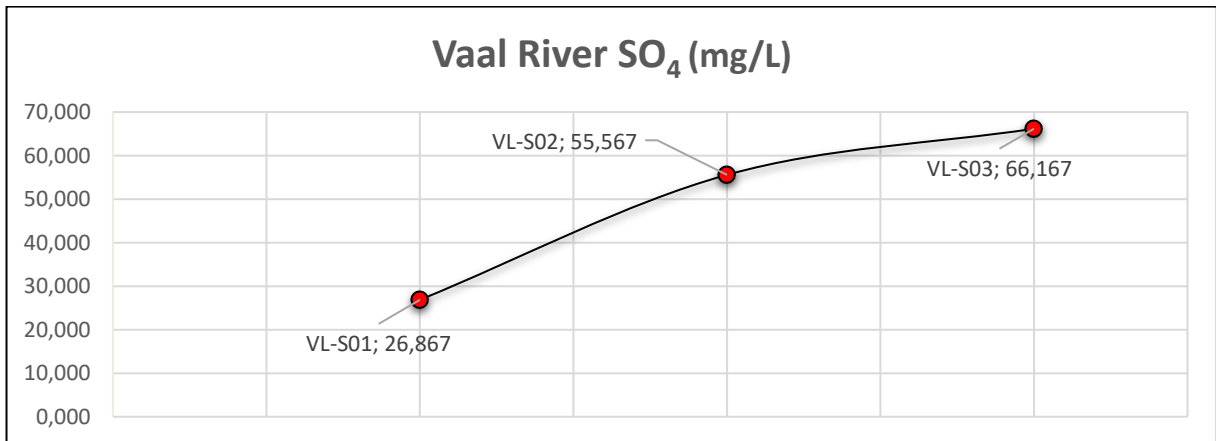
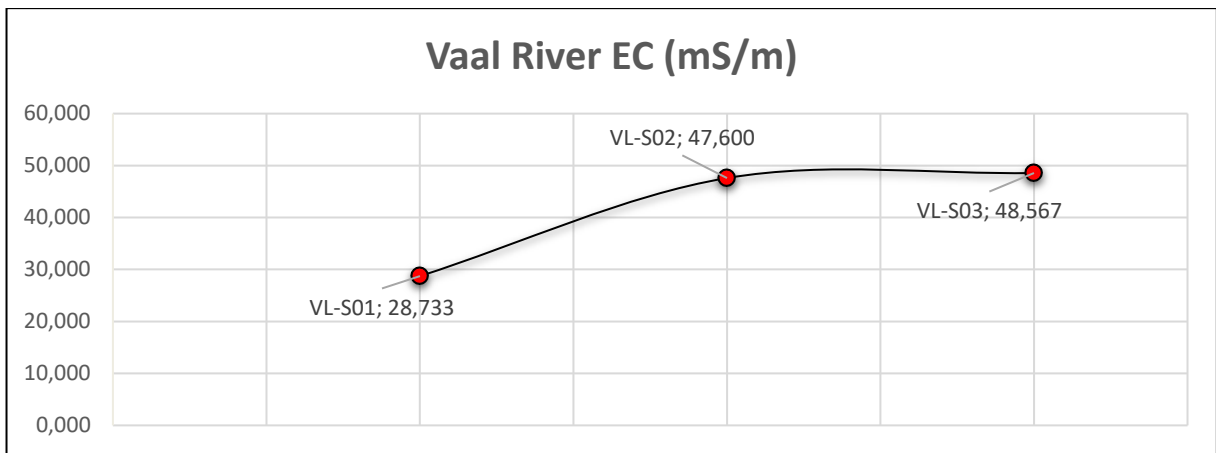
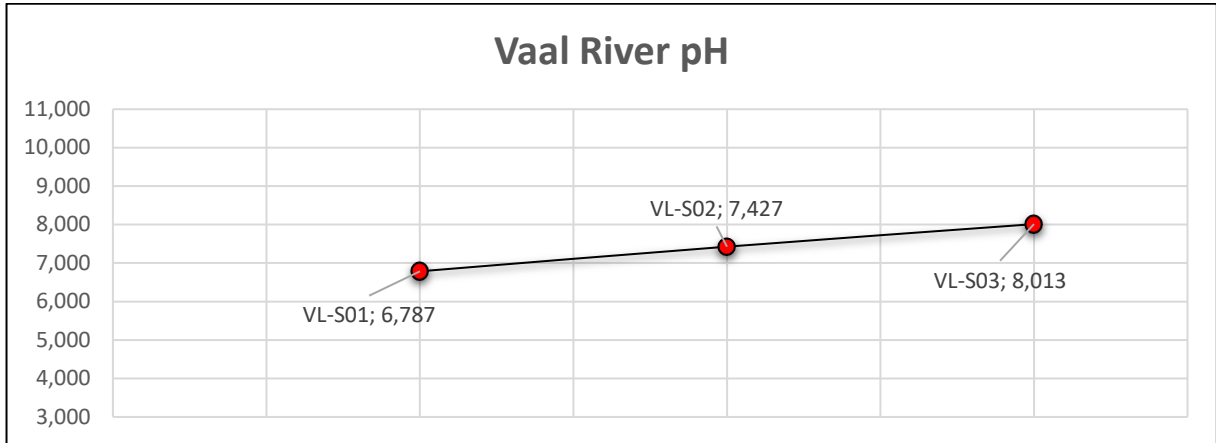
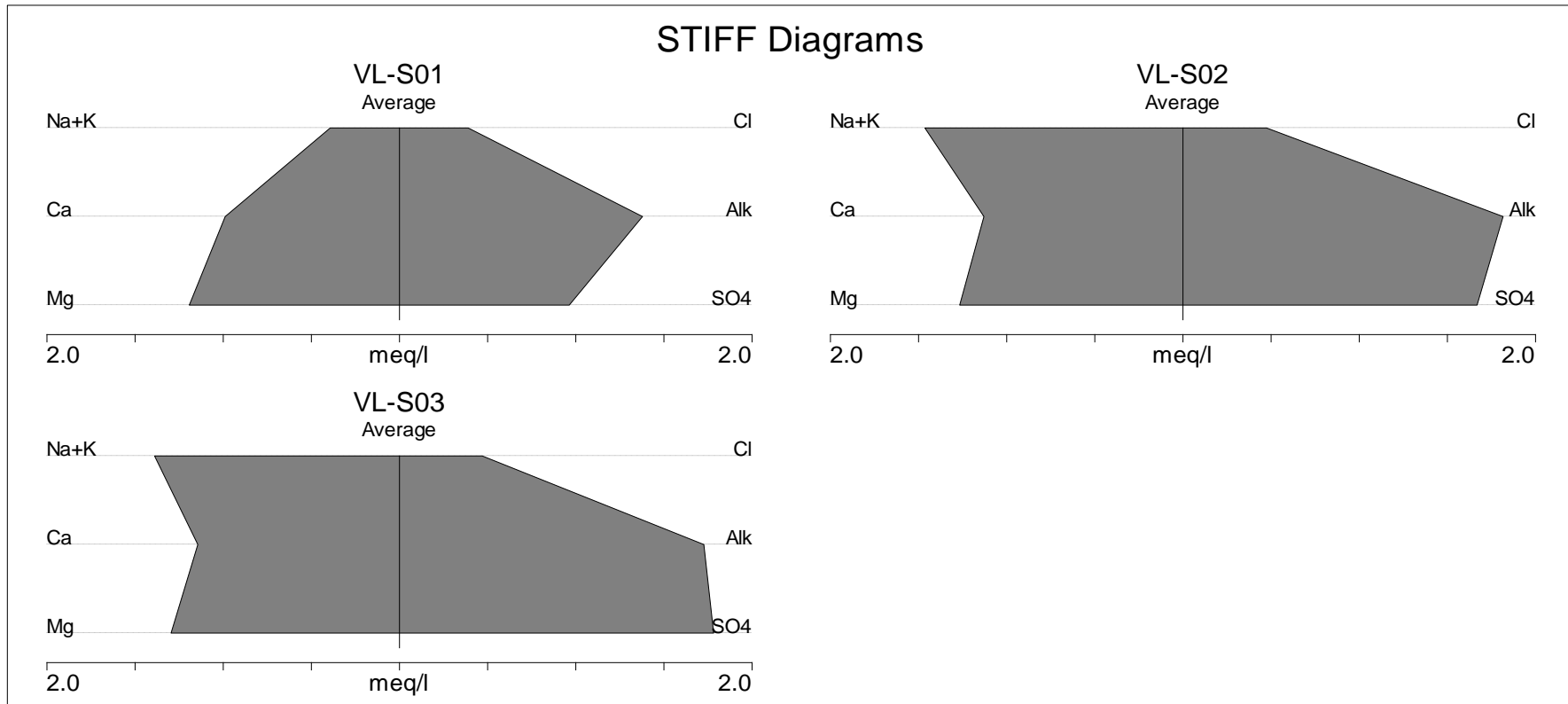


Figure 12 Vaal River stream profile - upstream left, downstream right.



- STIFF Diagram
- A dominant Sulphate (SO_4) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO_3^-) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO_4)

Figure 13 STIFF Diagrams for the Vaal River surface water monitoring points.



From **Table 8** and **Figures 11, 12** and **13** it is evident that water quality and composition of the Vaal River changed after the confluence with the Witpuntspruit (inflow between **VL-S01** and **VL-S02**).

The trend in water quality at **VL-S01** (upstream) can be ascribed to seasonal changes and possible upstream impacts where the addition of elevated variable concentrations from the Witpuntspruit (**WT-S06**) into the Vaal River system can be clearly observed in the difference of variable concentrations and composition as deterioration was recorded from **VL-S01** towards **VL-S02** (after confluence of Witpuntspruit).

Despite **WT-S05** was dry during the reporting period, the impact from **WT-S06** is still evident at **VL-S02**. From **VL-S02** to **VL-S03** the water quality remained relatively consistent indicated no additional impacts entering the Vaal river downstream of **VL-S02**.

Metal (Fe) concentrations in the Vaal River exceeded the IWUL Limits from upstream to downstream, with concentrations remaining relatively consistent or improving as water moves downstream, where the Al concentration recorded at **VL-S02** possibly originate from **WT-S06**.

Evidently, the Witpuntspruit has a negative impact on the Vaal River.

6.4 Groundwater

Table 9 indicates the average groundwater quality for Mooiplaats Colliery monitoring points compared to the IWUL limits, Grootdraai Dam Guidelines - Vaal Origin, DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards.

Figure 14 illustrate the variable concentration trends for groundwater.

Figure 15 illustrates the composition of the groundwater water quality in STIFF Diagrams.



Table 9 Average water quality for Mooiplaats groundwater monitoring points.

Average Groundwater Quality for Mooiplaats August 2024 - October 2024										
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	GAD-1	GAD-2S	GKL-1	GKL-2S	GKL-4D
pH	-	8.78	6.4 – 8.5	5.0 – 9.5	-	7,28	7,56	7,58	7,52	8,50
EC	mS/m	150	25	170	500	26,00	15,10	37,00	45,00	*246,00
TDS	mg/L	-	-	1200	3000	132	82	204	253	1421
Total Hardness	mg/L	-	-	-	-	106	60	160	203	15
Alkalinity	CaCO ₃ /L	-	75	-	-	127,000	47,200	208,000	226,000	691,000
Ca	mg/L	15.18	-	-	1000	26,600	13,000	40,700	45,900	3,860
Mg	mg/L	6.96	-	-	500	9,660	6,660	14,200	21,580	1,190
Na	mg/L	61.55	-	200	200	10,600	5,540	18,400	17,630	570,530
K	mg/L	-	-	-	-	2,290	0,790	1,180	1,290	5,070
F	mg/L	0.30	0.4	1.5	2	-0,090	-0,090	-0,090	-0,090	*3,240
Cl	mg/L	19.97	20	300	3000	6,160	9,980	1,510	3,800	*394,000
SO ₄	mg/L	0.25	30	500	1000	-0,500	1,300	3,620	27,300	7,890
NO ₃	mg/L	0.07	0.5	11	-	-0,010	-0,010	-0,010	-0,010	-0,010
NH ₃	mg/L	-	-	1.5	-	-0,450	-0,450	-0,450	-0,450	1,360
Al	mg/L	-	-	0.3	5	-0,010	-0,010	-0,010	-0,010	0,030
Fe	mg/L	-	-	0.3	10	0,370	0,210	0,020	-0,010	0,040
Mn	mg/L	-	-	0.1	10	0,140	-0,010	-0,010	0,030	-0,010

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*”Indicate variables exceeding the IWUL limits and GD-VO Guidelines.



Table 9 (cont.): Average water quality for Mooiplaats groundwater monitoring points.

Average Groundwater Quality for Mooiplaats August 2024 - October 2024									
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	GKL - 5S	GKL - 6M	GKL - 8M	GKL - 9D
pH	-	8.78	6.4 – 8.5	5.0 - 9.5	-	8,43	7,73	7,58	7,80
EC	mS/m	150	25	170	500	35,50	25,30	26,10	22,60
TDS	mg/L	-	-	1200	3000	201	142	144	140
Total Hardness	mg/L	-	-	-	-	66	65	100	65
Alkalinity	CaCO ₃ /L	-	75	-	-	174,000	136,000	135,000	134,000
Ca	mg/L	15.18	-	-	1000	17,590	18,600	28,200	17,870
Mg	mg/L	6.96	-	-	500	5,480	4,450	7,280	4,920
Na	mg/L	61.55	-	200	200	58,600	29,900	16,300	28,740
K	mg/L	-	-	-	-	1,900	1,320	2,040	2,080
F	mg/L	0.30	0.4	1.5	2	0,210	0,380	-0,090	-0,090
Cl	mg/L	19.97	20	300	3000	2,690	4,190	7,150	4,790
SO ₄	mg/L	0.25	30	500	1000	-0,500	-0,500	1,620	-0,500
NO ₃	mg/L	0.07	0.5	11	-	0,090	-0,010	-0,010	-0,010
NH ₃	mg/L	-	-	1.5	-	-0,450	-0,450	-0,450	0,520
Al	mg/L	-	-	0.3	5	-0,010	-0,010	-0,010	-0,010
Fe	mg/L	-	-	0.3	10	0,170	1,560	-0,010	0,080
Mn	mg/L	-	-	0.1	10	0,020	0,150	0,090	0,080

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*”Indicate variables exceeding the IWUL limits and GD-VO Guidelines.

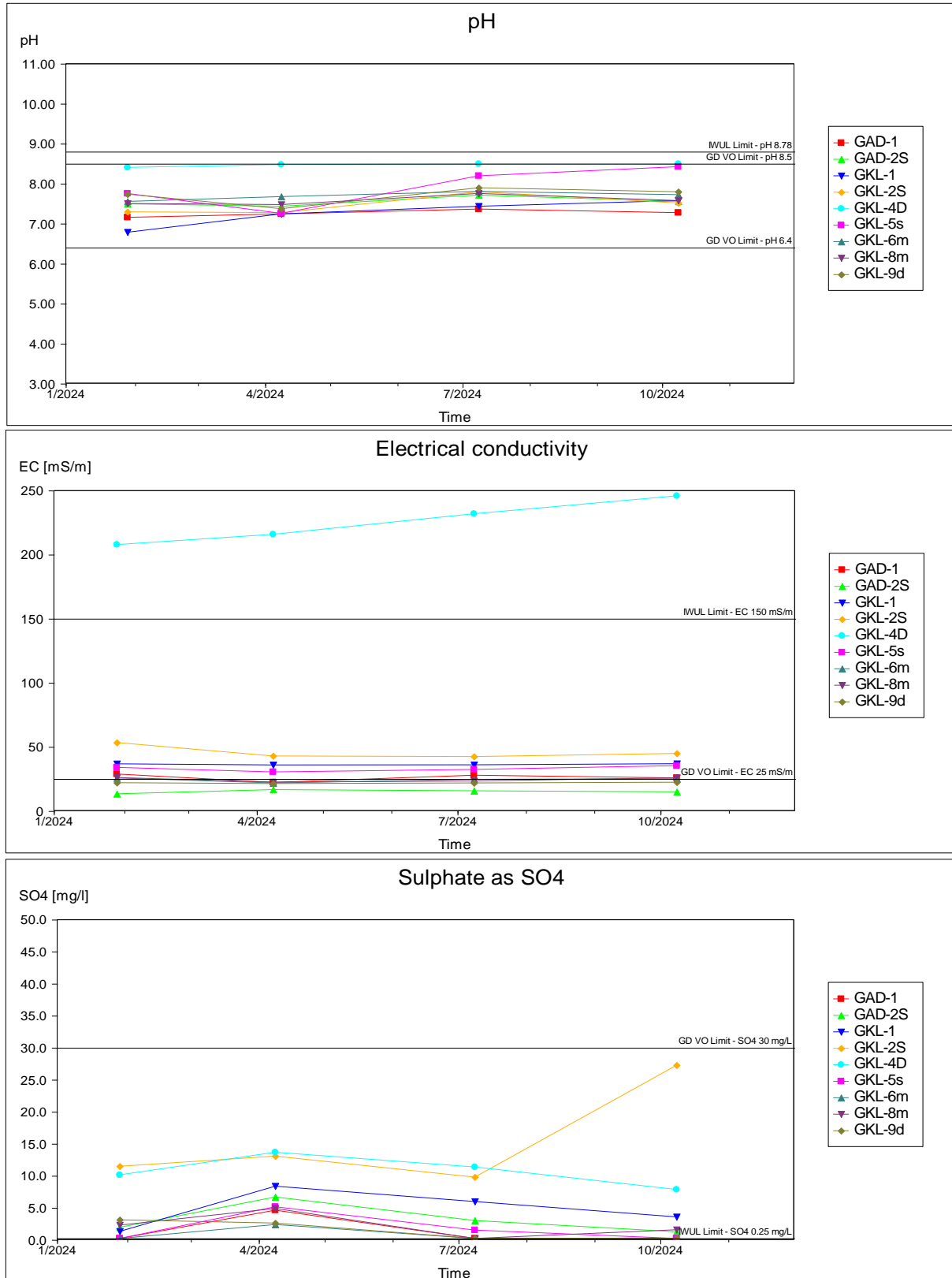
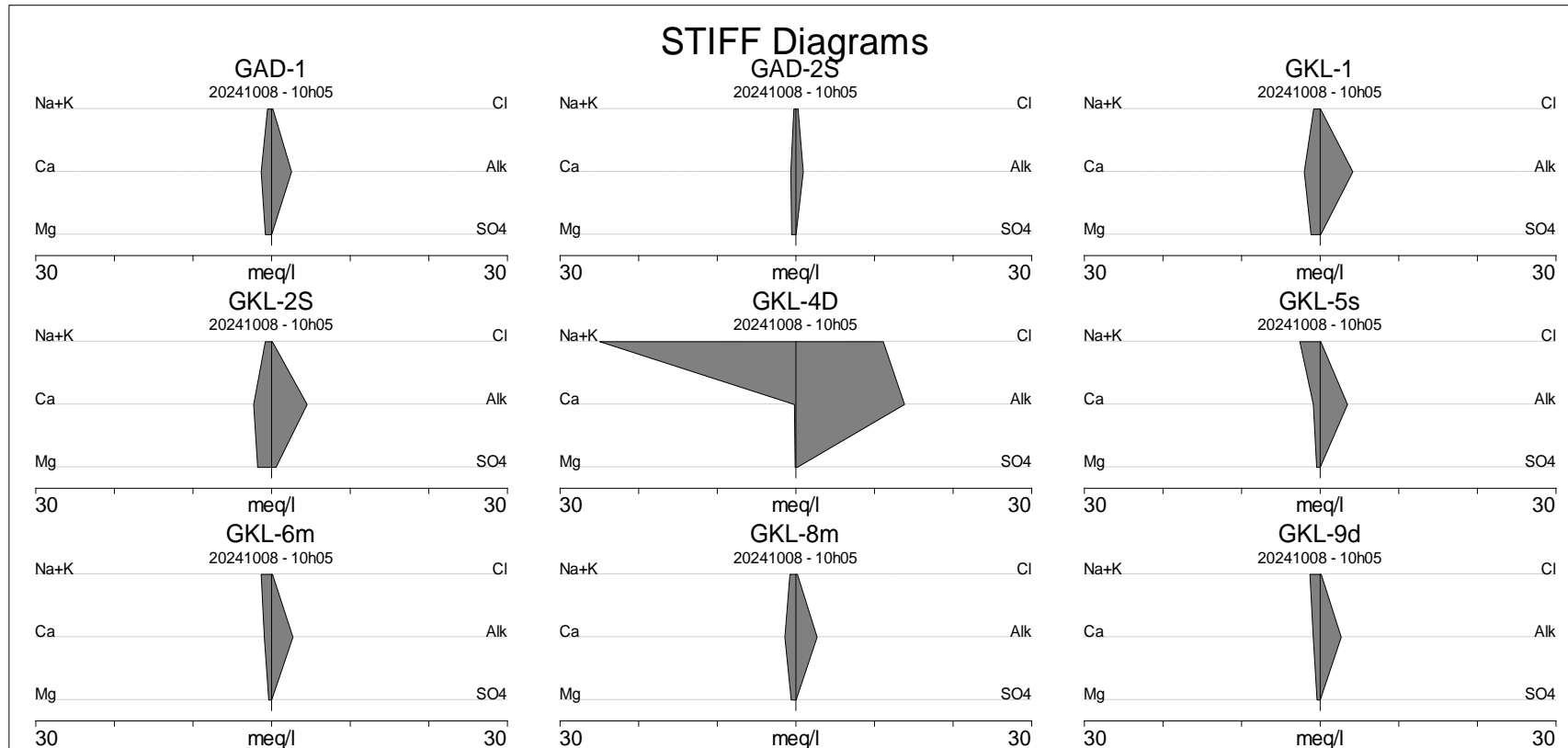


Figure 14 Variable concentration trends for groundwater monitoring points.



- STIFF Diagram - A dominant Sulphate (SO₄) anion indicates possible coal mining pollution.
- A dominant Alkalinity/Bicarbonate (HCO₃⁻) anion indicates fresh, natural and unimpacted water.
- Cations are indicators/subjected to/of the local geology and natural conditions.
- The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO₄)

Figure 15 STIFF Diagrams for Mooiplaats groundwater monitoring points.



From **Table 9** and **Figures 14** and **15** it is evident that groundwater quality outside the mining right area remained of good quality, with seasonal fluctuations, despite several Grootdraai dam Vaal Origin Guidelines and IWUL Limits being exceeded.

From **Figure 14**, the slight movement in variable concentrations are indicative of seasonal variation associated with geology and the consistent recharge of natural groundwater without mining impacts.

Furthermore, the SO_4 concentrations recorded during the reporting period remained low and in line with geological impacts despite the concentrations exceeding the IWUL Limits. The limit of 0.25 mg/L will be exceeded at most groundwater in its natural state.

Naturally high $CaCO_3$ and Ca concentrations (geological) resulted in elevated EC concentrations that exceeded the IWUL limits and Grootdraai Dam Guidelines - Vaal Origin for EC and $CaCO_3$. Due to very low IWUL limits (SO_4 of 0.25mg/L, Ca of 15.18mg/L and Mg of 6.96 mg/L) variable concentrations in its natural state exceeded the limits.

GKL-4d is drilled to a depth of 80 meters. Naturally high $CaCO_3$, Na and Cl concentrations (geological) elevated the EC concentrations, to exceed the IWUL Limit. Elevated $CaCO_3$, Na, Ca, Mg, Cl and Fe concentrations can be ascribed to the deeper geology of the area, as illustrated in the STIFF Diagrams.

The increase in SO_4 at **GKL-2s** (shallow aquifer) can possibly be ascribed to water quality from **VL-S03** (**GKL-2s** drilled on bank of Vaal river at **VL-S03**) entering the shallow aquifer, if the aquifer is connected to the Vaal river. However, the increase in SO_4 can just as likely be due to the natural geology.

Alkalinity ($CaCO_3$) dominate in terms of dominating cations at all groundwater indicating fresh and recharged water without mining impacts.

No impact from Mooiplaats colliery was observed in the groundwater monitored.

6.5 Groundwater Levels

Groundwater levels are monitored on a quarterly basis to determine the possible impact of mining activities on the groundwater aquifer.

Table 10 indicates groundwater levels below ground level (MBGL).

Figure 16 illustrates groundwater level trends.

Table 10 Mooiplaats groundwater levels.

Mooiplaats IWUL Groundwater Levels									
Date	GAD-1	GAD-2S	GKL-1	GKL-2S	GKL-4D	GKL-5s	GKL-6m	GKL-8m	GKL-9d
Jan-24	-3,72	-9,39	-24,78	-3,98	-2,51	-1,48	-0,85	-4,50	-12,68
Apr-24	-3,48	-8,08	-24,82	-4,17	-2,62	-1,53	-0,82	-4,58	-13,03
Jul-24	-4,28	-9,44	-24,98	-4,17	-2,61	-2,07	-1,63	-4,98	-13,19
Oct-24	-4,79	-10,02	-25,17	-2,68	-3,29	-2,3	-2,08	-5,21	-13,27

Evident from **Table 10** and **Figure 16**, groundwater levels fluctuate according to drilled depth and season with no indication of water levels impacted by mining activities. However, GKL-2s recorded an increase in water level (in line with the increase in the SO₄ concentration), while the water level of the Vaal river lowered in the same period. This trend should be closely monitored.

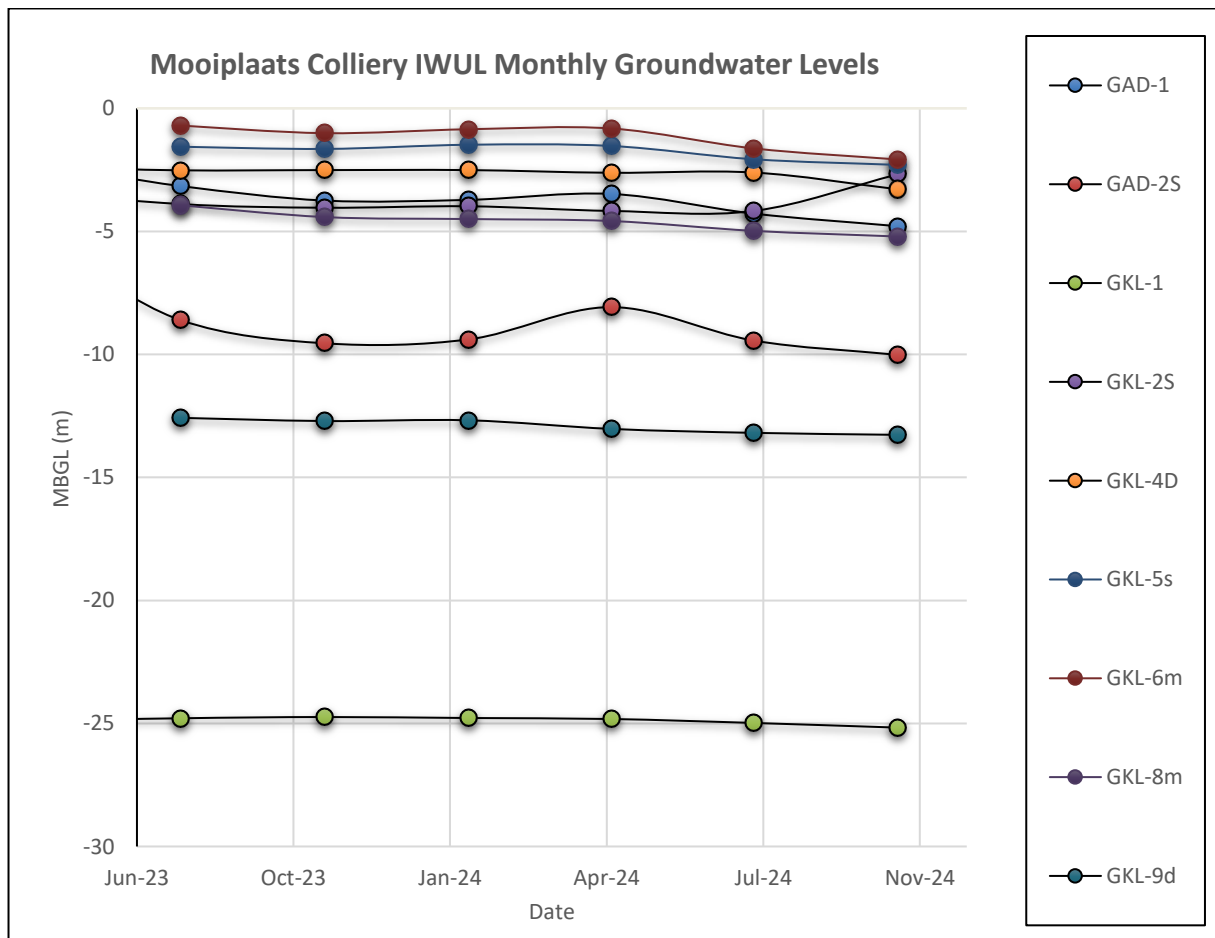


Figure 16 Mooiplaats groundwater level trends.



7. DISCUSSION AND CONCLUSION

The monitoring network provides information for risk-based decision making to Mooiplaats management with regard to effectiveness of pollution prevention measures and areas requiring management attention.

Note: Removing coal from underground / mining ceased on 31 December 2021, with only the coal washing plant being operational currently.

7.1 Surface water

Wastewater - Water quality from the mine water/pollution control dams exceeded limits in terms of EC, TDS, CaCO₃, Ca, Mg, Cl, SO₄, Fe, and Mn - typical of water associated with coal washing/mining activities. Wastewater is contained in storage facilities and circulated in a closed circuit. The pH of process / wastewater should be closely monitored and managed to prevent damage to water infrastructure.

Witpuntspruit – Although historic pollution from upstream of Mooiplaats is evident (at **WT-S01**), water quality recorded a general improvement in terms of several variable concentrations towards downstream. However, with the **Usuthu decant** inflow between **WT-S04** and **WT-S06** the water quality deteriorate again. From **WT-S01** to **WT-S06**, a slight net improvement was recorded. However, current and historical activities have a detrimental effect on this Spruit, which will have a long-term negative effect on the downstream environment of the Vaal River system.

Vaal River – A continuous deterioration was recorded after the confluence of the Witpuntspruit with the Vaal River (between **VL-S01** and **VL-S02**). The increase / variation in variable concentrations during the reporting period can be ascribed to the addition of variables from the Witpuntspruit drainage.

Although Fe exceeded the IWUL limits, concentrations remained low, relative consistent, and in line with historical trends, from upstream to downstream indicating the presence might possibly be geological / natural.

7.2 Groundwater

Groundwater - Outside the mining right area, water quality remains mostly stable and of good quality, with slight seasonal fluctuations. Neutral to high neutral pH values, Alkalinity (CaCO₃), and Ca concentrations indicate geological conditions. The movement of pH values, EC concentrations and variables associated with geology indicate the consistent recharge of



natural groundwater without mining impacts. However, water quality at **GKL-2s** should be closely monitored.

Groundwater levels continued to fluctuate according to seasonal factors and not due to mining impacts.

8. REFERENCES

- General Authorisations in terms of section 39 of the NWA, 1998 (Act No.36 of 1998), GG 36206 (4 March 2013), GNR 169, Section 21 (f) & (h).
- ISO 5667-1: 2006 Part 1: Guidance on the design of sampling programs and sampling techniques.
- ISO 5667-3: 2003 Part 3: Guidance on preservation and handling of samples.
- ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams.
- ISO 5667-11: 1993 Part 11: Guidance on sampling of groundwaters.
- Mineral and Petroleum Resources Development Act (Act No.28 of 2002).
- National Water Act (Act No. 36 of 1998).
- South African Water Quality Guidelines (1996). Volume 1. Domestic Use. Department of Water Affairs and Forestry.
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- Standards South Africa. SANS 241 – 1: 2011. South African National Standard. Drinking Water. (Edition 1).
- Standards South Africa. SANS 241 – 1: 2015. South African National Standard. Drinking Water. (Edition 2).
- Department of Water and Sanitation, National Water Resource Strategy, 2004.
- Mooiplaats North Colliery geology and groundwater study, Coal of Africa Limited. Report No. V1110001. J. Fourie, 2011.

— ANNEXURES

Refer to **Annexure A** for:

- In-field Sampling Sheets: Tables portraying the name, descriptions, and status of the monitoring points.

Refer to **Annexure B** for:

- Test Reports: Laboratory results displaying variable concentrations for all monitoring points during the reporting period.

ANNEXURE A





sanas
South African National Accreditation System

T0647

Analyses Required

pH, EC, P and M Alkalinity, Ca, Mg,
Na, K, F, Cl, SO₄, NO₃-N, Al, Fe, Mn,
NH₃

Sent by
L. W. M. M.

Received by:

YANKA KABS

Date

8/8/24



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15A Midas Ave, Olympys, Pretoria

Project: Mbitlana's IWUL Water Monitoring

Monitoring Month: Jul-24

Monitoring Occasion: Monthly Surface and Groundwater Monitoring

Date of Sampling: 08-Jul-24

Monitoring Point	Coordinates	Time	Sampled	Level	Description	Comment/Observations	Turbidity 0-5
✓ VL-S01	S26.64616° E30.09890°	11:57	Yes	Low	Surface Water Vaal River 1 US	Clear	1
✓ VL-S02	S26.64804° E30.15098°	11:11	Yes	Low	Vaal River 2 DS	Clear	1
✓ VL-S03	S26.67879° E30.12411°	11:28	Yes	Low	Vaal River 3 DS	Clear	1
✗ VL-S04	S26.70167° E30.08288°	11:22	No	-	Vaal River 4 DS	No Grass	-
✓ WT-S01	S26.71447° E30.06519°	09:15	Yes	Low	Witpuntspruit 1 US	Clear	0
✓ WT-S02	S26.59307° E30.09617°	08:58	Yes	Very Low	Witpuntspruit 2 MS	Clear	0
✓ WT-S03	S26.61826° E30.11211°	08:51	Yes	Low	Witpunt Tributary North DS 1	Clear	0
✗ WT-S04	S26.62014° E30.10781°	09:04	No	-	Witpuntspruit 3 MS	No Grass	9
✗ WT-S05	S26.62294° E30.11463°	09:04	No	-	Witpunt Tributary South DS 2	No Grass	-
✓ WT-S06	S26.62863° E30.11539°	09:25	Yes	Low	Witpuntspruit 6 MS	Clear	0
✓ MPS-S14	S26.64616° E30.09890°	09:57	Yes	0.4	Gen-sub PCD	Bottom	20
✓ MPS-S20	S26.64505° E30.10121°	10:47	Yes	1:0	Erickson Dams	Clear	20
✓ MPS-S21	S26.64198° E30.10059°	10:20	Yes	0.0	Main Holdings Dam	Clear	1
✓ MPS-S30	S26.64508° E30.09674°	10:05	Yes	0.0	Plant PCD	Black	4



sanas
South African Agricultural
Accreditation Agency

10647

Analyses Required

pH, EC, P and M Alkalinity, Ca, Mg,
Na, K, F, Cl, SO₄, NO₃-N, Al, Fe, Mn,
NH₃

Sent by:
L. Marais

Received by:

YANKA KAS

Date

12/9/24



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Project: Mooiplaats RWL Water Monitoring

Monitoring Month: Sep-24

Monitoring Occasion: Monthly Surface and Groundwater Monitoring

Date of sampling: 12-Sep-24

Monitoring Point	Coordinates	Time	Sampled	Level	Description	Comment/Observations	Turbidity 0-5
✓ VL-S01	S26.64616° E30.09890°	10:56	Yes	Low	Vaal River 1 US	Clear	0
✓ VL-S02	S26.64804° E30.15098°	10:15	Yes	Low	Vaal River 2 DS	Clear	0
✓ VL-S03	S26.67879° E30.12411°	10:35	Yes	High	Vaal River 3 DS	Clear	0
✗ VL-S04	S26.70167° E30.08288°	10:39	No	N/A	Vaal River 4 DS	No Access	-
✓ WT-S01	S26.71447° E30.06519°	08:13	Yes	Low	Witpunspruit 1 US	Clear	0
✓ WT-S02	S26.59307° E30.09617°	07:57	Yes	Low	Witpunspruit 2 MS	Clear	0
✓ WT-S03	S26.61826° E30.11211°	07:50	Yes	High	Witpunt Tributary North DS 1	Clear	0
✗ WT-S04	S26.62014° E30.10781°	08:03	No	N/A	Witpunspruit 3 MS	No Access	-
✗ WT-S05	S26.62294° E30.11463°	08:06	No	Low	Witpunt Tributary South DS 2	Clear	-
✓ WT-S06	S26.62863° E30.11539°	08:23	Yes	Low	Witpunspruit 6 MS	Clear	0
✓ MPS-S14	S26.64616° E30.09890°	09:03	Yes	*High	Gen-sub PCD	Clear	1
✓ MPS-S20	S26.64505° E30.10121°	09:55	Yes	1-1/2	Erickson Dams	Clear	0
✓ MPS-S21	S26.64198° E30.10059°	09:32	Yes	0.2	Main Holdings Dam	Clear	0
✓ MPS-S30	S26.64508° E30.09674°	09:09	Yes	*High	Plant PCD	Clear	1



T0647

Analysis Required

pH, EC, Alkalinity, Ca, Mg, Na, K, F, Cl, SO4, NO3-N, Al, Fe, Mn, NH3

Sent by:

Louise Mokoena

Received by:

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Project: Mooiplaats IWUL Water Monitoring

Monitoring Month: Oct-24

Monitoring Occasion: Quarterly Surface and Groundwater Monitoring

Date of Sampling: 09-Oct-24

Monitoring Point	Coordinates	Time	Sampled	Level	Medium	Comment/Observations	Turbidity
Surface Water							
✓ VL-S01	S26.64616° E30.09890°	13:36	Yes	Low	Vaal River 1 US	Clear	0
✓ VL-S02	S26.64804° E30.15098°	10:34	Yes	Low	Vaal River 2 DS	Clear	1
✓ VL-S03	S26.67879° E30.12411°	13:10	Yes	Low	Vaal River 3 DS	Clear	0
✗ VL-S04	S26.70167° E30.08288°	11:52	No	-	Vaal River 4 DS	No Access	-
✓ WT-S01	S26.71447° E30.06519°	08:50	Yes	Low	Witpuntspruit 1 US	Clear	0
✓ WT-S02	S26.59307° E30.09617°	08:05	Yes	Low	Witpuntspruit 2 MS	Clear	0
✗ WT-S03	S26.61826° E30.11211°	07:58	No	0	Witpunt Tributary North DS 1	No Access	-
✗ WT-S04	S26.62014° E30.10781°	08:10	No	-	Witpuntspruit 3 MS	No Access	-
✗ WT-S05	S26.62294° E30.11463°	08:10	No	-	Witpunt Tributary South DS 2	No Access	-
✓ WT-S06	S26.62863° E30.11539°	08:38	Yes	Low	Witpuntspruit 6 MS	Clear	1
Groundwater							
✓ GAD-1	S26.72733° E30.10144°	11:01	Yes	4-7.9	IWUL Borehole	Clear	0
✓ GAD-2s	S26.71269° E30.11414°	10:49	Yes	10.02	IWUL Borehole	Clear - Brown	1
✓ GKL-1	S26.69603° E30.07208°	11:47	Yes	25.17	IWUL Borehole	Clear	1
✓ GKL-2s	S26.70178° E30.08269°	13:01	Yes	2.68	IWUL Borehole	Brown	4
✓ GKL-4d	S26.70167° E30.08253°	13:06	Yes	3.29	IWUL Borehole	Brown	4
✓ GKL-5s	S26.66542° E30.09647°	12:18	Yes	2.30	IWUL Borehole	Clear	1
✓ GKL-6M	S26.66542° E30.09658°	12:22	Yes	2.08	IWUL Borehole	Clear	0
✓ GKL-8M	S26.67233° E30.10464°	12:33	Yes	5.21	IWUL Borehole	Black	2
✓ GKL-9D	S26.67231° E30.10450°	12:38	Yes	13.27	IWUL Borehole	Clear	1
Process Water							
✓ MPS-S14	S26.64616° E30.09890°	09:13	Yes	Med	Gen-sub PCD	Clear	1
✓ MPS-S20	S26.64505° E30.10121°	10:03	Yes	High	Erickson Dams	Clear	0
✓ MPS-S21	S26.64198° E30.10059°	09:35	Yes	High	Main Holdings Dam	Clear	0
✓ MPS-S30	S26.64508° E30.09674°	09:19	Yes	High	Plant PCD	Clear	1

ANNEXURE B





YANKA LABORATORIES

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Registration No. 2012/113891/07

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Geo Soil and Water CC
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 0040

Job No: **E75634 - W24 _ 5921**
 Report Reference: **ER_GEO_2024-08-12_01806_001**

Enquiries: **Rita Botha**Date: **2024/08/12**

RitaB@yanka.co.za

Job Reference: **W24/5921 - Advice Note 2408W246**Job Description: **11 x Routine Analysis**Project: **MOOPLAATS SURFACE & GROUNDWATER**

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & Groundwater - 08 August 2024

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see

<http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 8 August 2024 - 2024/08/20

SANAS Certificate obtainable from the address below

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*Results not marked with a Test Method YE####**, as well as results marked "Subcontracted" or "Outsourced", in this report, are not included in the SANAS Schedule of Accreditation for this laboratory. However, outsourced results may be within the Schedule of Accreditation of the source laboratory.*

Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.

Limits shown to the right of results are for information only and may need further interpretation, and is not suitable for conformance evaluation as shown.

Although reasonable precautions are taken to ensure accuracy, correctness, and applicability, it is emphasized that all results of analysis or any other notifications are provided on the explicit condition that YANKA LABORATORIES will accept no responsibility whatsoever, for any losses or costs that may result from faulty, incorrect, or inappropriate interpretation, use, or application of results.

Samples were tested as received, except where indicated otherwise. This report relates only to the specific sample(s) tested as identified herein and may not be reproduced in part without written permission from Laboratory Management.

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ANALYSTS

Marné, Magda, Venna, Drieka, Sue, Rosemary, Vida, Elize, Petricia, Stefan, Nadine, Corlia, Lindie, Jolene, Audrey, Mariëtte, Nicolene



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 06	MPS - S 14	MPS - S 20
SAMPLE NUMBER			E75634-001	E75634-002	E75634-003	E75634-004	E75634-005	E75634-006	E75634-007	E75634-008	E75634-009
SAMPLED	Test Method **		2024/08/07 11:51	2024/08/07 11:11	2024/08/07 11:28	2024/08/07 09:15	2024/08/07 08:58	2024/08/07 08:51	2024/08/07 09:25	2024/08/07 09:57	2024/08/07 10:47
Remarks			Clear	Clear	Clear	Clear	Clear	Clear	Clear	Greenish	Clear
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	92,1	134	134	0,00	149	113	1051	1033	968
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	92,1	134	134	0,00	149	113	1051	1033	968
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	92,1	134	134	0,00	149	113	1051	1033	968
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	28,6	43,0	44,3	229	94,5	60,9	249	288	375
pH (Laboratory)		YE030pH	5,71	6,46	7,32	4,13	6,39	6,51	7,99	7,82	7,78
Total Hardness	mg CaCO ₃ /L	YE061H	122	126	134	1477	353	221	139	180	433
Calcium Hardness	mg CaCO ₃ /L	YE061H	58,4	62,2	68,9	806	212	145	81,2	106	202
Magnesium Hardness	mg CaCO ₃ /L	YE061H	63,8	63,8	65,5	671	140	75,8	58,1	73,7	232
Total Dissolved Solids (TDS)	mg/L	Calculation	159	250	265	2288	637	407	1606	1968	2857
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	2,10	1,57
Calcium	mg Ca/L	YE060ICP	23,4	24,9	27,6	323	85,1	58,0	32,5	42,6	80,7
Chloride	mg Cl/L	YE070AK	16,5	19,7	20,0	26,5	26,2	12,7	70,7	67,2	70,0
Magnesium	mg Mg/L	YE060ICP	15,5	15,5	15,9	163	34,0	18,4	14,1	17,9	56,3
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	4,12
Potassium	mg K/L	YE060ICP	1,98	2,98	3,16	14,3	6,01	3,11	6,37	9,92	12,2
Sodium	mg Na/L	YE060ICP	12,0	42,9	43,2	53,5	80,4	49,4	563	711	849
Sulphate	mg SO ₄ /L	YE070AK	33,9	63,0	74,2	1659	316	197	286	495	1185
Aluminium	mg Al/L	YE060ICP	0,01	0,12	0,06	26,7	0,18	0,09	0,59	<0.01	0,05
Fluoride	mg F/L	YE070AK	<0.09	0,16	0,15	<0.09	0,11	<0.09	2,05	2,53	1,95
Iron	mg Fe/L	YE060ICP	0,05	0,10	0,11	0,16	<0.01	0,32	0,35	0,05	0,05
Manganese	mg Mn/L	YE060ICP	0,02	<0.01	0,01	22,1	0,03	0,07	0,06	<0.01	0,10
Langelier Index (indicative, not SANS)	Calculation		-2,45	-1,53	-0,63	-17,74	-1,06	-1,21	0,91	0,85	1,04
pHs (indicative, not SANS)	Calculation		8,16	7,99	7,95	21,87	7,45	7,72	7,08	6,97	6,74
Sodium Absorption Ratio (indicative)	Calculation		0,47	1,66	1,62	0,60	1,86	1,44	20,67	22,96	17,68
TDS to EC Ratio (indicative, not SANS)	Calculation		5,55	5,81	5,98	9,99	6,75	6,68	6,45	6,83	7,62
Corrosion Ratio (indicative, not SANS)	Calculation		0,70	0,66	0,71	93904995335,51	1,60	1,22	0,33	0,43	0,84
Ryznar Index (indicative, not SANS)	Calculation		10,60	9,52	8,57	39,60	8,51	8,92	6,16	6,13	5,70
Anion Sum			3,02	4,56	4,81	35,32	10,32	6,73	29,11	33,02	46,44
Cation Sum			3,04	4,50	4,68	36,20	10,76	6,69	27,51	34,93	46,09
Difference			0,02	-0,07	-0,13	0,88	0,44	-0,04	-1,60	1,91	-0,35
% Difference			0,31%	-0,74%	-1,35%	1,23%	2,09%	-0,27%	-2,83%	2,81%	-0,38%

Methods adapted to accommodate local laboratory conditions.

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please see <http://www.yanka.co.za/TestsAndStandards.htm> .

For ranges, uncertainties, etc., please contact us.



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11
SAMPLE DESCRIPTION			MPS - S 21	MPS - S 30
SAMPLE NUMBER			E75634-010	E75634-011
SAMPLED	Test Method **		2024/08/07 10:20	2024/08/07 10:05
Remarks			Brownish	Black
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	126	378
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	126	378
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	126	378
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	652	601
pH (Laboratory)		YE030pH	7,45	7,55
Total Hardness	mg CaCO ₃ /L	YE061H	2325	1485
Calcium Hardness	mg CaCO ₃ /L	YE061H	1204	946
Magnesium Hardness	mg CaCO ₃ /L	YE061H	1121	539
Total Dissolved Solids (TDS)	mg/L	Calculation	6287	4849
Temperature	°C	Thermometer	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	1,68	2,10
Calcium	mg Ca/L	YE060ICP	482	379
Chloride	mg Cl/L	YE070AK	67,3	76,0
Magnesium	mg Mg/L	YE060ICP	272	131
Nitrate and Nitrite (TON)	mg N/L	YE070AK	1,74	1,63
Potassium	mg K/L	YE060ICP	24,6	20,2
Sodium	mg Na/L	YE060ICP	1078	958
Sulphate	mg SO ₄ /L	YE070AK	4256	3048
Aluminium	mg Al/L	YE060ICP	<0.01	<0.01
Fluoride	mg F/L	YE070AK	0,39	0,26
Iron	mg Fe/L	YE060ICP	0,26	0,04
Manganese	mg Mn/L	YE060ICP	20,8	0,26
Langelier Index (indicative, not SANS)		Calculation	0,58	1,05
pHs (indicative, not SANS)		Calculation	6,87	6,50
Sodium Absorption Ratio (indicative)		Calculation	9,69	10,78
TDS to EC Ratio (indicative, not SANS)		Calculation	9,64	8,07
Corrosion Ratio (indicative, not SANS)		Calculation	19,09	4,76
Ryznar Index (indicative, not SANS)		Calculation	6,29	5,44
Anion Sum			93,25	73,36
Cation Sum			95,19	72,18
Difference			1,94	-1,18
% Difference			1,03%	-0,81%

Methods adapted to accommodate local laboratory conditions.

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Job No: **E76735 - W24 _ 7021**
 Report Reference: **ER_GEO_2024-09-17_02908_001**

Enquiries: **Rita Botha**Date: **2024/09/17**

RitaB@yanka.co.za

Job Reference: **W24/7021 - Advice Note 2409W483**Job Description: **11 x Routine Analysis**Project: **MOOPLAATS SURFACE & GW**

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & GW - 13 September 2024

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see

<http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 13 September 2024 - 2024/09/23

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Results not marked with a Test Method YE####, as well as results marked "Subcontracted" or "Outsourced", in this report, are not included in the SANAS Schedule of Accreditation for this laboratory. However, outsourced results may be within the Schedule of Accreditation of the source laboratory.*

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ANALYSTS

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YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 06	MPS - S 14	MPS - S 20
SAMPLE NUMBER			E76735-001	E76735-002	E76735-003	E76735-004	E76735-005	E76735-006	E76735-007	E76735-008	E76735-009
SAMPLED	Test Method **		2024/09/12 10:56	2024/09/12 10:13	2024/09/12 10:35	2024/09/12 08:13	2024/09/12 07:57	2024/09/12 07:50	2024/09/12 08:23	2024/09/12 09:03	2024/09/12 09:55
Remarks			Clear	Brownish	Clear	Clear	Clear	Clear	Yellowish	Greyish	Grey
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	101	167	151	0,00	172	127	1098	1206	1042
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	101	167	151	0,00	172	127	1040	1206	1042
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	57,6	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	101	167	151	0,00	172	127	1069	1206	1042
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	28,8	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	28,6	50,1	48,1	239	101	54,0	259	318	337
pH (Laboratory)		YE030pH	7,31	7,78	8,23	4,27	6,66	6,80	8,52	8,09	8,20
Total Hardness	mg CaCO ₃ /L	YE061H	122	124	135	1510	313	169	106	184	219
Calcium Hardness	mg CaCO ₃ /L	YE061H	51,7	53,9	60,4	781	160	97,9	54,7	101	90,9
Magnesium Hardness	mg CaCO ₃ /L	YE061H	70,4	70,4	74,5	729	153	70,8	51,5	82,8	128
Total Dissolved Solids (TDS)	mg/L	Calculation	158	283	275	2316	681	335	1625	2407	2239
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	0,79
Calcium	mg Ca/L	YE060ICP	20,7	21,6	24,2	313	64,0	39,2	21,9	40,5	36,4
Chloride	mg Cl/L	YE070AK	16,9	23,2	22,8	31,8	29,0	13,2	72,8	71,1	70,3
Magnesium	mg Mg/L	YE060ICP	17,1	17,1	18,1	177	37,2	17,2	12,5	20,1	31,2
Nitrate and Nitrite (TON)	mg N/L	YE070AK	0,37	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	1,44
Potassium	mg K/L	YE060ICP	2,58	3,90	4,16	19,4	8,26	3,95	7,07	11,4	11,6
Sodium	mg Na/L	YE060ICP	10,8	61,0	51,9	65,6	102	47,3	601	881	727
Sulphate	mg SO ₄ /L	YE070AK	27,6	55,8	62,5	1663	337	138	248	647	723
Aluminium	mg Al/L	YE060ICP	<0.01	0,15	<0.01	24,6	0,03	0,07	0,26	<0.01	<0.01
Fluoride	mg F/L	YE070AK	0,09	0,38	0,32	<0.09	0,27	0,13	3,39	4,47	4,61
Iron	mg Fe/L	YE060ICP	0,09	0,10	0,04	0,13	<0.01	0,01	0,12	<0.01	0,01
Manganese	mg Mn/L	YE060ICP	0,03	0,02	<0.01	21,6	<0.01	0,11	0,02	<0.01	<0.01
Langelier Index (indicative, not SANS)	Calculation		-0.86	-0.18	0.28	-17.61	-0.86	-1.03	1.29	1.15	1.15
pHs (indicative, not SANS)	Calculation		8.17	7.96	7.95	21.88	7.52	7.83	7.23	6.94	7.05
Sodium Absorption Ratio (indicative)	Calculation		0.42	2.37	1.94	0.73	2.50	1.58	25.27	28.17	21.27
TDS to EC Ratio (indicative, not SANS)	Calculation		5.52	5.66	5.71	9.69	6.74	6.21	6.28	7.57	6.64
Corrosion Ratio (indicative, not SANS)	Calculation		0.62	0.57	0.64	95586166293.23	1.50	0.86	0.30	0.45	0.55
Ryznar Index (indicative, not SANS)	Calculation		9.03	8.14	7.68	39.49	8.37	8.86	5.94	5.79	5.89
Anion Sum			3.11	5.19	4.99	35.55	11.30	5.80	29.38	39.97	38.31
Cation Sum			3.00	5.28	5.08	37.28	10.95	5.56	28.47	42.36	36.33
Difference			-0.10	0.09	0.09	1.73	-0.35	-0.24	-0.90	2.39	-1.98
% Difference			-1.69%	0.90%	0.93%	2.38%	-1.59%	-2.07%	-1.56%	2.90%	-2.65%

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YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11
SAMPLE DESCRIPTION			MPS - S 21	MPS - S 30
SAMPLE NUMBER			E76735-010	E76735-011
SAMPLED	Test Method **		2024/09/12 09:32	2024/09/12 09:09
Remarks			Brownish	Clear
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	0,00	396
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	396
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	0,00	396
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	739	468
pH (Laboratory)		YE030pH	4,14	7,54
Total Hardness	mg CaCO ₃ /L	YE061H	2706	859
Calcium Hardness	mg CaCO ₃ /L	YE061H	1320	427
Magnesium Hardness	mg CaCO ₃ /L	YE061H	1386	432
Total Dissolved Solids (TDS)	mg/L	Calculation	7609	3734
Temperature	°C	Thermometer	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	3,65	<0,45
Calcium	mg Ca/L	YE060ICP	529	171
Chloride	mg Cl/L	YE070AK	67,5	81,2
Magnesium	mg Mg/L	YE060ICP	337	105
Nitrate and Nitrite (TON)	mg N/L	YE070AK	0,49	1,29
Potassium	mg K/L	YE060ICP	28,5	22,1
Sodium	mg Na/L	YE060ICP	1156	849
Sulphate	mg SO ₄ /L	YE070AK	5433	2261
Aluminium	mg Al/L	YE060ICP	19,5	0,10
Fluoride	mg F/L	YE070AK	<0,09	1,82
Iron	mg Fe/L	YE060ICP	0,26	<0,01
Manganese	mg Mn/L	YE060ICP	32,2	0,02
Langelier Index (indicative, not SANS)		Calculation	-17,56	0,73
pHs (indicative, not SANS)		Calculation	21,70	6,81
Sodium Absorption Ratio (indicative)		Calculation	9,63	12,54
TDS to EC Ratio (indicative, not SANS)		Calculation	10,30	7,98
Corrosion Ratio (indicative, not SANS)		Calculation	302082104286,6	3,55
Ryznar Index (indicative, not SANS)		Calculation	39,27	6,08
Anion Sum			115,15	57,53
Cation Sum			109,08	54,77
Difference			-6,07	-2,76
% Difference			-2,71%	-2,46%

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SANS, and/or other national or international standards,

please see <http://www.yanka.co.za/TestsAndStandards.htm> .

For ranges, uncertainties, etc., please contact us.



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Job No: **E77450 - W24 _ 7735**
 Report Reference: **ER_GEO_2024-10-14_03622_001**

Enquiries: **Rita Botha**Date: **2024/10/14**

RitaB@yanka.co.za

Job Reference: **W24/7735 - Advice Note 2410W353**Job Description: **19 x Routine Analysis**Project: **MOOPLAATS SURFACE & GW**

TEST RESULTS FOR

Geo-Soil - Mooiplaats Surface & GW - 10 October 2024

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see

<http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 10 October 2024 - 2024/10/28

SANAS Certificate obtainable from the address below

<http://www.yanka.co.za/Services.htm>

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ANALYSTS

Marné, Magda, Venna, Drieka, Sue, Rosemary, Vida, Elize, Petricia, Stefan, Nadine, Corlia, Lindie, Jolene, Audrey, Mariëtte, Nicolene



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 06	GKL-1	GKL-4d	GKL-2s
SAMPLE NUMBER			E77450-001	E77450-002	E77450-003	E77450-004	E77450-005	E77450-006	E77450-007	E77450-008	E77450-009
SAMPLED		Test Method **	2024/10/09 13:36	2024/10/09 10:34	2024/10/09 13:10	2024/10/09 08:50	2024/10/09 08:05	2024/10/09 08:38	2024/10/09 11:47	2024/10/09 13:06	2024/10/09 13:01
Remarks			Yellowish	Yellowish	Yellowish	Yellowish	Clear	Yellowish	Clear	Brown	Brown
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	114	179	174	0,00	165	1060	208	723	226
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	114	179	146	0,00	165	837	208	659	226
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	28,0	0,00	0,00	223	0,00	63,6	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	114	179	160	0,00	165	1049	208	691	226
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	14,0	0,00	0,00	112	0,00	31,8	0,00
Conductivity (Laboratory)	mS/m	YE020CON	29,0	49,7	53,3	280	105	271	37,0	246	45,0
pH (Laboratory)		YE030pH	7,34	8,04	8,49	3,76	6,70	8,60	7,58	8,50	7,52
Total Hardness	mg CaCO ₃ /L	YE061H	119	120	133	1661	300	38,4	160	14,5	203
Calcium Hardness	mg CaCO ₃ /L	YE061H	49,0	49,7	56,2	804	139	38,0	102	9,64	115
Magnesium Hardness	mg CaCO ₃ /L	YE061H	70,0	70,0	76,6	857	161	0,41	58,5	4,90	88,9
Total Dissolved Solids (TDS)	mg/L	Calculation	156	280	301	2613	678	1631	204	1421	253
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	1,36	<0.45
Calcium	mg Ca/L	YE060ICP	19,6	19,9	22,5	322	55,7	15,2	40,7	3,86	45,9
Chloride	mg Cl/L	YE070AK	17,0	23,3	26,0	36,3	31,1	75,9	1,51	394	3,80
Magnesium	mg Mg/L	YE060ICP	17,0	17,0	18,6	208	39,0	0,10	14,2	1,19	21,6
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Potassium	mg K/L	YE060ICP	2,68	3,97	4,90	24,3	8,85	7,28	1,18	5,07	1,29
Sodium	mg Na/L	YE060ICP	11,7	59,9	62,2	81,4	117	621	18,4	571	17,6
Sulphate	mg SO ₄ /L	YE070AK	19,1	47,9	61,8	1891	327	270	3,62	7,89	27,3
Aluminium	mg Al/L	YE060ICP	<0.01	0,16	<0.01	23,6	0,06	1,83	<0.01	0,03	<0.01
Fluoride	mg F/L	YE070AK	<0.09	0,34	0,30	<0.09	0,27	2,91	<0.09	3,24	<0.09
Iron	mg Fe/L	YE060ICP	0,05	0,11	0,04	0,44	<0.01	0,74	0,02	0,04	<0.01
Manganese	mg Mn/L	YE060ICP	0,01	0,03	<0.01	25,6	0,05	0,07	<0.01	<0.01	0,03
Langelier Index (indicative, not SANS)		Calculation	-0.80	0,07	0,56	-18,11	-0.89	1,20	0,00	0,34	0,02
pHs (indicative, not SANS)		Calculation	8,14	7,97	7,93	21,87	7,59	7,40	7,58	8,16	7,50
Sodium Absorption Ratio (indicative)		Calculation	0,46	2,37	2,34	0,87	2,93	43,56	0,63	64,90	0,54
TDS to EC Ratio (indicative, not SANS)		Calculation	5,36	5,63	5,64	9,33	6,46	6,02	5,53	5,78	5,63
Corrosion Ratio (indicative, not SANS)		Calculation	0,51	0,51	0,61	108757411906,35	1,56	0,33	0,03	1,54	0,11
Ryznar Index (indicative, not SANS)		Calculation	8,94	7,90	7,37	39,98	8,49	6,21	7,58	7,81	7,48
Anion Sum			3,16	5,26	5,53	40,43	11,02	29,15	4,28	26,05	5,20
Cation Sum			2,98	5,14	5,51	41,17	11,36	28,20	4,05	25,33	4,89
Difference			-0,19	-0,12	-0,02	0,74	0,34	-0,95	-0,23	-0,72	-0,30
% Difference			-3,03%	-1,14%	-0,17%	0,91%	1,53%	-1,66%	-2,75%	-1,40%	-3,01%

Methods adapted to accommodate local laboratory conditions.

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YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11	SpGeo 12	SpGeo 13	SpGeo 14	SpGeo 15	SpGeo 16	SpGeo 17	SpGeo 18
SAMPLE DESCRIPTION			GAD-2s	GAD-1	GKL-9D	GKL-8M	GKL-5S	GKL-6M	MPS - S 14	MPS - S 20	MPS - S 21
SAMPLE NUMBER			E77450-010	E77450-011	E77450-012	E77450-013	E77450-014	E77450-015	E77450-016	E77450-017	E77450-018
SAMPLED		Test Method **	2024/10/09 10:49	2024/10/09 11:01	2024/10/09 12:38	2024/10/09 12:33	2024/10/09 12:18	2024/10/09 12:22	2024/10/09 09:13	2024/10/09 10:03	2024/10/09 09:35
Remarks			Brown	Brownish	Clear	Greyish	Clear	Brownish	Yellowish	Clear	Clear
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	47,2	127	134	135	190	136	1080	1147	43,0
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	47,2	127	134	135	156	136	1080	1080	43,0
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	33,6	0,00	0,00	67,2	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	47,2	127	134	135	174	136	1080	1113	43,0
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	16,8	0,00	0,00	33,6	0,00
Conductivity (Laboratory)	mS/m	YE020CON	15,1	26,0	22,6	26,1	35,5	25,3	307	354	769
pH (Laboratory)		YE030pH	7,56	7,28	7,80	7,58	8,43	7,73	7,82	8,24	7,54
Total Hardness	mg CaCO ₃ /L	YE061H	59,9	106	64,9	100	66,5	64,8	151	220	2767
Calcium Hardness	mg CaCO ₃ /L	YE061H	32,5	66,4	44,6	70,4	43,9	46,4	75,4	71,4	1391
Magnesium Hardness	mg CaCO ₃ /L	YE061H	27,4	39,8	20,3	30,0	22,6	18,3	75,4	149	1376
Total Dissolved Solids (TDS)	mg/L	Calculation	81,9	132	140	144	201	142	2121	2617	7790
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	0,52	<0.45	<0.45	<0.45	2,01	<0.45	2,41
Calcium	mg Ca/L	YE060ICP	13,0	26,6	17,9	28,2	17,6	18,6	30,2	28,6	557
Chloride	mg Cl/L	YE070AK	9,98	6,16	4,79	7,15	2,69	4,19	66,3	67,2	75,8
Magnesium	mg Mg/L	YE060ICP	6,66	9,66	4,92	7,28	5,48	4,45	18,3	36,2	334
Nitrate and Nitrite (TON)	mg N/L	YE070AK	3,64	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	0,36	<0.35
Potassium	mg K/L	YE060ICP	0,79	2,29	2,08	2,04	1,90	1,32	11,1	11,5	30,5
Sodium	mg Na/L	YE060ICP	5,54	10,6	28,7	16,3	58,6	29,9	782	930	1440
Sulphate	mg SO ₄ /L	YE070AK	1,30	<0.5	<0.5	1,62	<0.5	<0.5	560	850	5296
Aluminium	mg Al/L	YE060ICP	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0,16	<0.01
Fluoride	mg F/L	YE070AK	<0.09	<0.09	<0.09	<0.09	0,21	0,38	2,94	2,99	0,70
Iron	mg Fe/L	YE060ICP	0,21	0,37	0,08	<0.01	0,17	1,56	0,08	0,02	0,07
Manganese	mg Mn/L	YE060ICP	<0.01	0,14	0,08	0,09	0,02	0,15	0,06	0,09	27,1
Langelier Index (indicative, not SANS)	Calculation		-1,11	-0,67	-0,31	-0,33	0,45	-0,35	0,71	1,12	0,26
pHs (indicative, not SANS)	Calculation		8,67	7,95	8,11	7,91	7,98	8,08	7,11	7,12	7,28
Sodium Absorption Ratio (indicative)	Calculation		0,31	0,45	1,55	0,71	3,12	1,61	27,61	27,12	11,87
TDS to EC Ratio (indicative, not SANS)	Calculation		5,43	5,08	6,18	5,50	5,65	5,62	6,91	7,39	10,13
Corrosion Ratio (indicative, not SANS)	Calculation		0,61	0,14	0,10	0,16	0,04	0,09	0,44	0,55	69,07
Ryznar Index (indicative, not SANS)	Calculation		9,78	8,63	8,41	8,23	7,53	8,44	6,40	5,99	7,02
Anion Sum			1,52	2,72	2,82	2,94	3,89	2,86	35,31	42,76	113,39
Cation Sum			1,48	2,68	2,65	2,78	3,94	2,72	37,48	45,21	120,25
Difference			-0,04	-0,04	-0,17	-0,16	0,05	-0,14	2,17	2,45	6,86
% Difference			-1,30%	-0,68%	-3,04%	-2,75%	0,70%	-2,43%	2,98%	2,79%	2,94%

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CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 19
SAMPLE DESCRIPTION			MPS - S 30
SAMPLE NUMBER			E77450-019
SAMPLED	Test Method **		2024/10/09 09:19
Remarks			Greyish
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	617
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	617
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	617
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00
Conductivity (Laboratory)	mS/m	YE020CON	405
pH (Laboratory)		YE030pH	8,06
Total Hardness	mg CaCO ₃ /L	YE061H	376
Calcium Hardness	mg CaCO ₃ /L	YE061H	127
Magnesium Hardness	mg CaCO ₃ /L	YE061H	249
Total Dissolved Solids (TDS)	mg/L	Calculation	2978
Temperature	°C	Thermometer	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45
Calcium	mg Ca/L	YE060ICP	50,9
Chloride	mg Cl/L	YE070AK	72,7
Magnesium	mg Mg/L	YE060ICP	60,4
Nitrate and Nitrite (TON)	mg N/L	YE070AK	1,79
Potassium	mg K/L	YE060ICP	18,2
Sodium	mg Na/L	YE060ICP	836
Sulphate	mg SO ₄ /L	YE070AK	1559
Aluminium	mg Al/L	YE060ICP	0,01
Fluoride	mg F/L	YE070AK	2,78
Iron	mg Fe/L	YE060ICP	<0.01
Manganese	mg Mn/L	YE060ICP	0,09
Langelier Index (indicative, not SANS)		Calculation	0.92
pHs (indicative, not SANS)		Calculation	7.14
Sodium Absorption Ratio (indicative)		Calculation	18.68
TDS to EC Ratio (indicative, not SANS)		Calculation	7.35
Corrosion Ratio (indicative, not SANS)		Calculation	1.65
Ryznar Index (indicative, not SANS)		Calculation	6.21
Anion Sum			47,17
Cation Sum			44,40
Difference			-2,77
% Difference			-3,02%

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1.

QUARTERLY WATER QUALITY REPORT 2-2024

01 MAY 2024 TO 31 JULY 2024

**IWUL: Licence No. 08/C11B/AGJ/2141,
File No. 16/2/7/C112/C155, 2013**

Mooiplaats Colliery (Pty) Ltd

AUGUST 2024



DOCUMENT CONTROL

PROJECT	NAME	Mooiplaats Colliery (Pty) Ltd. IWUL Surface and Groundwater Monitoring
REPORT	TITLE	Quarterly Water Quality Report 2-2024 01 May 2024 - 31 July 2024 Mooiplaats Colliery (Pty) Ltd. August 2024
REPORT STATUS		FINAL
DATE		August 2024
REFERENCE NUMBER		MC-QWQR 2-2024
PROJECT TEAM		Louis Marais
REVIEWER		Adri Joubert
CONTACT DETAILS		082 926 8460 (CELL)
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*The original document is signed and stored in the offices of Geo Soil and Water cc,
15a Midas Street, Olympus, South Africa*



ABBREVIATIONS

AMD	Acid Mine Drainage
Ag	Silver
Al	Aluminium
As	Arsenic
AWQR	Annual Water Quality Report
BDL	Below detection limit
BH	Borehole
BPG	Best Practice Guideline
Ca	Calcium
Cd	Cadmium
Cl	Chloride
CoC	Chain of Custody
COD	Chemical Oxygen Demand
Co	Cobalt
Cr6+	Hexavalent Chrome
CSIR	Council for Scientific and Industrial Research
Cu	Copper
DEA	Department of Environmental Affairs
DMRE	Department of Mineral Resources and Energy
DRO	Diesel Range Organics
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
F	Fluoride
Fe	Iron
GC-MS	Gas Chromatography Mass Spectrometer



GD-VO	Grootdraai Dam Guidelines - Vaal Origin Catchment
GPS	Global Positioning System
GRO	Gasoline Range Organics
GSW	Geo Soil & Water (Pty) Ltd GSW
GW	Groundwater
HCO ₃ ⁻	Bicarbonate
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
IWUL	Integrated Water Use License
K	Potassium
mamsl	metres above mean sea level
mbgl	metres below ground level
Mg	Magnesium
mg/l	milligram per litre
Mn	Manganese
mg/L	Milligrams per Liter
MPN	Mooiplaats Colliery North
MPS	Mooiplaats Colliery South
Na	Sodium
NEMA	National Environmental Management Act (Act No. 107 of 1998)
Ni	Nickel
NO ₃ ⁻	Nitrate
NWA	National Water Act (Act No. 36 of 1998)
ORP	Oxidation Reduction Potential
Pb	Lead
QWQR	Quarterly Water Quality Report
RQO	Resource Quality Objective
SANAS	South African National Accreditation System
SANS	South African National Standard
SAR	Sodium Absorption Ratio
Se	Selenium



SO₄

Sulphate

TDS

Total Dissolved Solids

WGS 84

World Geodetic System 1984

WUL

Water Use License

Zn

Zinc



DEFINITIONS

Acid Mine Drainage

Acid Mine Drainage (AMD) refers to the outflow of acidic water from metal or coal mines due to the oxidation of sulphide minerals.

Anions

Ions with a net negative charge. Examples: OH⁻, O²⁻, SO₄²⁻, Alk (HCO₃⁻), Cl⁻, etc. The Bicarbonate (HCO₃⁻) ion is the largest component of Alkalinity.

Artesian borehole

Boreholes that penetrate confined aquifers, in which the piezometric surface is above ground level, so that the boreholes spontaneously discharge water without being pumped.

Aquifer vulnerability

Tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer.

Borehole

Includes a well, excavation, or any other artificially constructed or improved underground cavity which can be used for the purpose of intercepting, collecting, or storing water in or removing water from an aquifer; observing and collecting data and information on water in an aquifer; or recharging an aquifer. Source: National Water Act (Act No. 36 of 1998).

Cations

Ions with a net positive charge. Examples: Ca⁺, Mg⁺, Na⁺, K⁺, Fe²⁺.

Compliance monitoring

Monitoring done in compliance with permit or license conditions.

Contamination

Substances that make it impure and unfit for consumption or an intended use and can cause harm to human health or the environment. Contaminants can be naturally occurring or caused by humans.



Data interpretation

The analysis of data to obtain information concerning the groundwater system which in turn can be used to manage/remediate the system.

Data management

The effective use of the data while ensuring its integrity and providing a centralized repository for storage.

Drawdown

The distance between the static water level and the surface of the cone of depression.

Environment

The external circumstances, conditions and objects that affect the existence and development of an individual, organism, or group. These circumstances include biophysical, social, economic, historical, cultural, and political aspects. 'Environment' is described as the surroundings within which humans exist and is made up of:

- the land, water, and atmosphere of the earth,
- micro-organisms, plant, and animal life,
- any part or combination of (i) and (ii) and the interrelationships among and between them; and
- the physical, chemical, aesthetic, and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Groundwater Flow

The movement of water through openings in sediment and rock; occurs in the zone of saturation in the direction of the hydraulic gradient.

Groundwater modelling

Numerical representation of a groundwater flow system that attempts to mimic the natural processes in nature. It is a simplified version of a natural system, compiled with geological, hydrogeological, hydrological, and meteorological data, which utilises a governing equation to incorporate all this data to simulate the hydraulic properties of the groundwater system.

Hydrocensus

Gathering of hydrogeological information through field measurements.



Hydrogeology

The study of the interrelationships of geologic materials and processes with water, especially groundwater.

Impact Assessment

A formal process used to predict the environmental consequences (positive or negative) of a plan, policy, program, or project prior the implementation decision, it proposes measures to adjust impacts to acceptable levels or to investigate new technological solution.

Infiltration

The downward movement of water from the atmosphere into the ground.

Leaching

The process by which soluble materials in the soil, such as salts, nutrients, pesticide chemicals, or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

Monitoring Programme

A programme for taking regular measurements of the quantity and/or quality of a water resource, waste, or wastewater discharge at specified intervals and at specific locations to determine the chemical, physical and biological nature of the water resource, waste, or wastewater discharge.

Piezometric surface

An imaginary or hypothetical surface of the piezometric pressure or hydraulic head throughout all or part of a confined or semi-confined aquifer; analogous to the water table of an unconfined aquifer.

Plume

An underground pattern of contaminant concentrations in groundwater created by the movement of groundwater beneath a contaminant source. Contaminants spread mostly laterally in the direction of groundwater movement. The source site has the highest concentration, and the concentration decreases away from the source.



Recharge

Water added to a groundwater aquifer. For example, when rainwater seeps into the ground. Recharge may occur naturally through precipitation or surface water or artificially through injection wells or by spreading water over groundwater reservoirs. See also infiltration.

Reserve

The quantity and quality of water required to supply basic needs of people to be supplied with water from that resource, and to protect aquatic ecosystems in order to secure ecologically sustainable development and use of water resources. This is a unique water resource management requirement of South African legislation.

Resource Quality Objectives

Used to put a Classification and Reserve into practice by specifying conditions that will ensure that the Class is not compromised, and the Reserve can be met. Resource quality may relate to critical flows, groundwater levels and quality that must be maintained.

Sampling and monitoring controls: Control measures to demonstrate the accuracy (how close to the real result you are) and precision (how reproducible your results are) of your monitoring.

STIFF Diagram

A graphical representation or fingerprint of chemical analyses displaying the major ion composition of a water sample. A polygonal shape is created from three parallel horizontal axes extending on either side of a vertical zero axis. Cations are plotted in mill equivalents per liter on the left side of the zero axis, one to each horizontal axis, and anions are plotted on the right side. Stiff patterns are useful in making a rapid visual comparison between water from different sources.

Transmissivity

The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is expressed as the product of the average hydraulic conductivity and thickness of the saturated portion of an aquifer.

Water Quality

The physical, chemical, toxicological, biological (including microbiological) and aesthetic properties of water that determine sustained (1) healthy functioning of aquatic ecosystems



and (2) fitness for use (e.g., domestic, recreational, agricultural, and industrial). Water quality is therefore reflected in (a) concentrations or loads of substances (either dissolved or suspended) or micro-organisms, (b) physic-chemical attributes (e.g., temperature) and (c) certain biological responses to those concentrations, loads or physic-chemical attributes.

Water Resource

A water resource includes any watercourse, surface water, estuary, or aquifer. Watercourses include rivers, springs, and natural perennial and non-perennial channels, wetlands, lakes, dams, or any collection identified as such by the Minister in the Government Gazette.

Water Use License

An authorisation from the Department of Water and Sanitation to a designated water user to use water. The authorisation will provide details on the timeframes and conditions for the designated water use.



EXECUTIVE SUMMARY

Mooiplaats Colliery (Pty) Ltd (Mooiplaats) appointed Geo Soil & Water (Pty) Ltd (GSW) to conduct water sampling, water quality analyses and water quality reporting at Mooiplaats in accordance with the requirements of the 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).

The reporting period is from 01 May 2024 - 31 July 2024.

Water qualities were compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.

The monitoring network provides information for risk-based decision making to Mooiplaats management with regard to effectiveness of pollution prevention measures and areas requiring management attention.

The following is a summary of the results:

Note: Removing coal from underground / mining ceased on 31 December 2021, with only the coal washing plant being operational currently.

Wastewater - Water quality from the mine water/pollution control dams exceeded limits in terms of EC, TDS, CaCO₃, Ca, Mg, Cl, SO₄, Fe, and Mn - typical of water associated with coal washing/mining activities. Wastewater is contained in storage facilities and circulated in a closed circuit. The pH of process / wastewater should be closely monitored and managed to prevent damage to water infrastructure.

Witpuntspruit – Although historic pollution from upstream of Mooiplaats is still evident, variable concentrations deteriorated towards downstream due to the inflow from **WT-S05**, and the **Usuthu decant** between **WT-S04** and **WT-S06** indicating that current and historical activities have a detrimental effect on this Spruit, which will have a long-term negative effect on the downstream environment of the Vaal River system.

Vaal River – A continuous deterioration was recorded after the confluence of the Witpuntspruit with the Vaal River (between **VL-S01** and **VL-S02**). The increase / variation in



variable concentrations during the reporting period can be ascribed to the addition of variables from the Witpuntspruit drainage.

Although Fe exceeded the IWUL limits, concentrations remained low, relative consistent, and in line with historical trends, from upstream to downstream indicating the presence might possibly be geological / natural.

Groundwater - Outside the mining right area, water quality remains stable and of good quality, with slight seasonal fluctuations. Neutral to high neutral pH values, Alkalinity (CaCO_3), and Ca concentrations indicate geological conditions. The movement of pH values, EC concentrations and variables associated with geology indicate the consistent recharge of natural groundwater without mining impacts.

Groundwater levels continued to fluctuate according to seasonal factors and not due to mining impacts.



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This report has been prepared by Geo Soil and Water cc (GSW), using information provided by the client as well as third parties, which information has been presumed to be correct. While GSW has made every endeavour to supply accurate information, and exercised all care, skill, and diligence in the drafting of this report, errors and omissions may occur. Accordingly, GSW does not warrant the accuracy or completeness of the materials in this report. GSW does not accept any liability for any loss or damage which may directly or indirectly result from any advice, opinion, information, representation, or omission, whether negligent or otherwise, contained in this report, including the use and interpretation of this report by the client, its officials, or their representative agents.

1. INTRODUCTION

1.1 Scope of Work

Mooiplaats Colliery (Pty) Ltd (Mooiplaats) appointed Geo Soil & Water (Pty) Ltd to conduct water sampling, water quality analyses and water quality reporting at Mooiplaats in accordance with the requirements of the 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).

Various activities of an anthropogenic nature take place in South Africa's riverine environments. As custodian of the natural water resources, it is an integral function of the Department of Water and Sanitation (DWS) to manage the effects of these activities on the country's water resources.

Water quality monitoring is a mandatory requirement, stipulated in the National Water Act (1998) and forms an integral part of the auditing requirements in terms of the Mineral and Petroleum Resources Development Act (2002) (MPRDA). The MPRDA, Section 39 (1) (2) (3) stipulates that each mine in possession of a mining right must conduct an Environmental Impact Assessment (EIA) and prepare an Environmental Management Program (EMP) of which a monitoring and report auditing process is an integral part of.

The NWA provides for the development of regulations to, amongst others:

- Require that the use of water from a water resource be monitored, measured, and recorded,



- Regulate or prohibit any activity in order to protect a water resource or in-stream or riparian habitat, and
- Prescribe the outcome or effect, which must be achieved through management practices for the treatment of waste, or any class of waste before it is discharged into or allowed to enter a water resource.

In order to reach the above-mentioned objectives monitoring systems need to be established, according to Section 137 (2) and implemented to assess, among others:

- Quality of water resources,
- Use and rehabilitation of water resources,
- Compliance to resource water quality objectives, and
- Health of aquatic ecosystems.

1.2 Purpose of Monitoring Report

As part of the commitments made in the Environmental Management Programme Report (EMPR) and conditions set out in the IWUL, surface - and groundwater monitoring will be implemented and quarterly reports, reflecting the results, submitted to the DWS.

GSW was commissioned by Mooiplaats to implement and conduct surface - and groundwater monitoring as prescribed in the IWUL, 2013. Surface and groundwater water monitoring points are sampled on a monthly and quarterly basis.

The results of the monitoring report are used to inform Mooiplaats management of the impact from mining activities on water resources, the effectiveness of mitigation measures and the potential need to improve water resource impact prevention measures.

With regular and accurate monitoring of resources a comprehensive management system interprets and assists in pollution prevention, pollution management, the determination, improvement, or deterioration of the receiving and surrounding resources.

1.3 Approach to Study

This report investigates and provides summarised information of the monitoring system and various monitoring points at Mooiplaats Colliery. The work done during the monitoring period of the contract included:



Routine monitoring:

- **May 2024 to July 2024** - **IWUL water monitoring:**
- Monthly Surface water monitoring,
- Quarterly Groundwater Monitoring, and
- Quarterly Groundwater Level Monitoring.

2. PROJECT BACKGROUND INFORMATION

Mooiplaats operates an underground mine on Portions 1 and 9 of the Farm Mooiplaats 290IT, approximately 20 km east of Ermelo in the Mpumalanga Province, South Africa. The relevant infrastructure consists of a wash plant, pollution control dams, co-disposal dump, offices, workshops, weighbridge, diesel bowsers, coal stockpiles, overburden stockpiles, etc. Wastewater is contained in storage facilities and circulated in a closed circuit.

Mooiplaats received a Mining Right MP 30/5/1/2/2/68 MP, 2007 (MR) and was granted an Integrated Water Use Licence No. 08/C11B/AGJ/2141, File No: 16/2/7/C112/C155 dated 02 May 2013 (IWUL), from the Department of Water and Sanitation in accordance with the National Water Act, 1998 (NWA).

2.1 Location

Mooiplaats is situated on Portions 1 and 9 of the Farm Mooiplaats 290IT, in the magisterial district of Ermelo, within the Msukaligwa Local Municipality, situated in the Gert Sibande District Municipality. Refer to **Figure 1**.

2.2 Catchment, Rainfall Supply and Use and Surrounding Activities

Mooiplaats is situated in the Upper Vaal Catchment Management Area (WMA), within the C11B quaternary catchment. Several streams, wetlands and springs are located in the area which drains south and east towards the Witpuntspruit and Vaal River, within the Grootdraai Dam / Upper Vaal Catchment.

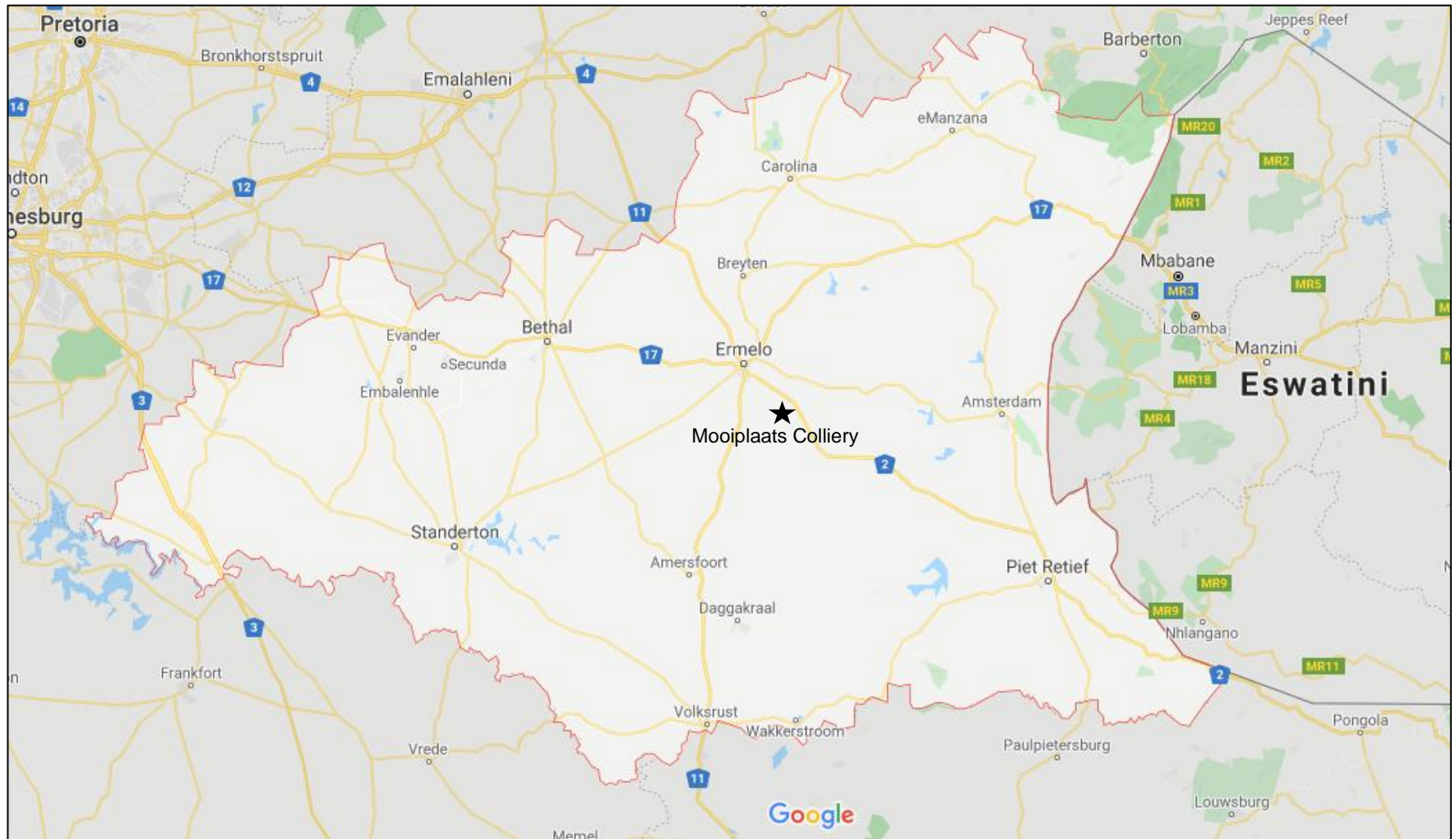


Figure 1: Locality map.



The Witpuntspruit is heavily modified due to the impact of previous and current mining activities. Well known decant water enters the Humanspruit, which enters the Witpuntspruit and eventually, the Vaal River which may have a detrimental effect on downstream users. The Witpuntspruit passes Mooiplaats and joins the Vaal River.

“The Upper Vaal water management area lies in the eastern interior of South Africa. From a water resources management perspective, it is a pivotal water management area in the country. Large quantities of water are transferred into the area from two neighbouring areas, as well as water sourced from the Upper Orange River via Lesotho. Similarly, large quantities of water are transferred out to three other water management areas, which are dependent on water from the Upper Vaal water management area to meet much of their requirements.

Extensive urbanisation and mining and industrial activity, which relate to the rich gold and coal deposits in the area, occur in the northern part of the water management area. Economic activity in the remainder of the Upper Vaal water management area mainly relates to livestock farming and rain fed cultivation.

Because of the high level of urbanisation and economic activity in the area and its pivotal role as a water transfer point to other water management areas, water resources in the area are highly developed and regulated, and only marginal potential for further development remains. The total yield transferred into the catchment is in excess of 120 per cent of the yield from local surface resources, while virtually the same quantity of water is again transferred out of the area. Groundwater is mainly used for rural domestic needs and for stock watering, while a substantial quantity of water is also abstracted from dolomitic aquifers for urban use.

The Upper Vaal water management area is highly developed and impacted upon by human activity. The quantities of water transferred into and out of the area are largely dictated by the population needs and economic activity in this as well as similar needs in other recipient water management areas.

Water quality in the Vaal River and in some tributaries downstream of Vaal Dam is seriously affected by urban and industrial and mining return flows and the intensive mining activity. The water resources are therefore carefully managed to maintain acceptable water quality standards. Particular attention is also to be given to the impacts that closure of mines may have on both surface and groundwater.” DWS, 2004.



2.3 Summary of Previous Studies

Several studies have been and are being conducted as part of impact determination in terms of the water resources. Studies include:

- Surface and Groundwater Monitoring,
- Groundwater Study, 2011.
- Mooiplaats Annual Water Quality Report 2019. GSW 2019,
- Mooiplaats Annual Water Quality Report 2020. GSW 2020,
- Mooiplaats Annual Water Quality Report 2021. GSW 2022.
- Mooiplaats Annual Water Quality Report 2022. GSW 2023.

Abstract from “Mooiplaats North Colliery geology and groundwater study.” Fourie, 2011.

Geology baseline

The B Upper seam is well developed throughout the succession and is the only seam which is considered to be economically viable. Because of the depth of this reserve only underground mining methods are proposed.

Within the mine layout the thickness of the seam range between 1.5 - 2.9 m, averaging at 2.1 m. The depth of the coal seam roof within the mine layout ranges between 40 - 165 meters below surface (mbs), averaging at 115 mbs.

Several dolerite dykes and sills have been identified in the area. A major dyke is present between MPN and the old Usutu underground workings. A sill breakthrough also occurs between MPN and MPS. This has resulted in the compartmentalisation of the MPN underground workings as the dolerite will form no-flow boundaries with relation to inter-mine flow. Drilling has been performed in order to target the dolerite between MPN and Usutu. The drilling results were incorporated into the groundwater study.

The geophysical survey confirmed the presence of a dyke between the Usutu and MPN underground mines, as well as the approximate depth of the dyke. The dyke was targeted with 6 boreholes. These boreholes will monitor the groundwater level and quality between the two mines, as well as any potential impact (on the aquifer) caused by pumping of the Usutu mine water by MPN. MBV-2A is the closest to the pumped borehole MS-B7 and shows a slight depletion in groundwater level.



Groundwater baseline

Geohydrological drilling and groundwater field work was completed in April 2011. Field work included measurements of the water levels, as well as slug testing of all monitoring boreholes. A hydro-census within at least 1 km buffer zone around MPN was performed in order to identify the presence and status of existing boreholes and fountains, as well as groundwater use in the area. A total of 10 external users' boreholes were surveyed that are located around MPN, near homesteads, or present in the farming field. Of the 10 boreholes only 2 external user boreholes (WT-B1 and MS-B4) are currently in use for domestic (for a guesthouse) and stock watering purposes, respectively. This indicates the low level of groundwater use in the area. A total of 3 fountains were included in the survey. Two of them (WT-F1 and F2) are used for domestic and stock watering purposes, respectively.

Hydro-chemical samples were taken from all monitoring boreholes and several external users' boreholes and fountains. Overall, the groundwater in the area is of good quality with only 1) the Usutu monitoring borehole that has non-compliant concentration of Na and F, as well as marginally elevated SO₄, and 2) a slightly elevated SO₄ in one plant monitoring borehole. The background groundwater could be classified as Na(Ca)-CO₃ dominated water. Groundwater with SO₄ contamination could be distinguished from the background groundwater as SO₄ becomes the dominant anion. Any future mining impact could therefore easily be identified.

The hydraulic conductivity for the shallow weathered aquifer, the deep fractured aquifer and alluvium/soils were determined from slug tests at Mooiplaats North and Mooiplaats South. The chosen hydraulic conductivity used for groundwater modelling is taken as 0.03 m/d, 0.007m/d and 4 m/d, respectively.

The Karoo Formation aquifer of the Mooiplaats area can in general be classified as a low yielding aquifer. It does have a viable exploitation potential for domestic and stock-watering application and as such is the main water resource for these applications to the farming communities in the area. The aquifers will however not support formal irrigation application over any extensive area (> 10 ha). The shallow weathered aquifer can therefore be classified as a minor aquifer system in terms of aquifer management.

Groundwater impact assessment

The impact on the geohydrology has been assessed by means of a numerical groundwater model for the MPN area.



The objective of the groundwater flow and transport model was to quantify the impact of mining on the following aspects:

- Influx of groundwater into mine workings,*
- Inter-mine flow between adjacent mines,*
- Impact on external users' boreholes,*
- Impact on fountains and stream base flow,*
- Impact of pumping/groundwater use,*
- Development of pollution plume in aquifer down-gradient of the plant area.*

No significant impact will be presented by the bord-and-pillar mine towards the adjacent mining as the MPN is significantly compartmentalised by sills.

The MPN will also have a negligible impact on external users' boreholes and base flow to streams and fountains. As a worst case the mine may have a small impact on MS-B4 (windpump of Mr Klopper). The depth of this borehole was however not available, and the impact is uncertain.

Pumping of Usutu East by MPN will have no adverse effect for Usutu both in terms of the mine water quality and quantity. With respect to both the pumping may actually have a beneficial effect as decanting of Usutu is prolonged and the mine water quality will probably improve.

The most significant impact of MPN relates to the potential plume development down-gradient of the co-disposal facility after closure. The plume will eventually reach the Witpuntspruit tributary. The following comments relate to the seepage water quality:

- The co-disposal will show an increase in the total dissolved solids with SO_4 as the dominant anion and will most likely acidify after closure; and*
- Significant elevation of Al, Fe and Mn will occur. Other metals such as Cd, Sb and Se may also be present in seepage but most probably not at non-compliant concentrations.*

From the model it was calculated that the contamination plume will not develop further than about 100 - 200 m horizontally from the mine boundary within one hundred years after closure. The following relates to the mine water quality:

- The underground mine water will show an increase in the total dissolved solids with SO_4 as the dominant anion but will most likely not acidify; and*



- *No significant elevation of metals will occur in the near-neutral mine water.*

An important management measure during the operational and post-closure phase is the establishment of a groundwater monitoring system in order to detect any impact on the groundwater environment.

Monitoring of the impact on the groundwater relates to the following:

- *Development of cones of depression around the mine.*
- *Influxes of groundwater into the underground mine workings.*
- *Possible impact on the water levels and yields of external users' boreholes and fountains for at least a 1 km buffer zone around any old or active mine working.*
- *Possible depletion of groundwater base flow towards streams.*
- *Mine water levels in the underground mine."*

2.4 Information and Knowledge Gaps

The following are areas of uncertainty:

- The design of some of the monitoring boreholes and drill information (e.g., casing depth, perforated casing depth, drill water strike depth, lithology, and slug test results),
- Complete geophysical information on preferred flow paths; and
- The effect of local farming and associated contaminants.
- All possible pollution sources caused by current and historical mining. The extent / presence of informal historical mining in the catchment.
- Pre-mining / Baseline water quality.
- The impact from current upstream mining activities and industries.

3. OBJECTIVES OF THE MONITORING PROGRAMME

3.1 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.

4. TERMS OF REFERENCE

Water qualities were compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.

4.1 Changes/Additions in/to Monitoring Network.

Fourteen (14) surface water monitoring points and nine (9) groundwater monitoring points are included in the IWUL.

Several additional surface and groundwater monitoring points are sampled on an ad hoc, monthly, and / or quarterly basis, depending on need/request.

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

At surface water, Total Hardness, Alkalinity, Potassium and Nitrate are analysed additionally and at the groundwaters, Total Dissolved Solids, Total Hardness, Alkalinity, Potassium, Ammonia, Aluminium, Iron and Manganese are analysed additionally.

4.2 Surface Water

Surface water monitoring points are sampled on a monthly basis for quality, as prescribed in the IWUL. Refer to **Annexure A** for in-field sampling sheets.



Fourteen (14) IWUL surface water monitoring points are included in the water monitoring programme.

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

Figure 3 displays 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.

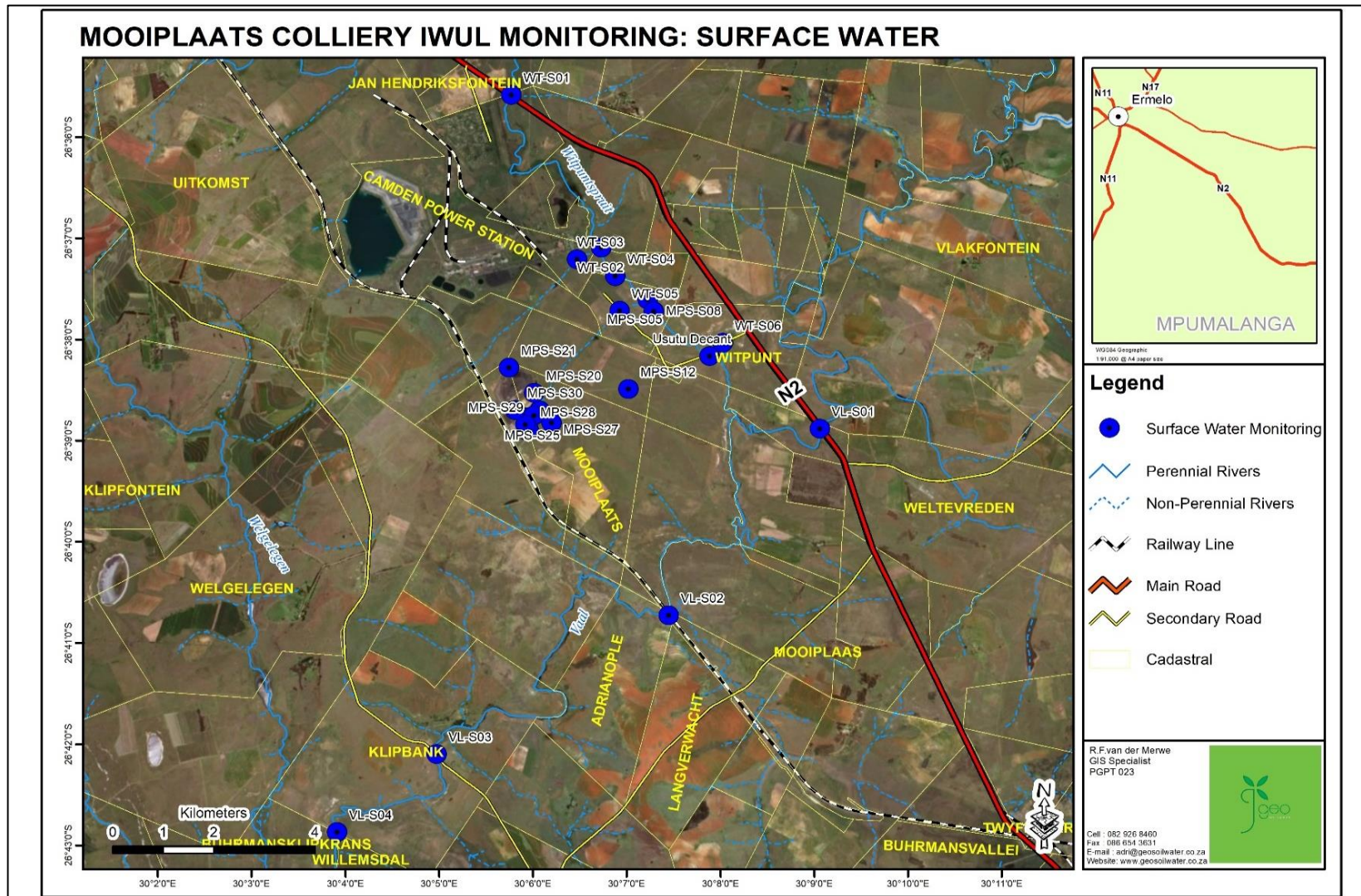


Figure 2 Location of surface water monitoring points.



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°	Ad Hoc
MPS-S12	Witpuntspruit Tributary @ Access Road	S26.64150° E30.11697°	Ad Hoc
MPS-S13	Runoff from Loading Area	S26.64837° E30.09888°	Ad Hoc
MPS-S14	Gen-sub PCD	S26.64616° E30.09890°	Monthly
MPS-S15	Stormwater trench @ Security	S26.64837° E30.09888°	Ad Hoc
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°	Ad Hoc
MPS-S27	Witpuntspruit Tributary entering MP	S26.64716° E30.10336°	Ad Hoc
MPS-S28	Confluence of MPS-S13 and MPS-S15	S26.64808° E30.09925°	Ad Hoc
MPS-S29	Storm water @ Offices	S26.64743° E30.09802	Ad Hoc
MPS-S30	Plant PCD	S26.64508° E30.09674°	Monthly
MPS-S31	Decant from Old Usutu Workings decanting into the Witpuntspruit Upstream of WT-06 – via surface .	S26.63611°E30.13139°	Ad Hoc
MPS-S32	Decant from Old Usutu Workings decanting into the Witpuntspruit Upstream of WT-06 – in cement sump	S26.63611°E30.13139°	Ad Hoc
	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



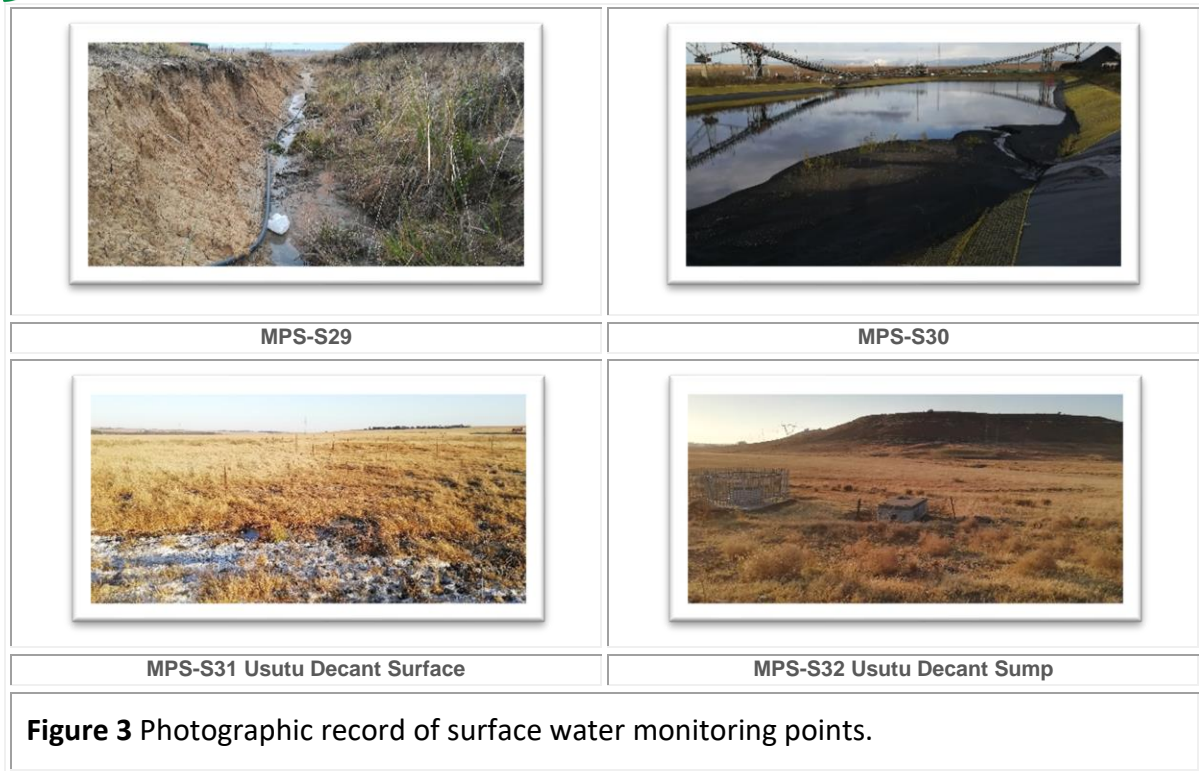
MPS-S25



MPS-S27



MPS-S28



4.3 Groundwater

Groundwater monitoring points are sampled on a quarterly (for levels and quality) basis, as prescribed in the IWUL. Refer to **Annexure A** for in-field sampling sheets.

Nine (9) IWUL groundwater monitoring points are included in the monitoring programme.

Figure 4 indicates the positions of the groundwater monitoring points relative to Mooiplaats and water resources.

Figure 5 displays 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.

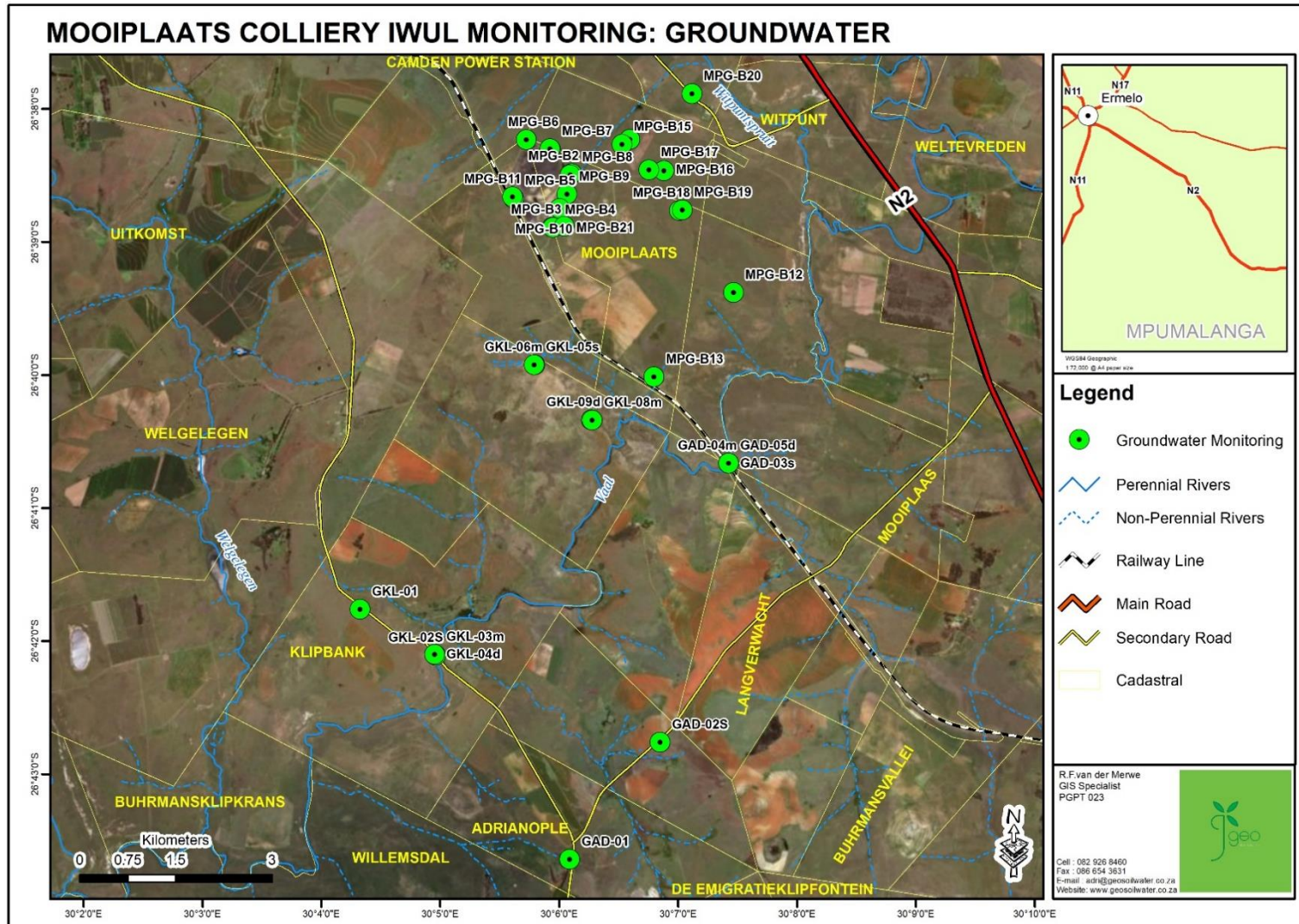


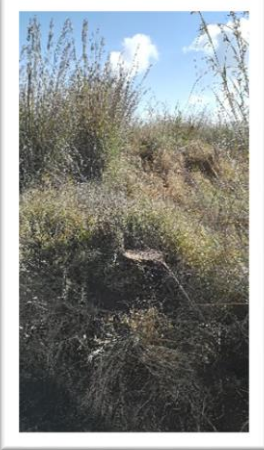
Figure 4 Location of groundwater monitoring points.


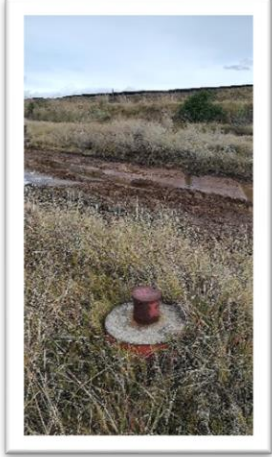







Table 2 Summary of groundwater monitoring points.

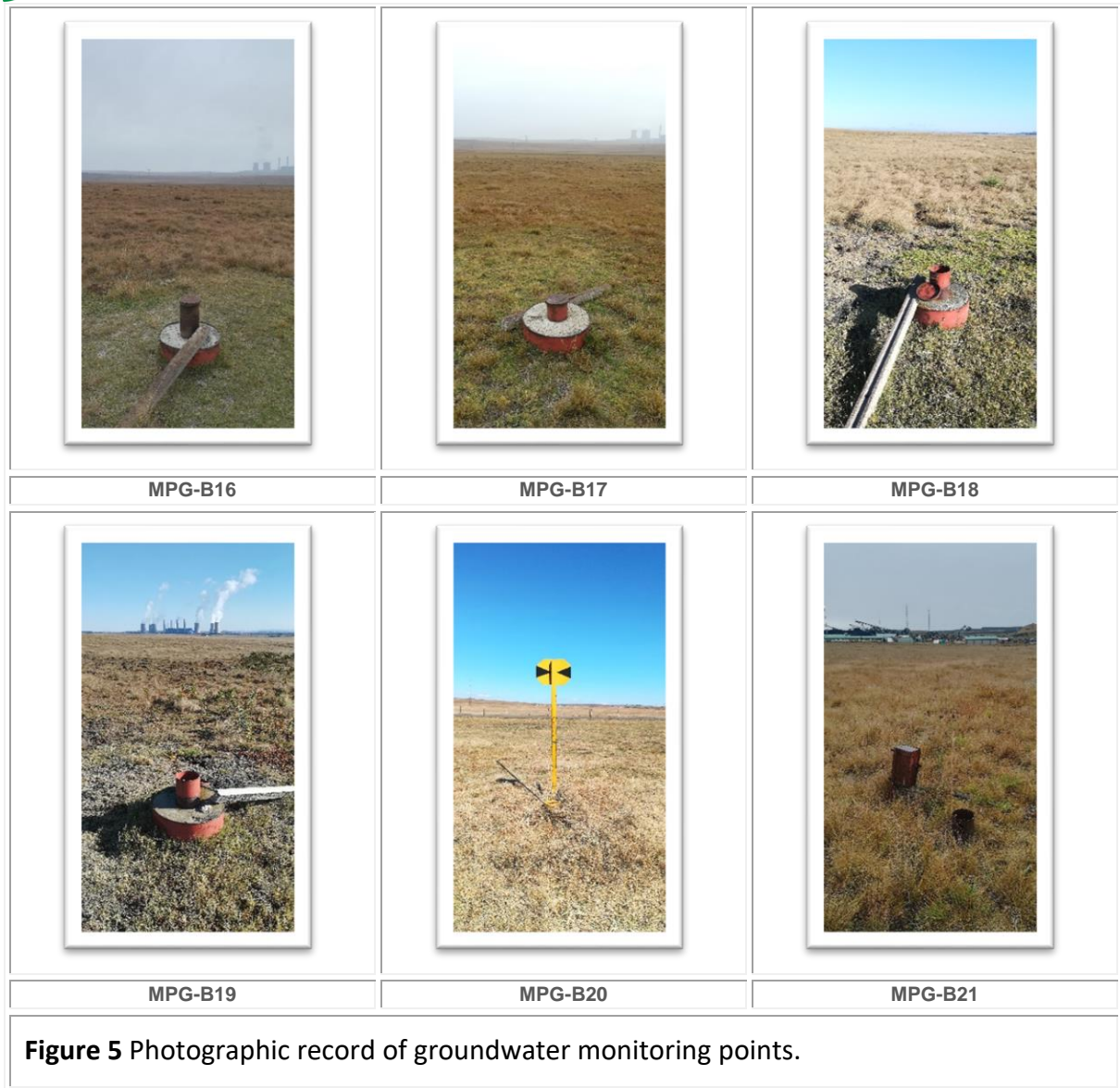
Mooiplaats Colliery Groundwater Monitoring Programme			
Groundwater Monitoring Points			
Locality	Locality Description	Coordinates WGS 84 ddd.ddddd	Monitoring Frequency
GKL-1	IWUL Borehole – Outer perimeter borehole	S26.69603° E30.07208°	Quarterly
GKL-4d	IWUL Borehole – Outer perimeter borehole	S26.70167° E30.08253°	Quarterly
GKL-3m	Borehole – Outer Perimeter borehole	S26.70178° E30.08269°	Ad Hoc
GKL-2s	IWUL Borehole – Outer perimeter borehole	S26.70178° E30.08269°	Quarterly
GAD-2s	IWUL Borehole – Outer perimeter borehole	S26.71269° E30.11414°	Quarterly
GAD-1	IWUL Borehole – Outer perimeter borehole	S26.72733° E30.10144°	Quarterly
GKL-9D	IWUL Borehole – Outer perimeter borehole	S26.67231° E30.10450°	Quarterly
GKL-8M	IWUL Borehole – Outer perimeter borehole	S26.67233° E30.10464°	Quarterly
GKL-5S	IWUL Borehole – Outer perimeter borehole	S26.66542° E30.09647°	Quarterly
GKL-6M	IWUL Borehole – Outer perimeter borehole	S26.66542° E30.09658°	Quarterly
GKL-7D	Outer perimeter borehole	S26.66542° E30.09658°	Ad Hoc
GAD-3s	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
GAD-4m	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
GAD-5d	Borehole – Outer Perimeter borehole	S26.67772° E30.12374°	Ad Hoc
MPG-B1	Down gradient (north) of the co-disposal facility.	S26.63843° E30.09878°	Ad Hoc
MPG-B2	Down gradient (east) of the lined Settling Dams and co-disposal.	S26.64143° E30.10175°	Ad Hoc
MPG-B3	Near the security gate.	S26.64816° E30.09905°	Ad Hoc
MPG-B4	Near the security gate.	S26.64819° E30.09910°	Ad Hoc
MPG-B5	Up-gradient (south-west) of the plant area next to the railway line.	S26.64457° E30.09363°	Ad Hoc
MPG-B6	Adjacent to the return water dam.	S26.63719° E30.09540°	Ad Hoc
MPG-B7	Down gradient (north) of the co-disposal facility.	S26.63832° E30.09870°	Ad Hoc
MPG-B8	Down gradient (east) of the lined Settling Dams.	S26.64160° E30.10155°	Ad Hoc
MPG-B9	Down gradient (east) of the plant area.	S26.64403° E30.10107°	Ad Hoc
MPG-B10	Down gradient (east) of the plant area.	S26.64581° E30.10007°	Ad Hoc
MPG-B11	Up-gradient (south-west) of the plant area next to the railway line.	S26.64435° E30.09344°	Ad Hoc
MPG-B12	At MPN Vunene extension	S26.65633° E30.12443°	Ad Hoc
MPG-B13	South of the mine next to the railway line.	S26.66689° E30.11329°	Ad Hoc
MPG-B14	Between Usutu/MPN	S26.63716° E30.10992°	Ad Hoc
MPG-B15	Between Usutu/MPN	S26.63778° E30.10881°	Ad Hoc
MPG-B16	Between Usutu/MPN	S26.64106° E30.11469°	Ad Hoc
MPG-B17	Between Usutu/MPN	S26.64095° E30.11259°	Ad Hoc
MPG-B18	Between Usutu/MPN	S26.64608° E30.11685°	Ad Hoc
MPG-B19	Between Usutu/MPN	S26.64600° E30.11725°	Ad Hoc
MPG-B20	Usutu UG. Borehole intersecting mine at 90 m	S26.63144° E30.11860°	Ad Hoc

Mooiplaats Colliery Groundwater Monitoring Programme			
Groundwater Monitoring Points			
Locality	Locality Description	Coordinates WGS 84 ddd.ddddd	Monitoring Frequency
	Additional Monitoring Points		
	IWUL Monitoring Points		

		
GKL-1	GKL-2s GKL-3m GKL-4d	GKL-5s GKL-6m GKL-7d
		
GKL-8m	GKL-9d	GAD-1

		
<p>GAD-2S</p>	<p>GAD-3S</p>	<p>GAD-4M</p>
		
<p>GAD-5D</p>	<p>MPG-B1</p>	<p>MPG-B2</p>
		
<p>MPG-B3</p>	<p>MPG-B4</p>	<p>MPG-B5</p>

		
<p align="center">MPG-B6</p>	<p align="center">MPG-B7</p>	<p align="center">MPG-B8</p>
		
<p align="center">MPG-B9</p>	<p align="center">MPG-B10</p>	<p align="center">MPG-B11</p>
		
<p align="center">MPG-B13</p>	<p align="center">MPG-B14</p>	<p align="center">MPG-B15</p>



5. METHODOLOGY

The following is a description of the sampling protocol, analyses, and reporting of the Mooiplaats monitoring programme.

5.1 Sampling Protocol

GSW is responsible for the sampling of the monitoring points, the assessment evaluation and report writing. Yanka Laboratories (Pty) Ltd (Yanka) with SANAS Accreditation Number T0647 performs the physical and chemical analyses.



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 (BPGs) for water quality management in the South African mining industry. This series of BPGs forms a component of the overall source directed water policy for mining and related activities implemented by the DWAF. 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.

5.2 Surface water

For chemical analyses, a 1000 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 occurred at fourteen (14) IWUL water monitoring points and zero (0) additional points.

Monthly surface water samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity CaCO₃/L
- Ca mg/L



- Mg mg/L
- Na mg/L
- K mg/L
- F mg/L
- Cl mg/L
- SO₄ mg/L
- NO₃ mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH₃ mg/L

5.3 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 occurred at nine (9) groundwater monitoring points, nine (9) IWUL points on a quarterly basis and zero (0) additional points (during this reporting period).

Water levels were monitored on a quarterly basis.

Groundwater samples are analysed for:

- pH
- EC mS/m
- TDS mg/L
- Total Hardness mg/L
- Alkalinity CaCO₃/L
- Ca mg/L
- Mg mg/L
- Na mg/L



- K mg/L
- F mg/L
- Cl mg/L
- SO₄ mg/L
- NO₃ mg/L
- Al mg/L
- Fe mg/L
- Mn mg/L
- NH₃ mg/L

5.4 Water levels

Groundwater levels at nine (9) monitoring points are recorded on a quarterly basis, using an electronic water level meter with a probe.

5.5 Water sample analyses

Both, surface - and groundwater samples are submitted to Yanka for physical and chemical analyses. Surface - and groundwater samples are analysed for variables as described in **Sections 5.2** and **5.3**.

5.6 Reporting

The quarterly, biannual, and / or annual surface - and groundwater assessments are compiled and evaluated by a registered Pr.Sci.Nat. Environmental Scientist and annual groundwater assessments are evaluated by a registered Pr.Sci.Nat. Geohydrologist.

Various types of reporting are included as required by the enquiry document:

- Quarterly Surface – and Groundwater Monitoring Reports; or
- Comprehensive Annual Water Quality Report.

Quarterly and Bi-annual Reports will include basic representation of data, evaluated against appropriate water quality guidelines with related discussions.

The *Annual Assessment Reports* will be more extensive and include a full evaluation of the results obtained during the year. The report will typically include, but is not limited to, the following functions:



- The Surface Water Report will include a statistical summary (temporal & spatial) of all the chemical variables for all the monitoring points, time-series graphs, linear trend determinations and compliance assessments, water quality thematic maps indicating pollution sources and impacts on the receiving water body as well as a discussion; and
- The Groundwater Report will be similar to the surface water section and will include a statistical summary (temporal & spatial) of all the chemical variables for all the monitoring boreholes, as well as time-series graphs and linear trend determinations.

Temporal trends are subject to a series of sampling frequencies.

6. RESULTS

Water monitoring according to IWUL, 2013 included in this report:

- **May to July 2024** - IWUL surface water monitoring,
- **July 2024** - IWUL groundwater monitoring,

Refer to **Annexure A** for:

- In-field Sampling Sheets: Tables portraying the name, descriptions, and status of the monitoring points.

Refer to **Annexure B** for:

- Test Reports: Laboratory results displaying variable concentrations for all monitoring points during the reporting period.

Water quality results will be described using the DWS Water Quality Guidelines: Domestic Use (Volume 01) 1996 in which summarised descriptions are given for pH (**Table 3**), salinity (**Table 4**) and hardness (**Table 5**).

Table 3 Summary of pH values.

pH Values used to indicate alkalinity or acidity of water	
pH: > 8.5	Alkaline/Basic
pH: 6.0- 8.5	Neutral
pH: < 6	Acidic

Table 4 Summary of TDS concentration.

TDS Concentrations to indicate the salinity of water	
TDS < 450 mg/l	Non-saline
TDS 450 - 1 000 mg/l	Saline
TDS 1 000 - 2 400 mg/l	Very saline
TDS 2 400 - 3 400 mg/l	Extremely saline

Table 5 Summary of Total Hardness concentrations.

Hardness concentrations to indicate softness or hardness of water	
Hardness < 50 mg/l	Soft
Hardness 50 – 100 mg/l	Moderately soft
Hardness 100 – 150 mg/l	Slightly hard
Hardness 150 – 200 mg/l	Moderately hard
Hardness 200 – 300 mg/l	Hard
Hardness 300 – 600 mg/l	Very hard
Hardness > 600mg/l	Extremely hard

Sections 6.1 to 6.6 are detailed discussions on water qualities associated with Mooiplaats – reporting period 01 May 2024 to 31 July 2024.

Section 6.1: Wastewater

Section 6.2: Witpuntspruit

Section 6.3: Vaal River

Section 6.4: Groundwater

Section 6.5: Groundwater Levels

Surface - and groundwater monitoring points will be compared to IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering and the South African National Standard, Drinking Water Standard (Edition 2) (SANS 241:2015) was included as supplementary comparative guidelines and not for compliance purposes.



6.1 Wastewater

Table 6 indicates the average water quality for the wastewater monitoring points compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin.

Wastewater includes:

MPS-S14: Genset PCD

MPS-S20: Underground Erickson Dams.

MPS-S21: North Shaft Return Water Dam (NS RWD).

MPS-S30: Wash Plant PCD

Figure 6 illustrates variable concentration trends for wastewater monitoring points.

Figure 7 illustrates the average STIFF diagrams for wastewater monitoring points.



Table 6 Average water quality for wastewater monitoring points.

Average Wastewater Quality for Mooiplaats May 2024 - July 2024									
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	MPS-S14	MPS-S20	MPS-S21	MPS-S30
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	8,083	7,980	7,627	7,870
EC	mS/m	150	25	170	500	*263,000	*383,333	*664,000	*490,333
TDS	mg/L	1288	-	1200	3000	1614,860	2731,447	6206,066	3915,191
Total Hardness	mg/L	-	-	-	-	212,830	502,399	2385,959	1166,251
Alkalinity	CaCO ₃ /L	-	75	-	-	653,133	778,187	66,500	380,333
Ca	mg/L	87	-	-	1000	44,247	77,667	449,463	226,363
Mg	mg/L	51.40	-	-	500	24,853	74,907	306,860	145,950
Na	mg/L	725	-	200	200	504,083	763,157	968,853	840,440
K	mg/L	-	-	-	-	11,520	13,050	21,467	22,913
F	mg/L	3.23	0.4	1.5	2	3,057	*3,570	0,100	1,463
Cl	mg/L	116.66	20	300	3000	66,700	66,633	56,967	67,267
SO ₄	mg/L	740	30	500	1000	563,517	*1259,983	*4341,913	*2379,937
NO ₃	mg/L	-	0.5	11	-	-0,023	0,620	-0,067	0,227
NH ₃	mg/L	0.24	-	1.5	-	2,850	0,407	1,510	0,633
Al	mg/L	0.09	-	0.3	5	0,203	0,057	-0,010	-0,010
Fe	mg/L	0.001	-	0.3	10	0,167	0,053	0,270	-0,010
Mn	mg/L	0.15	-	0.1	10	0,023	1,987	17,557	0,320

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

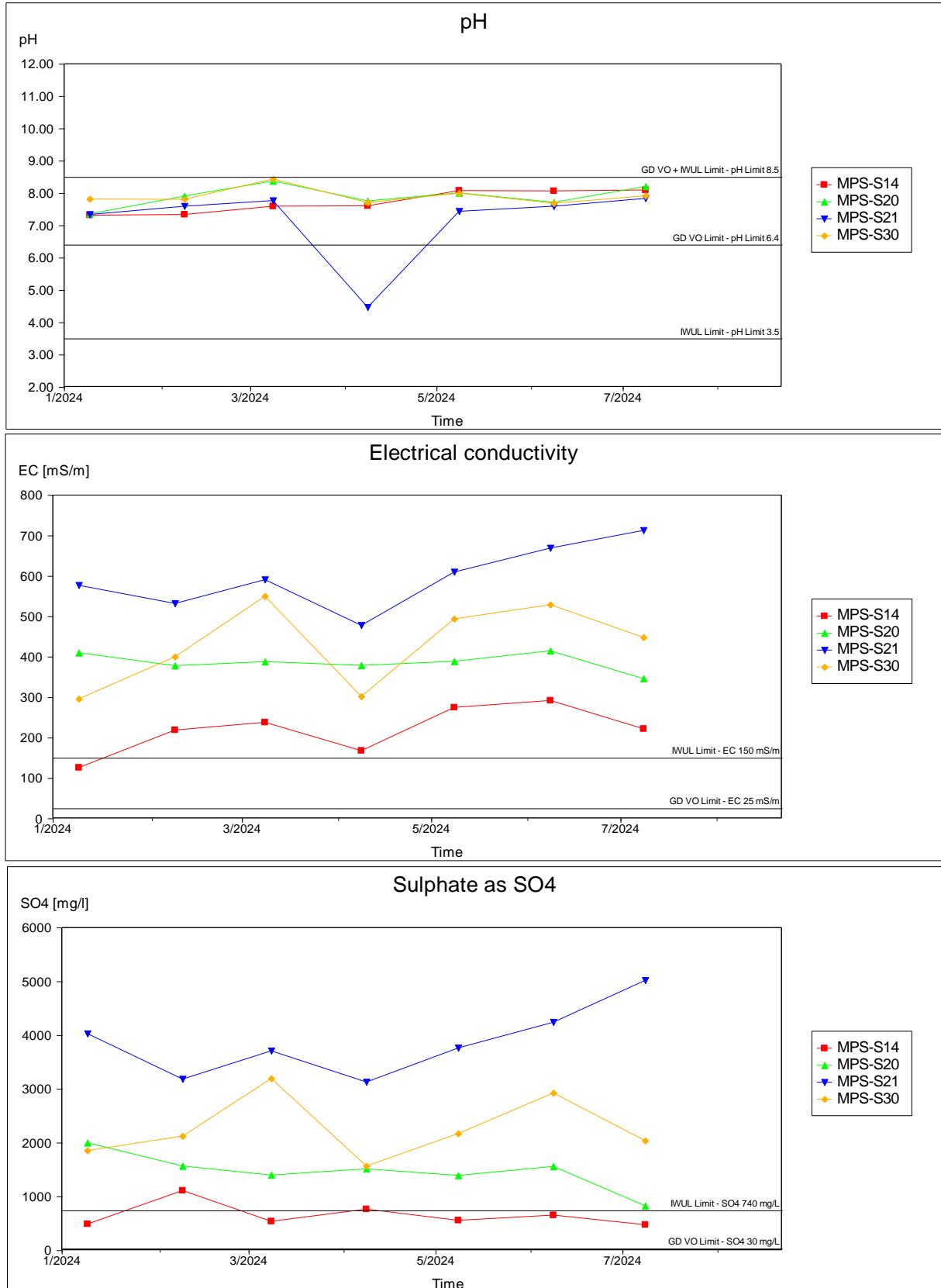
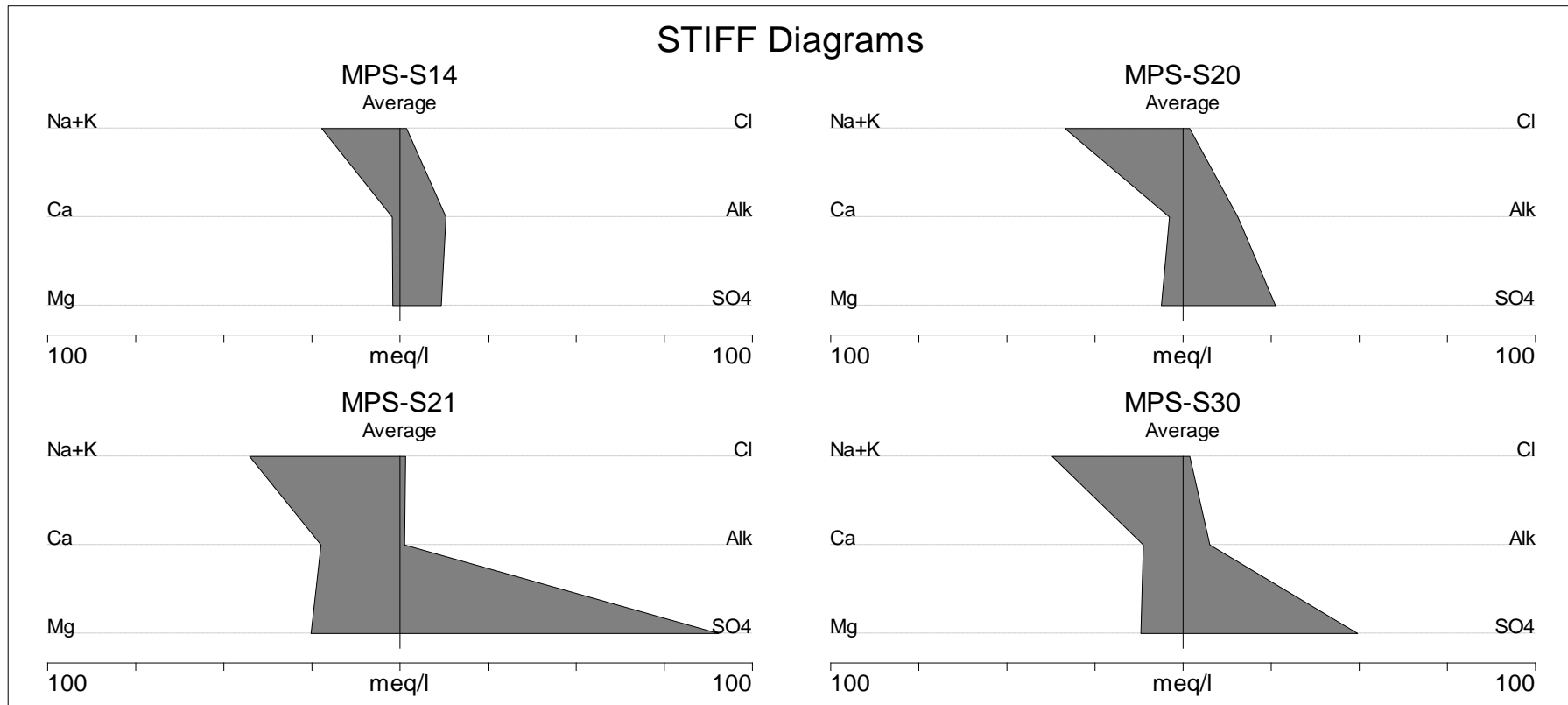


Figure 6 Wastewater variable concentration trends.



- STIFF Diagram
- A dominant Sulphate (SO₄) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO₃⁻) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO₄)

Figure 7 Average wastewater STIFF diagrams.



From **Table 6**, **Figures 6** and **7** it is evident that wastewater qualities exceeded several IWUL limits and In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin.

Genset PCD (**MPS-S14**), NS RWD (**MPS-S21**), Wash Plant PCD (**MPS-S30**) and Underground Erickson Dams / Settling Dam 3 (**MPS-S20**) are wastewater containment facilities, which reports to the co-disposal facility and again to the NS RWD (**MPS-S21**), from where it is recycled and distributed.

It is evident that the water compositions and concentrations (**Figure 7**) of wastewater remained high and remained stable in terms of the dominating cations and anions. However, the difference in water quality and composition can be ascribed to the different inflows into the waste facility before the water gets transferred to the next facility. Water quality and composition at **MPS-S14** differed from the above-mentioned wastewater facilities as runoff from the workshop areas reports to **MPS-S14**. Although water quality concentrations exceeded the IWUL limits, it must be noted that the containment facilities are HDPE lined or concreted. The increase in concentrations at **MPS-S21** can be ascribed to less / no rainfall entering the system during the reporting period.

SO₄ is the dominant anion in terms of composition (**Figure 7**), well in line with water exposed to coal handling activities. Low pH values will have negative effects on water infrastructure; therefore, process water should be managed to prevent low pH values.

6.2 Witpuntspruit Surface Water

Table 7 indicates the average surface water quality for the Witpuntspruit and associated tributaries. Water quality from these monitoring points is compared to the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin and IWUL Wastewater Limits. The DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards was included for comparative purposes.

Witpuntspruit and associated tributaries includes:

Witpuntspruit monitoring points include **WT-SW01** (Upstream), **WT-S02**, **WT-S04** (Midstream) and **WT-S06** (Downstream) where the adjoining tributaries include **WT-S03** and **WT-S05**.

Figure 8 illustrates variable concentration trends for the Witpuntspruit and associated tributaries. **Figure 9** illustrates the stream profile for the Witpuntspruit.

Figure 10 illustrates the average STIFF diagrams for the Witpuntspruit and associated tributaries.



Table 7 Average water quality for the Witpuntspruit and associated tributaries.

Average Witpuntspruit Water Quality for Mooiplaats May 2024 - July 2024											
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241: 2011	DWS Livestock Watering	WT-S01	WT-S03	WT-S02	WT-S04	WT-S05	WT-S06
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	4,33	6,77	6,46	6,83	7,14	7,92
EC	mS/m	150	25	170	500	180,67	61,57	92,27	98,17	326,67	304,33
TDS	mg/L	1288	-	1200	3000	1532	391	629	674	2639	2307
Total Hardness	mg/L	-	-	-	-	952	198	345	387	951	746
Alkalinity	CaCO ₃ /L	-	75	-	-	0,000	102,513	95,767	93,200	303,033	446,000
Ca	mg/L	87	-	-	1000	185,947	48,367	75,567	83,733	159,253	143,383
Mg	mg/L	51.40	-	-	500	118,400	18,633	37,967	43,200	134,360	94,260
Na	mg/L	725	-	200	200	49,300	48,867	62,233	59,933	455,273	470,920
K	mg/L	-	-	-	-	12,747	4,000	7,527	9,730	12,997	15,500
F	mg/L	3.23	0.4	1.5	2	-0,090	-0,023	0,123	0,157	0,743	1,817
Cl	mg/L	116.66	20	300	3000	23,567	13,400	25,433	31,833	42,823	55,300
SO ₄	mg/L	740	30	500	1000	1106,103	195,427	362,333	388,000	1650,667	1256,647
NO ₃	mg/L	-	0.5	11	-	-0,350	-0,350	-0,350	0,043	-0,350	-0,350
NH ₃	mg/L	0.240	-	1.5	-	-0,450	-0,450	-0,450	0,097	0,253	-0,063
Al	mg/L	0.090	-	0.3	5	23,333	0,097	0,017	0,000	0,127	0,030
Fe	mg/L	0.001	-	0.3	10	0,053	0,213	-0,003	0,013	0,120	0,047
Mn	mg/L	0.15	-	0.1	10	12,257	-0,010	0,020	0,060	0,277	1,060

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

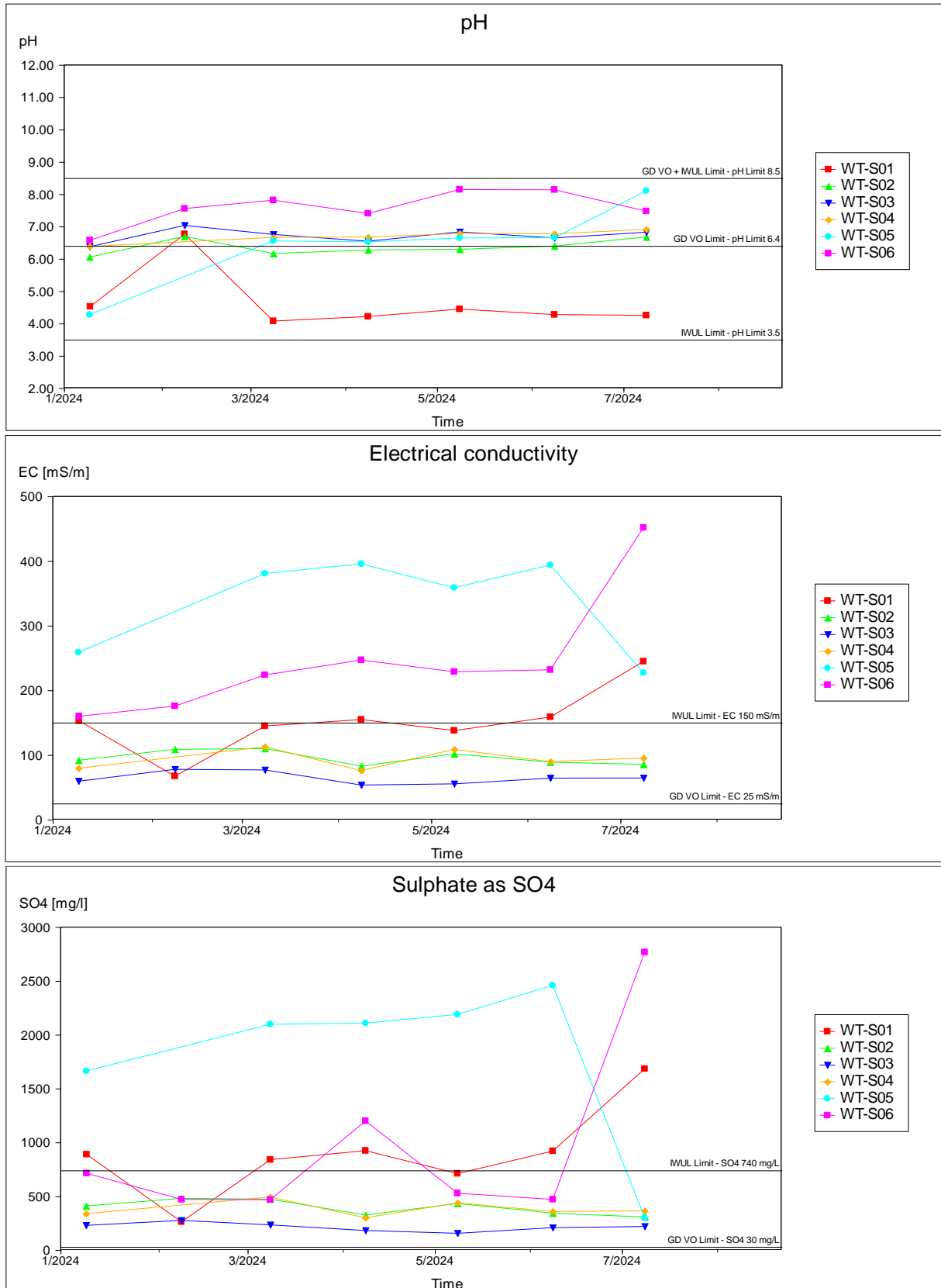


Figure 8 Variable concentration trends for the Witpuntspruit and associated tributaries.

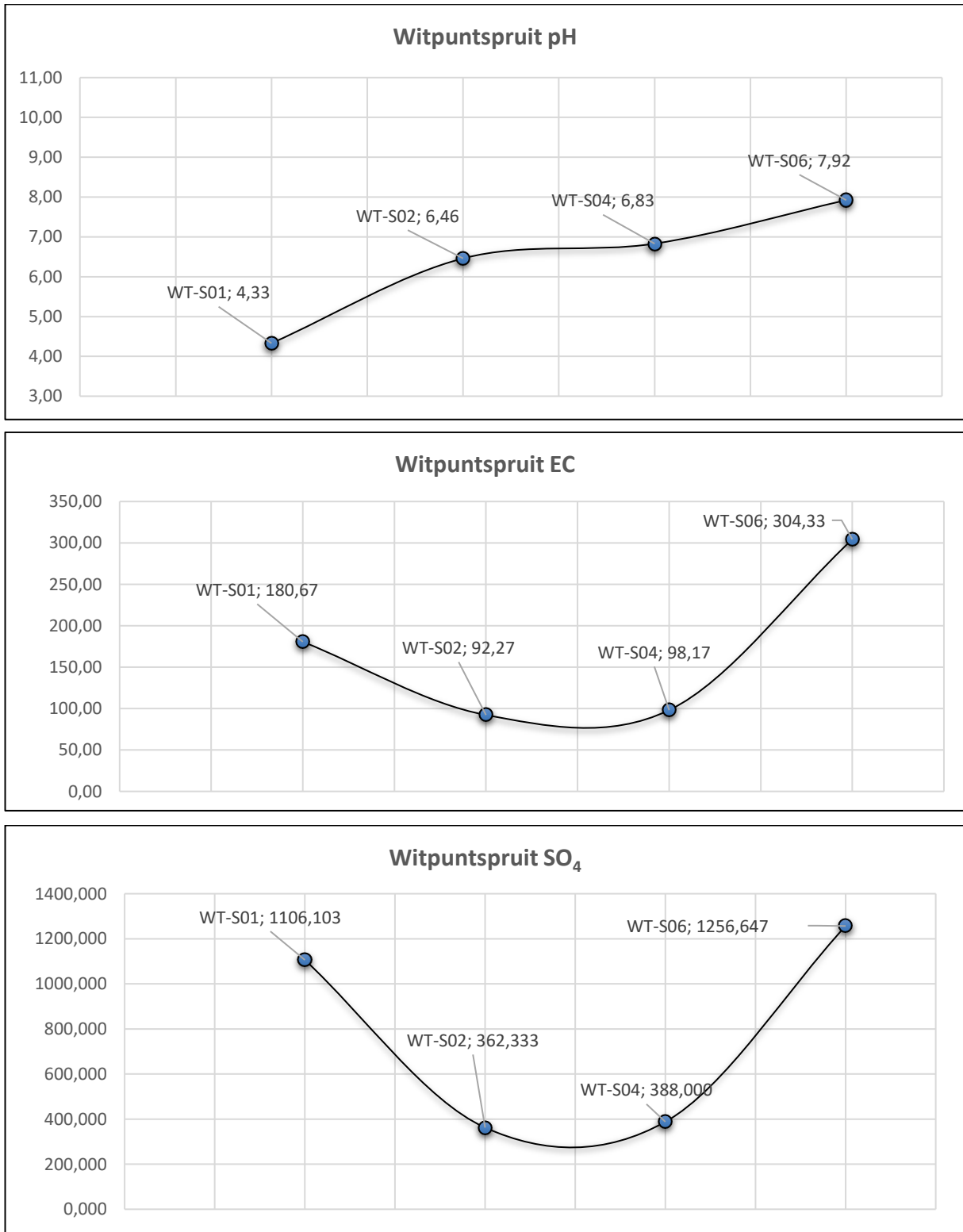
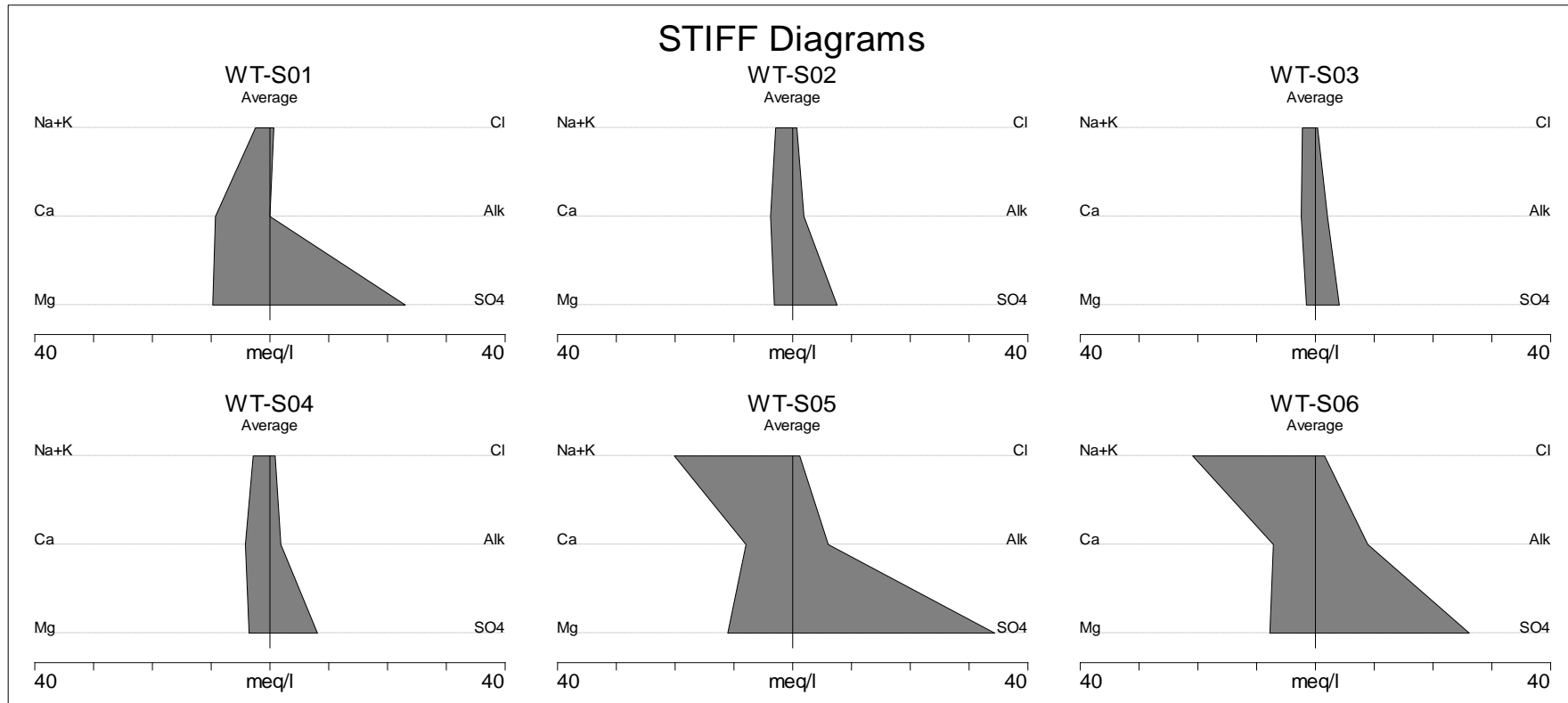


Figure 9 Stream profile for the Witpuntspruit - upstream left, downstream right.



- STIFF Diagram
- A dominant Sulphate (SO_4) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO_3^-) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO_4)

Figure 10 STIFF Diagrams for the Witpuntspruit surface water monitoring points.



From **Table 7, Figure 8, 9 and 10** it is evident that the Witpuntspruit are impacted on, from upstream (**WT-S01**) to downstream (**WT-S06**), before the confluence with the Vaal River, exceeding the Grootdraai Dam Guidelines for the Vaal origin sub-catchment.

From **Figures 8 and 9**, although the pH recovers from **WT-S01** to **WT-S06**, the impact of **WT-S05** on the Witpuntspruit is evident as water quality at **WT-S02, WT-S03, and WT-S04** remained stable and lower during the reporting period, where water quality at **WT S06** deteriorated in terms of several variable concentrations after the impact from **WT-S05** (EC, TDS, Na, and SO_4) and the historical **Usuthu decant** (EC, $CaCO_3$, Na, and Cl). Furthermore, very low to no fresh rainwater entered the system during the reporting period which could dilute the water quality downstream in the Witpuntspruit. Generally, **WT-S06** recorded deterioration in comparison with the upstream **WT-S01**.

Although the **WT-05** tributary became stagnant at the end of the reporting period, the deposition of variables during the majority of the reporting period, impacted on the Witpuntspruit. It is expected that with no inflow from **WT-S05** from July, the water quality will improve downstream. However, the variable concentrations and flow rate from the addition of the Usuthu decant will determine the improvement in water quality at **WT S06**.

The **WT -S03** tributary receives water from neighbouring industrial activities, as well as from a small portion of Mooiplaats. However, the **WT-S05** tributary receives water from Mooiplaats and farming activities in the sub-catchment.

The addition of the Alkalinity (from the Usuthu decant) to the Witpuntspruit and eventually the Vaal River is not necessary only a negative impact, but variables such as Na, Ca, Cl, and SO_4 in excessive concentrations over an extended period will have a detrimental effect on the receiving environment and Vaal River system.

6.3 Vaal River Surface Water

Table 8 indicates the average surface water quality for the Vaal River and associated tributaries compared to the IWUL Limits and the In-stream Water Quality Guidelines for the Grootdraai Dam Catchment - Vaal origin. The DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards was included for comparative purposes.

Figure 11 illustrates variable concentration trends for the Vaal River.

Figure 12 illustrates the stream profile for the Vaal River.

Figure 13 illustrates the average STIFF diagrams for the Vaal River.



Table 8 Average water quality for the Vaal River.

Average Vaal River Water Quality for Mooiplaats May 2024 - July 2024								
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	VL-S01	VL-S02	VL-S03
pH	-	3.5 – 8.5	6.4 – 8.5	5.0 - 9.5	-	6,913	7,203	7,437
EC	mS/m	150	25	170	500	26,267	38,400	38,433
TDS	mg/L	1288	-	1200	3000	147,633	224,967	226,563
Total Hardness	mg/L	-	-	-	-	109,179	119,933	122,150
Alkalinity	CaCO ₃ /L	-	75	-	-	68,933	90,800	86,333
Ca	mg/L	87	-	-	1000	19,817	22,633	22,933
Mg	mg/L	51.40	-	-	500	14,497	15,400	15,757
Na	mg/L	725	-	200	200	7,380	31,573	29,800
K	mg/L	-	-	-	-	2,833	3,540	3,653
F	mg/L	3.23	0.4	1.5	2	-0,090	0,170	0,150
Cl	mg/L	116.66	20	300	3000	13,833	16,833	16,667
SO ₄	mg/L	740	30	500	1000	46,267	80,133	85,600
NO ₃	mg/L	-	0.5	11	-	0,077	-0,350	-0,350
NH ₃	mg/L	0.24	-	1.5	-	-0,450	-0,450	-0,450
Al	mg/L	0.09	-	0.3	5	0,013	0,070	0,063
Fe	mg/L	0.001	-	0.3	10	0,247	0,130	0,140
Mn	mg/L	0.15	-	0.1	10	0,007	-0,003	-0,010

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-”Indicate values below laboratory detection limit.
- “*” indicate variables exceeding the IWUL limits and GD-VO Guidelines.

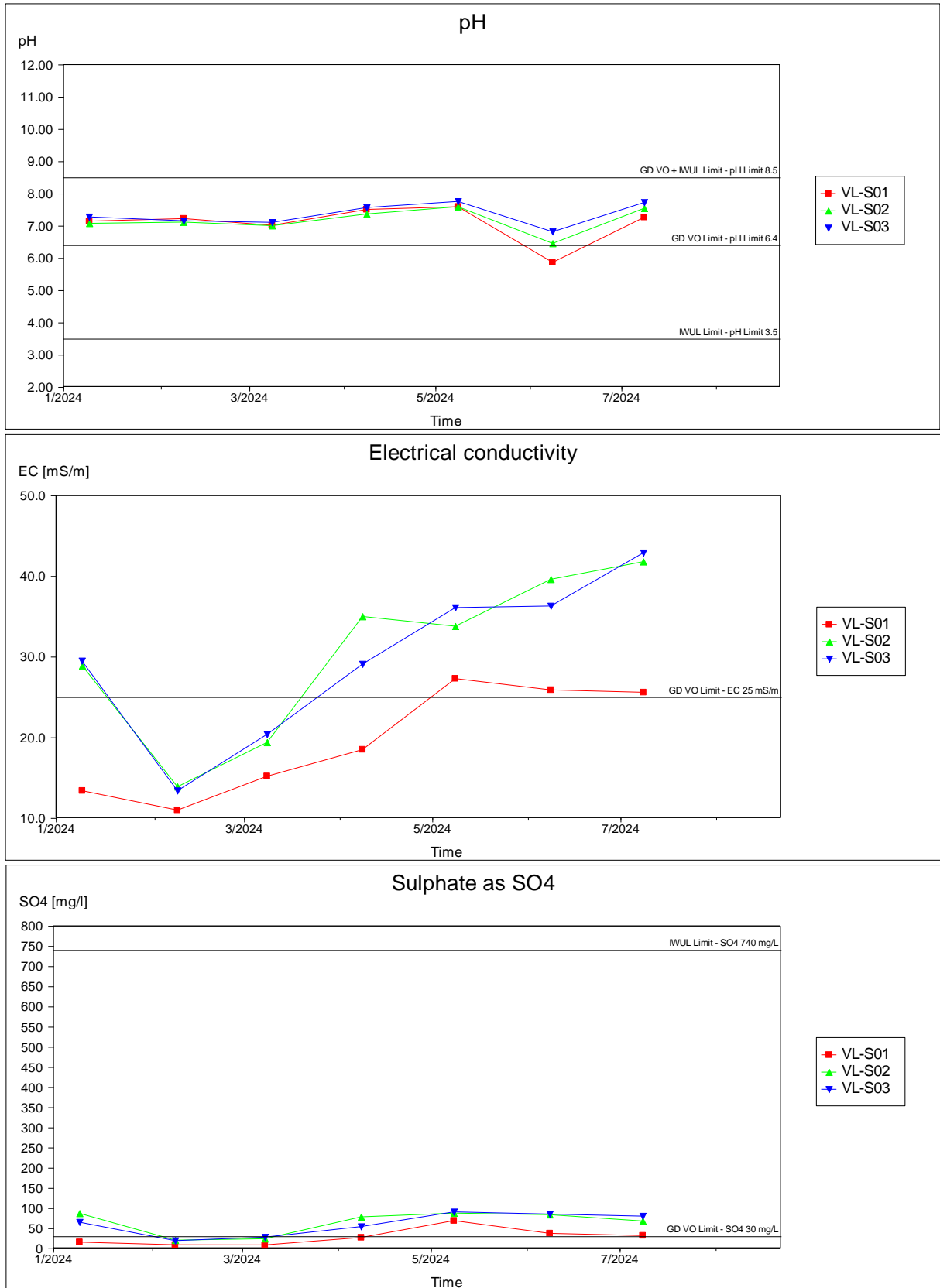


Figure 11 Variable concentration trends for the Vaal River.

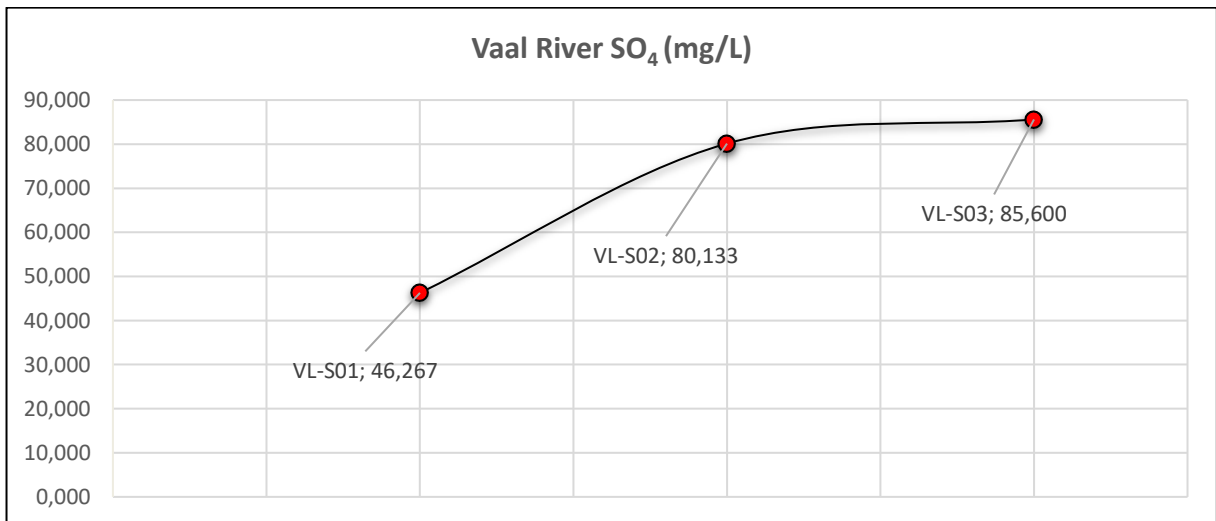
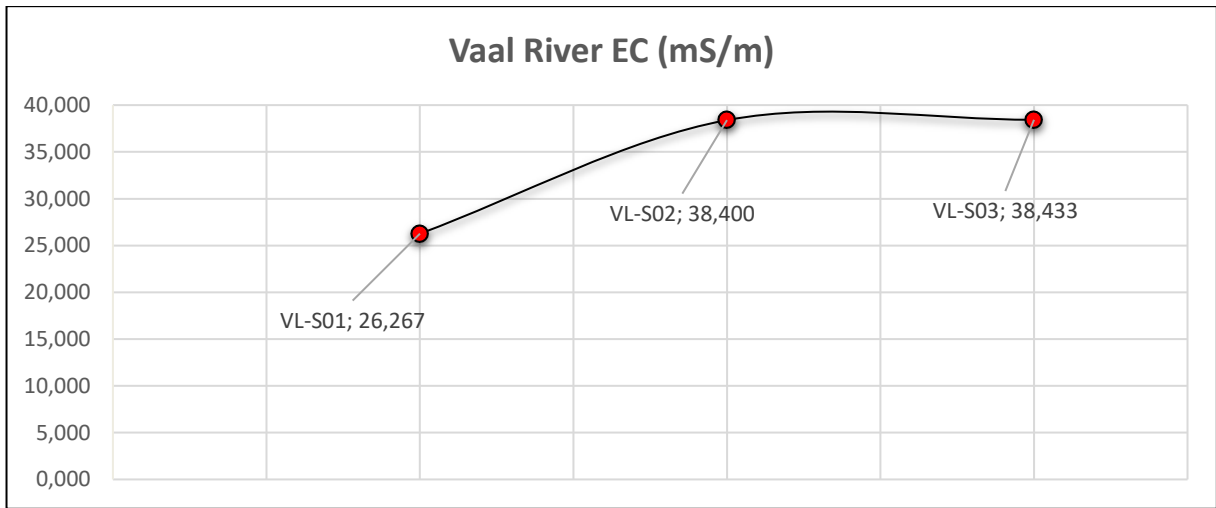
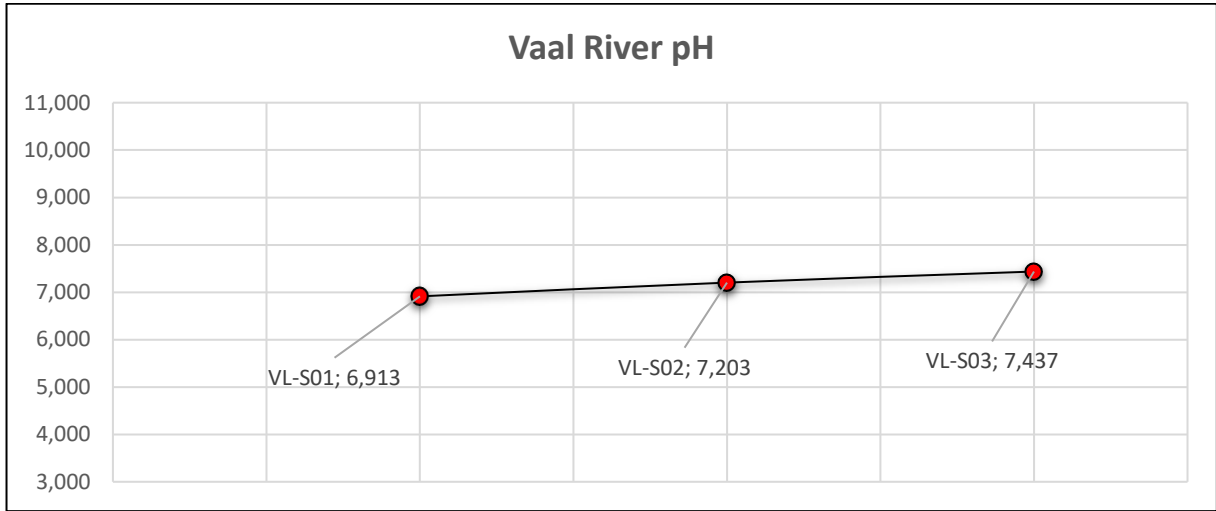
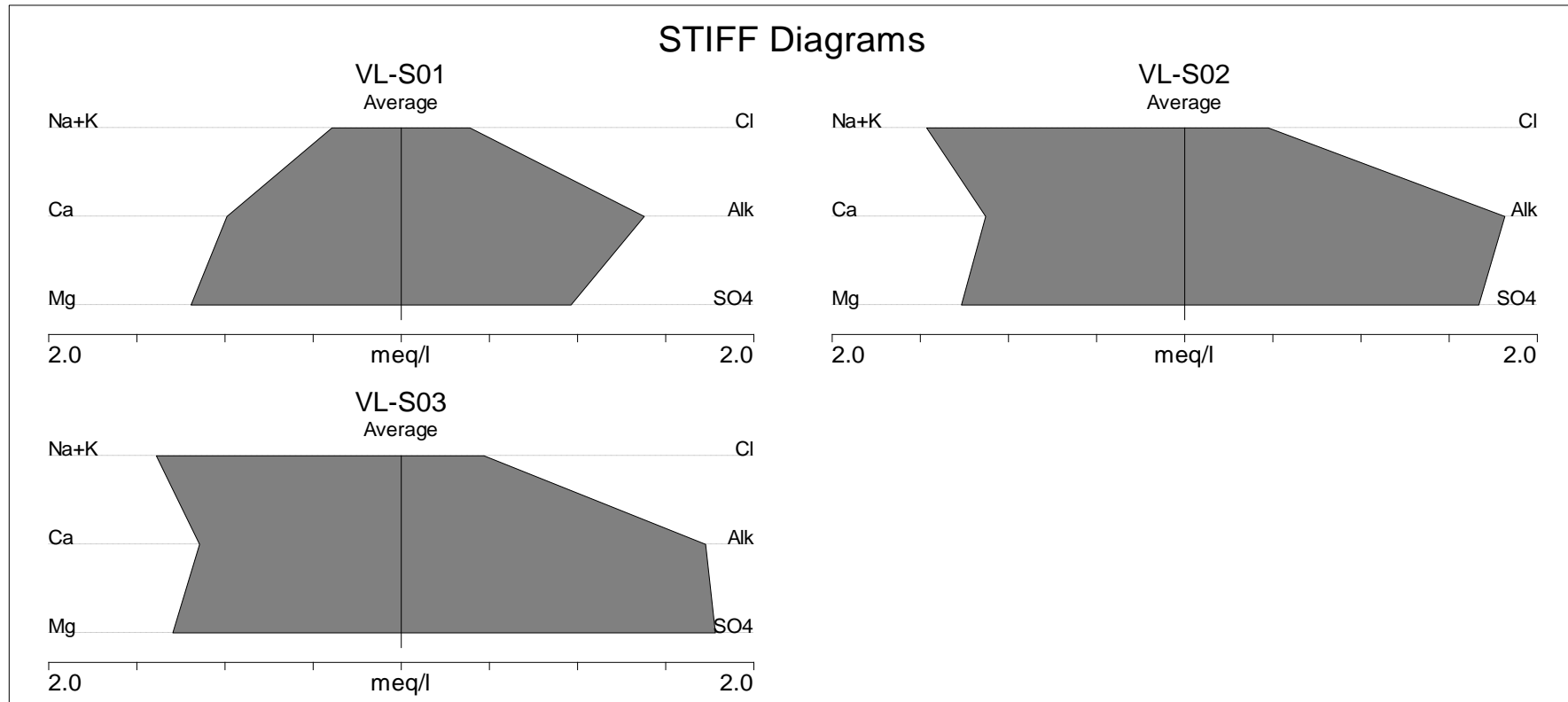


Figure 12 Vaal River stream profile - upstream left, downstream right.

- STIFF Diagram
- A dominant Sulphate (SO₄) anion indicates possible coal mining pollution.
 - A dominant Alkalinity/Bicarbonate (HCO₃⁻) anion indicates fresh, natural and unimpacted water.
 - Cations are indicators/subjected to/of the local geology and natural conditions.
 - The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO₄)

Figure 13 STIFF Diagrams for the Vaal River surface water monitoring points.



From **Table 8** and **Figures 11, 12** and **13** it is evident that water quality and composition of the Vaal River changed after the confluence with the Witpuntspruit (inflow between **VL-S01** and **VL-S02**).

The trend in water quality at **VL-S01** (upstream) can be ascribed to seasonal changes and possible upstream impacts where the addition of elevated variable concentrations from the Witpuntspruit (**WT-S06**) into the Vaal River system can be clearly observed in the difference of variable concentrations and composition as deterioration was recorded from **VL-S01** towards **VL-S02** (after confluence of Witpuntspruit).

Despite the addition of freshwater (rainfall) during the previous reporting period (April), the impact from **WT-S06** is still evident at **VL-S02**. However, the slight improvement from **VL-S02** to **VL-S03** that was recorded indicated no additional impacts entering the Vaal river downstream of **VL-S02**.

Metal (Fe) concentrations in the Vaal River exceeded the IWUL Limits from upstream to downstream, with concentrations remaining relatively consistent or improving as water moves downstream. The historic Fe and Al concentrations can possibly be ascribed to regional and geological factors.

Evidently, the Witpuntspruit has a negative impact on the Vaal River.

6.4 Groundwater

Table 9 indicates the average groundwater quality for Mooiplaats Colliery monitoring points compared to the IWUL limits, Grootdraai Dam Guidelines - Vaal Origin, DWS Livestock watering upper limit, 1996 and the SANS 241:2015 drinking water standards.

Figure 14 illustrate the variable concentration trends for groundwater.

Figure 15 illustrates the composition of the groundwater water quality in STIFF Diagrams.



Table 9 Average water quality for Mooiplaats groundwater monitoring points.

Average Groundwater Quality for Mooiplaats May 2024 - July 2024										
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	GAD-1	GAD-2S	GKL-1	GKL-2S	GKL-4D
pH	-	8.78	6.4 – 8.5	5.0 - 9.5	-	7,37	7,72	7,44	7,80	8,50
EC	mS/m	150	25	170	500	28,10	15,90	36,20	42,60	*232,00
TDS	mg/L	-	-	1200	3000	147	81	204	229	1342
Total Hardness	mg/L	-	-	-	-	136	63	164	195	15
Alkalinity	CaCO ₃ /L	-	75	-	-	141,000	48,400	204,000	225,000	621,600
Ca	mg/L	15.18	-	-	1000	35,800	13,000	42,300	42,300	4,100
Mg	mg/L	6.96	-	-	500	11,200	7,460	14,100	21,800	1,270
Na	mg/L	61.55	-	200	200	7,650	3,820	16,200	14,200	539,270
K	mg/L	-	-	-	-	1,920	0,810	1,090	1,330	4,610
F	mg/L	0.30	0.4	1.5	2	0,260	-0,090	-0,090	-0,090	2,680
Cl	mg/L	19.97	20	300	3000	4,890	15,800	1,540	4,370	*389,000
SO ₄	mg/L	0.25	30	500	1000	-0,500	3,050	6,010	9,820	11,400
NO ₃	mg/L	0.07	0.5	11	-	-0,350	1,520	-0,350	-0,350	-0,350
NH ₃	mg/L	-	-	1.5	-	-0,450	0,660	-0,450	-0,450	1,340
Al	mg/L	-	-	0.3	5	-0,010	-0,010	0,010	-0,010	0,590
Fe	mg/L	-	-	0.3	10	0,170	0,040	-0,010	0,090	1,850
Mn	mg/L	-	-	0.1	10	0,130	0,020	0,050	0,030	0,010

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*”Indicate variables exceeding the IWUL limits and GD-VO Guidelines.



Table 9 (cont.): Average water quality for Mooiplaats groundwater monitoring points.

Average Groundwater Quality for Mooiplaats May 2024 - July 2024									
Variable	Unit	IWUL Limit	Grootdraai Dam Guidelines Vaal Origin	SANS 241:2011	DWS Livestock Watering	GKL - 5S	GKL - 6M	GKL - 8M	GKL - 9D
pH	-	8.78	6.4 – 8.5	5.0 - 9.5	-	8,20	7,81	7,76	7,90
EC	mS/m	150	25	170	500	32,60	24,90	23,50	22,00
TDS	mg/L	-	-	1200	3000	186	137	124	116
Total Hardness	mg/L	-	-	-	-	64	69	96	58
Alkalinity	CaCO ₃ /L	-	75	-	-	177,000	133,000	116,000	111,000
Ca	mg/L	15.18	-	-	1000	16,300	20,100	28,000	16,200
Mg	mg/L	6.96	-	-	500	5,670	4,570	6,230	4,320
Na	mg/L	61.55	-	200	200	51,100	26,500	11,400	22,300
K	mg/L	-	-	-	-	1,670	1,200	1,650	1,930
F	mg/L	0.30	0.4	1.5	2	0,140	0,320	-0,090	0,120
Cl	mg/L	19.97	20	300	3000	3,290	3,630	7,320	3,820
SO ₄	mg/L	0.25	30	500	1000	1,550	-0,500	-0,500	-0,500
NO ₃	mg/L	0.07	0.5	11	-	-0,350	-0,350	-0,350	-0,350
NH ₃	mg/L	-	-	1.5	-	-0,450	-0,450	-0,450	0,580
Al	mg/L	-	-	0.3	5	-0,010	-0,010	-0,010	-0,010
Fe	mg/L	-	-	0.3	10	0,390	0,910	0,110	0,070
Mn	mg/L	-	-	0.1	10	0,020	0,070	0,040	0,080

- Variables highlighted in grey are specified by the IWUL where the remainder are additional analyses.
- Values highlighted in red exceeds the limits set in the IWUL where variables highlighted in green exceeds the Grootdraai Dam Catchment Guidelines of the Vaal Origin
- “-“Indicate values below laboratory detection limit.
- “*”Indicate variables exceeding the IWUL limits and GD-VO Guidelines.

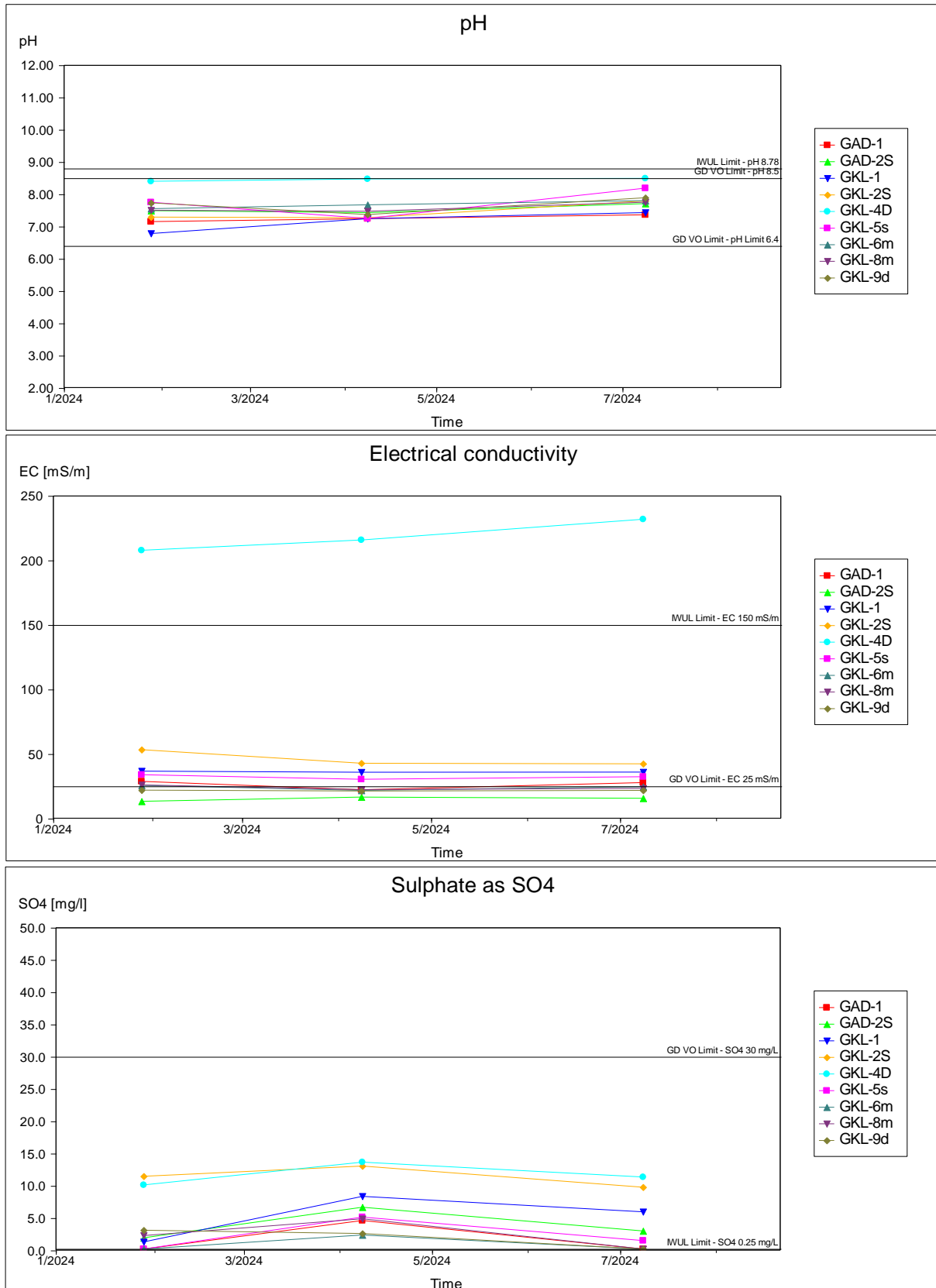
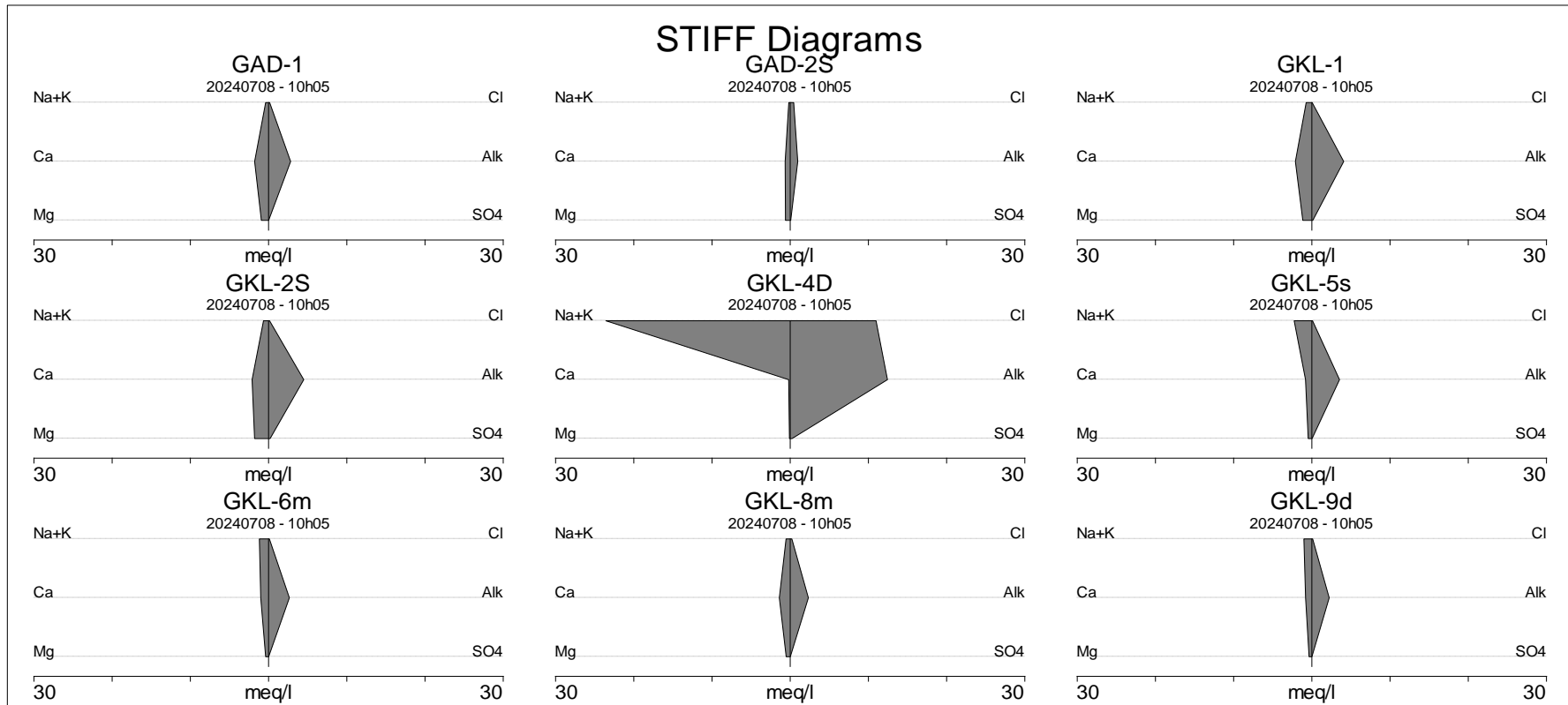


Figure 14 Variable concentration trends for groundwater monitoring points.



- STIFF Diagram - A dominant Sulphate (SO₄) anion indicates possible coal mining pollution.
- A dominant Alkalinity/Bicarbonate (HCO₃⁻) anion indicates fresh, natural and unimpacted water.
- Cations are indicators/subjected to/of the local geology and natural conditions.
- The “size/width” of the diagram indicates the concentrations where the shape indicates the composition of the water.



* Cations left (Na+K, Ca, Mg)

* Anions right (Cl, Alk, SO₄)

Figure 15 STIFF Diagrams for Mooiplaats groundwater monitoring points.



From **Table 9** and **Figures 14** and **15** it is evident that groundwater quality outside the mining right area remained of good quality, with seasonal fluctuations, despite several Grootdraai dam Vaal Origin Guidelines and IWUL Limits being exceeded.

From **Figure 14**, the slight movement in variable concentrations are indicative of seasonal variation associated with geology and the consistent recharge of natural groundwater without mining impacts.

Furthermore, the SO_4 concentrations recorded during the reporting period remained low and in line with geological impacts despite the concentrations exceeding the IWUL Limits. The limit of 0.25 mg/L will be exceeded at most groundwater in its natural state.

Naturally high $CaCO_3$ and Ca concentrations (geological) resulted in elevated EC concentrations that exceeded the IWUL limits and Grootdraai Dam Guidelines - Vaal Origin for EC and $CaCO_3$. Due to very low IWUL limits (SO_4 of 0.25mg/L, Ca of 15.18mg/L and Mg of 6.96 mg/L) variable concentrations in its natural state exceeded the limits.

GKL-4d is drilled to a depth of 80 meters. Naturally high $CaCO_3$, Na and Cl concentrations (geological) elevated the EC concentrations, to exceed the IWUL Limit. Elevated $CaCO_3$, SO_4 , Na, Ca, Mg, Cl and Fe concentrations can be ascribed to the deeper geology of the area, as illustrated in the STIFF Diagrams.

Alkalinity ($CaCO_3$) dominate in terms of dominating cations at all groundwater indicating fresh and recharged water without mining impacts.

No impact from Mooiplaats colliery was observed in the groundwater monitored.

6.5 Groundwater Levels

Groundwater levels are monitored on a quarterly basis to determine the possible impact of mining activities on the groundwater aquifer.

Table 10 indicates groundwater levels below ground level (MBGL).

Figure 16 illustrates groundwater level trends.

Table 10 Mooiplaats groundwater levels.

Mooiplaats IWUL Groundwater Levels									
Date	GAD-1	GAD-2S	GKL-1	GKL-2S	GKL-4D	GKL-5s	GKL-6m	GKL-8m	GKL-9d
Oct-23	-3,75	-9,55	-24,74	-4,04	-2,51	-1,65	-1,01	-4,42	-12,71
Jan-24	-3,72	-9,39	-24,78	-3,98	-2,51	-1,48	-0,85	-4,50	-12,68
Apr-24	-3,48	-8,08	-24,82	-4,17	-2,62	-1,53	-0,82	-4,58	-13,03
Jul-24	-4,28	-9,44	-24,98	-4,17	-2,61	-2,07	-1,63	-4,98	-13,19

Evident from **Table 10** and **Figure 16**, all groundwater levels fluctuate according to drilled depth and season with no indication of water levels impacted by mining activities.

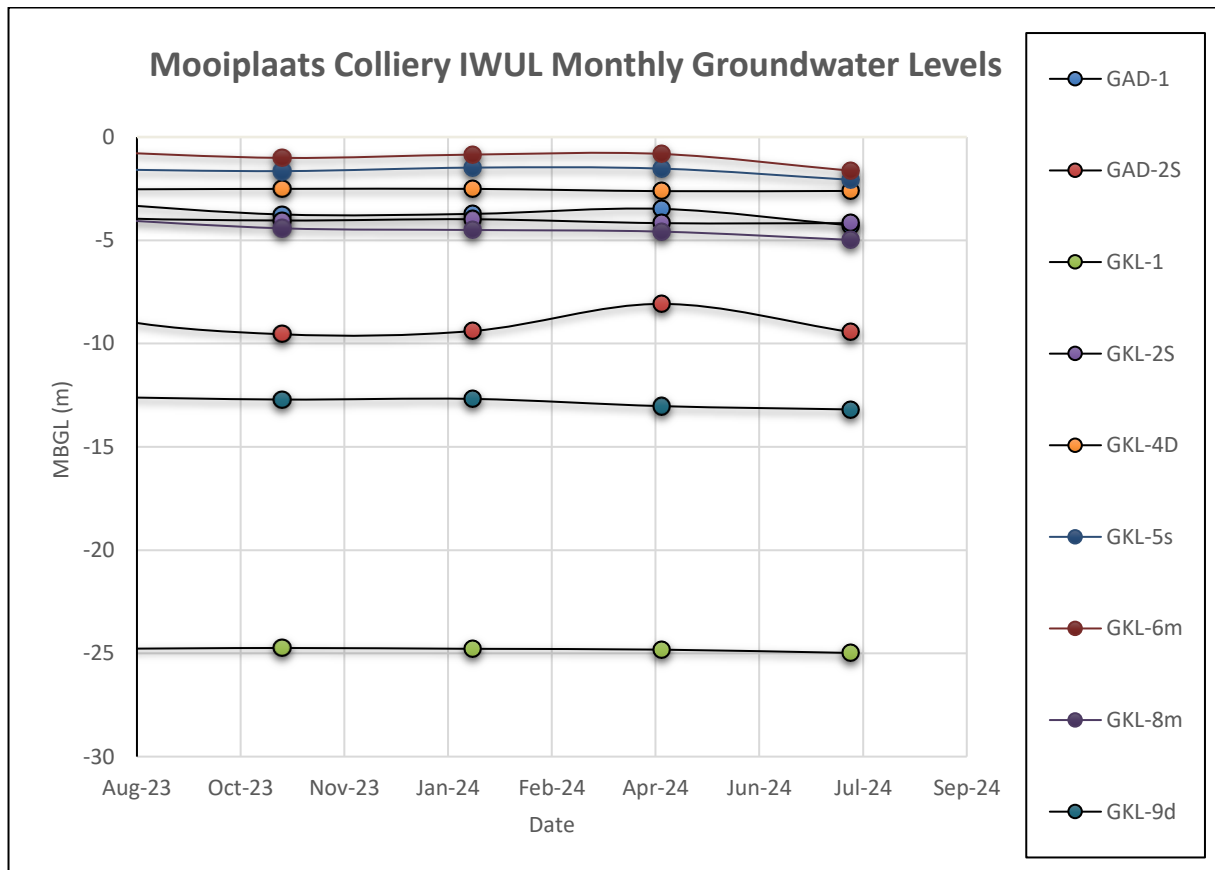


Figure 16 Mooiplaats groundwater level trends.



7. DISCUSSION AND CONCLUSION

The monitoring network provides information for risk-based decision making to Mooiplaats management with regard to effectiveness of pollution prevention measures and areas requiring management attention.

Note: Removing coal from underground / mining ceased on 31 December 2021, with only the coal washing plant being operational currently.

7.1 Surface water

Wastewater - Water quality from the mine water/pollution control dams exceeded limits in terms of EC, TDS, CaCO₃, Ca, Mg, Cl, SO₄, Fe, and Mn - typical of water associated with coal washing/mining activities. Wastewater is contained in storage facilities and circulated in a closed circuit. The pH of process / wastewater should be closely monitored and managed to prevent damage to water infrastructure.

Witpuntspruit – Although historic pollution from upstream of Mooiplaats is still evident, variable concentrations deteriorated towards downstream due to the inflow from **WT-S05**, and the **Usuthu decant** between **WT-S04** and **WT-S06** indicating that current and historical activities have a detrimental effect on this Spruit, which will have a long-term negative effect on the downstream environment of the Vaal River system.

Vaal River – A continuous deterioration was recorded after the confluence of the Witpuntspruit with the Vaal River (between **VL-S01** and **VL-S02**). The increase / variation in variable concentrations during the reporting period can be ascribed to the addition of variables from the Witpuntspruit drainage.

Although Fe exceeded the IWUL limits, concentrations remained low, relative consistent, and in line with historical trends, from upstream to downstream indicating the presence might possibly be geological / natural.

7.2 Groundwater

Groundwater - Outside the mining right area, water quality remains stable and of good quality, with slight seasonal fluctuations. Neutral to high neutral pH values, Alkalinity (CaCO₃), and Ca concentrations indicate geological conditions. The movement of pH values, EC concentrations and variables associated with geology indicate the consistent recharge of natural groundwater without mining impacts.



Groundwater levels continued to fluctuate according to seasonal factors and not due to mining impacts.

8. REFERENCES

- General Authorisations in terms of section 39 of the NWA, 1998 (Act No.36 of 1998), GG 36206 (4 March 2013), GNR 169, Section 21 (f) & (h).
- ISO 5667-1: 2006 Part 1: Guidance on the design of sampling programs and sampling techniques.
- ISO 5667-3: 2003 Part 3: Guidance on preservation and handling of samples.
- ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams.
- ISO 5667-11: 1993 Part 11: Guidance on sampling of groundwaters.
- Mineral and Petroleum Resources Development Act (Act No.28 of 2002).
- National Water Act (Act No. 36 of 1998).
- South African Water Quality Guidelines (1996). Volume 1. Domestic Use. Department of Water Affairs and Forestry.
- South African Water Quality Guidelines (1996). Volume 7. Aquatic Ecosystems. Department of Water Affairs and Forestry.
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- Standards South Africa. SANS 241 – 1: 2011. South African National Standard. Drinking Water. (Edition 1).
- Standards South Africa. SANS 241 – 1: 2015. South African National Standard. Drinking Water. (Edition 2).
- Department of Water and Sanitation, National Water Resource Strategy, 2004.
- Mooiplaats North Colliery geology and groundwater study, Coal of Africa Limited. Report No. V1110001. J. Fourie, 2011.

— ANNEXURES

Refer to **Annexure A** for:

- In-field Sampling Sheets: Tables portraying the name, descriptions, and status of the monitoring points.

Refer to **Annexure B** for:

- Test Reports: Laboratory results displaying variable concentrations for all monitoring points during the reporting period.



T0647

Analyses Required

pH, EC, P and M Alkalinity, Ca, Mg, Na, K, F, Cl, SO4, NO3-N, Al, Fe, Mn, NH3

Sent by:
L. Marais

Received by:

YANCA LABS

Date

6/6/24



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Fax: 086 654 3631
E-mail: louis@geosoilwater.co.za
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WAT No: 4420244586
Postnet Suite C319 Private Bag X18 Lynnwood Ridge 0040
15A Midas Ave, Clympps, Pretoria

Project: Mooiplaats IWUL Water Monitoring
Monitoring Month: Jun-24
Monthly Surface and Groundwater Monitoring
Date of Sampling: 05-Jun-24

Monitoring Point	Coordinates	Time	Sampled	Level	Description	Comment/Observations	Turbidity G.S
Surface Water							
✓ VL-S01	S26.64616° E30.09890°	10:58	Yes	Low	Vaal River 1 US	Clear	1
✓ VL-S02	S26.64804° E30.15098°	10:19	Yes	Low	Vaal River 2 DS	Clear	1
✓ VL-S03	S26.67879° E30.12411°	10:35	Yes	Low	Vaal River 3 DS	Clear	0
✗ VL-S04	S26.70167° E30.08288°	10:28	No	-	Vaal River 4 DS	By Access	-
✓ WT-S01	S26.71447° E30.06519°	11:18	Yes	Low	Witpunspruit 1 US	Clear	0
✓ WT-S02	S26.59307° E30.09617°	08:01	Yes	Low	Witpunspruit 2 MS	Clear	0
✓ WT-S03	S26.61826° E30.11211°	07:53	Yes	Low	Witpunt Tributary North DS 1	Clear	0
✓ WT-S04	S26.62014° E30.10781°	08:09	Yes	Low	Witpunspruit 3 MS	Clear	0
✓ WT-S05	S26.62294° E30.11463°	08:15	Yes	Low	Witpunt Tributary South DS 2	Clear	0
✓ WT-S06	S26.62863° E30.11539°	11:03	Yes	Low	Witpunspruit 6 MS	Clear	0
✓ MPS-S14	S26.64616° E30.09890°	08:59	Yes	High	Gen-sub PCD	Black	4
✓ MPS-S20	S26.64505° E30.10121°	09:53	Yes	High	Erickson Dams	Clear	1
✓ MPS-S21	S26.64198° E30.10059°	09:22	Yes	High	Main Holdings Dam	Clear	0.1
✓ MPS-S30	S26.64508° E30.09674°	09:03	Yes	High	Plant PCD	Black	2



sanas
South African National
Accreditation System

T0647

Analyses Required

pH, EC, Alkalinity, Ca, Mg, Na, K, F,
Cl, SO4, NO3-N, Al, Fe, Mn, NH3

Sent by:

Louis Marais

Requested by:
Rebecca Samband

Date

11/7/24

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15A Midas Ave, Olympos, Pretoria



Project: Mooiplaats IWUL Water Monitoring

Monitoring Month: Jul-24

Monitoring Occasion: Quarterly Surface and Groundwater Monitoring

Date of Sampling: 11-Jul-24

Monitoring Point	Coordinates	Time	Sampled	Level	Medium	Comment/Observations	Turbidity
Surface Water							
✓ VL-S01	S26.64616° E30.09890°	12:58	Yes	Low	Vaal River 1 US	Clear	F 0
✓ VL-S02	S26.64804° E30.15098°	10:25	Yes	Low	Vaal River 2 DS	Clear	F 0
✓ VL-S03	S26.67879° E30.12411°	12:39	Yes	Low	Vaal River 3 DS	Clear	F 0
X VL-S04	S26.70167° E30.08288°	11:18	No	-	Vaal River 4 DS	No Access	-
✓ WT-S01	S26.71447° E30.06519°	13:09	Yes	Low	Witpuntspruit 1 US	Clear	F 0
✓ WT-S02	S26.59307° E30.09617°	08:02	Yes	Low	Witpuntspruit 2 MS	Clear	F 0
✓ WT-S03	S26.61826° E30.11211°	07:55	Yes	Low	Witpunt Tributary North DS 1	Clear	F 0
✓ WT-S04	S26.62014° E30.10781°	08:14	Yes	Low	Witpuntspruit 3 MS	Clear	F 0
✓ WT-S05	S26.62294° E30.11463°	08:22	Yes	Low	Witpunt Tributary South DS 2	Clear	S 0
✓ WT-S06	S26.62863° E30.11539°	08:36	Yes	Low	Witpuntspruit 6 MS	Clear	F 0
Groundwater							
✓ GKL-1	S26.69603° E30.07208°	11:23	Yes	24.98	IWUL Borehole	Clear	1
✓ GKL-4d	S26.70167° E30.08253°	12:27	Yes	2.61	IWUL Borehole	Brown	4
✓ GKL-2s	S26.70178° E30.08269°	12:33	Yes	4.17	IWUL Borehole	Brown	2
✓ GAD-2s	S26.71269° E30.11414°	10:55	Yes	9.44	IWUL Borehole	Clear	1
✓ GAD-1	S26.72733° E30.10144°	11:10	Yes	4.28	IWUL Borehole	Clear	0
✓ GKL-9D	S26.67231° E30.10450°	12:01	Yes	13.19	IWUL Borehole	Clear	0
✓ GKL-8M	S26.67233° E30.10464°	12:06	Yes	4.98	IWUL Borehole	Clear	1
✓ GKL-5S	S26.66542° E30.09647°	11:48	Yes	2.07	IWUL Borehole	Clear	1
✓ GKL-6M	S26.66542° E30.09658°	11:52	Yes	1.63	IWUL Borehole	Clear	1
Process Water							
✓ MPS-S14	S26.64616° E30.09890°	09:14	Yes	Med	Gen-sub PCD	Clear	1
✓ MPS-S20	S26.64505° E30.10121°	10:04	Yes	Med	Erickson Dams	Clear	0
✓ MPS-S21	S26.64198° E30.10059°	09:42	Yes	High	Main Holdings Dam	Clear	0.2m
✓ MPS-S30	S26.64508° E30.09674°	09:19	Yes	High	Plant PCD	Black	0.2m

ANNEXURE B





YANKA LABORATORIES

(Pty) Ltd.

Registration No. 2012/113891/07

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E-Mail: yanka@yanka.co.za

Geo Soil and Water CC
Attention: Louis Marais
 Postnet Suite C319
 Private Bag X18
LYNNWOOD RIDGE
 0040

Job No: **E73253 - W24 _ 3541**
 Report Reference: **ER_GEO_2024-05-10_09435_001**
 Enquiries: **Rita Botha**
 Date: **2024/05/10**
RitaB@yanka.co.za
 Job Reference: **W24/3541 - Advice Note 2405W331**
 Job Description: **13 x Routine Analysis**
 Project: **MOOIPLAATS SW & GW**

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & GW - 09 May 2024

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see <http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 9 May 2024 - 2024/05/23
 SANAS Certificate obtainable from the address below
<http://www.yanka.co.za/Services.htm>

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Samples were tested as received, except where indicated otherwise. This report relates only to the specific sample(s) tested as identified herein and may not be reproduced in part without written permission from Laboratory Management.

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ANALYSTS

Marné, Magda, Venna, Drieka, Sue, Rosemary, Vida, Elize, Petricia, Stefan, Nadine, Corlia, Lindie, Jolene, Audrey, Mariëtte, Nicolene



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 04	WT - S 05	WT - S 06
SAMPLE NUMBER			E73253-001	E73253-002	E73253-003	E73253-004	E73253-005	E73253-006	E73253-007	E73253-008	E73253-009
SAMPLED		Test Method **	2024/05/08 11:43	2024/05/08 11:07	2024/05/08 11:25	2024/05/08 12:18	2024/05/08 08:27	2024/05/08 08:15	2024/05/08 08:41	2024/05/08 08:50	2024/05/08 12:02
Remarks			Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	57,1	63,2	65,0	0,00	43,1	106	64,2	19,1	592
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	57,1	63,2	65,0	0,00	43,1	106	64,2	19,1	592
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	57,1	63,2	65,0	0,00	43,1	106	64,2	19,1	592
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	27,3	33,8	36,1	138	102	55,5	109	359	229
pH (Laboratory)		YE030pH	7,60	7,60	7,76	4,45	6,30	6,84	6,79	6,65	8,15
Total Hardness	mg CaCO ₃ /L	YE061H	116	122	121	631	414	183	452	1252	326
Calcium Hardness	mg CaCO ₃ /L	YE061H	53,3	57,7	56,4	307	219	115	234	519	163
Magnesium Hardness	mg CaCO ₃ /L	YE061H	62,6	64,7	64,9	324	195	67,9	218	733	163
Total Dissolved Solids (TDS)	mg/L	Calculation	165	201	207	1016	686	335	724	3060	1436
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	0,55	<0.45
Calcium	mg Ca/L	YE060ICP	21,4	23,1	22,6	123	87,6	46,0	93,8	208	65,4
Chloride	mg Cl/L	YE070AK	13,0	14,7	14,9	27,6	29,7	11,0	33,8	30,4	56,8
Magnesium	mg Mg/L	YE060ICP	15,2	15,7	15,8	78,7	47,3	16,5	53,0	178	39,6
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Potassium	mg K/L	YE060ICP	2,92	3,57	3,71	11,0	9,94	2,87	11,5	14,6	14,3
Sodium	mg Na/L	YE060ICP	8,48	17,5	19,7	43,8	51,3	37,2	53,3	426	373
Sulphate	mg SO ₄ /L	YE070AK	69,3	88,0	90,9	712	434	157	440	2190	529
Aluminium	mg Al/L	YE060ICP	0,03	0,03	0,09	12,1	<0.01	0,12	<0.01	<0.01	<0.01
Fluoride	mg F/L	YE070AK	<0.09	0,13	0,12	<0.09	0,21	0,11	0,24	0,37	2,20
Iron	mg Fe/L	YE060ICP	0,41	0,15	0,24	0,04	<0.01	0,27	0,01	0,16	0,04
Manganese	mg Mn/L	YE060ICP	0,02	0,01	<0.01	7,80	0,02	<0.01	0,05	0,53	0,04
Langelier Index (indicative, not SANS)		Calculation	-0.80	-0.73	-0.57	-17.80	-1.67	-1.00	-0.99	-1.36	1,14
pHs (indicative, not SANS)		Calculation	8,40	8,33	8,33	22.25	7,97	7,84	7,78	8,01	7,01
Sodium Absorption Ratio (indicative)		Calculation	0,34	0,69	0,77	0,76	1,09	1,19	1,09	5,22	8,96
TDS to EC Ratio (indicative, not SANS)		Calculation	6,04	5,94	5,73	7,36	6,72	6,03	6,64	8,52	6,27
Corrosion Ratio (indicative, not SANS)		Calculation	1,27	1,38	1,37	44882596227.02	7,18	1,07	5,05	64,17	0,74
Ryznar Index (indicative, not SANS)		Calculation	9,20	9,07	8,90	40,05	9,65	8,83	8,76	9,37	5,88
Anion Sum			2,96	3,52	3,63	15,62	10,76	5,71	11,43	46,90	24,60
Cation Sum			2,80	3,33	3,42	16,53	10,81	5,39	11,72	44,19	23,17
Difference			-0,15	-0,20	-0,21	0,90	0,04	-0,31	0,29	-2,70	-1,42
% Difference			-2,66%	-2,86%	-2,94%	2,81%	0,21%	-2,81%	1,26%	-2,97%	-2,98%

Methods adapted to accommodate local laboratory conditions.

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please see <http://www.yanka.co.za/TestsAndStandards.htm> .

For ranges, uncertainties, etc., please contact us.



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CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11	SpGeo 12	SpGeo 13
SAMPLE DESCRIPTION			MPS - S 14	MPS - S 20	MPS - S 21	MPS - S 30
SAMPLE NUMBER			E73253-010	E73253-011	E73253-012	E73253-013
SAMPLED	Test Method **		2024/05/08 09:53	2024/05/08 10:46	2024/05/08 10:16	2024/05/08 10:00
Remarks			Yellowish	Clear	Clear	Black
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	906	612	29,6	378
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	906	612	29,6	378
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	906	612	29,6	378
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	275	389	610	494
pH (Laboratory)		YE030pH	8,08	8,01	7,44	8,00
Total Hardness	mg CaCO ₃ /L	YE061H	215	548	1996	973
Calcium Hardness	mg CaCO ₃ /L	YE061H	89,0	221	938	380
Magnesium Hardness	mg CaCO ₃ /L	YE061H	126	327	1057	593
Total Dissolved Solids (TDS)	mg/L	Calculation	1838	2744	5297	3560
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	1,09	<0.45	1,46	0,71
Calcium	mg Ca/L	YE060ICP	35,6	88,6	376	152
Chloride	mg Cl/L	YE070AK	57,7	60,9	47,3	60,4
Magnesium	mg Mg/L	YE060ICP	30,5	79,4	257	144
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	0,59	<0.35	0,42
Potassium	mg K/L	YE060ICP	12,0	13,2	24,9	23,9
Sodium	mg Na/L	YE060ICP	596	735	785	775
Sulphate	mg SO ₄ /L	YE070AK	559	1393	3765	2173
Aluminium	mg Al/L	YE060ICP	<0.01	0,05	<0.01	<0.01
Fluoride	mg F/L	YE070AK	2,50	2,73	0,09	1,79
Iron	mg Fe/L	YE060ICP	0,10	<0.01	0,34	<0.01
Manganese	mg Mn/L	YE060ICP	0,03	1,83	22,3	0,27
Langelier Index (indicative, not SANS)		Calculation	0,97	1,11	-0,15	1,12
pHs (indicative, not SANS)		Calculation	7,11	6,90	7,59	6,88
Sodium Absorption Ratio (indicative)		Calculation	17,62	13,59	7,62	10,77
TDS to EC Ratio (indicative, not SANS)		Calculation	6,68	7,05	8,68	7,21
Corrosion Ratio (indicative, not SANS)		Calculation	0,50	1,46	70,71	3,44
Ryznar Index (indicative, not SANS)		Calculation	6,13	5,78	7,74	5,76
Anion Sum			31,54	43,19	80,39	54,69
Cation Sum			30,62	43,40	75,90	53,98
Difference			-0,92	0,21	-4,48	-0,70
% Difference			-1,49%	0,24%	-2,87%	-0,65%

Methods adapted to accommodate local laboratory conditions.

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For ranges, uncertainties, etc., please contact us.



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Job No: **E73978 - W24_4265**
 Report Reference: **ER_GEO_2024-06-10_00154_001**
 Enquiries: **Rita Botha**
 Date: **2024/06/10**
RitaB@yanka.co.za
 Job Reference: **W24/4265 - Advice Note 2406W250**
 Job Description: **13 x Routine Analysis**

Project: **MOOPLAATS SURFACE & GW**

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & Groundwater - 06 June 2024

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see <http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 6 June 2024 - 2024/06/21
 SANAS Certificate obtainable from the address below
<http://www.yanka.co.za/Services.htm>

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ANALYSTS

Marné, Magda, Venna, Drieka, Sue, Rosemary, Vida, Elize, Petricia, Stefan, Nadine, Corlia, Lindie, Jolene, Audrey, Mariëtte, Nicolene



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CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 04	WT - S 05	WT - S 06
SAMPLE NUMBER			E73978-001	E73978-002	E73978-003	E73978-004	E73978-005	E73978-006	E73978-007	E73978-008	E73978-009
SAMPLED		Test Method **	2024/06/05 10:58	2024/06/05 10:19	2024/06/05 10:35	2024/06/05 11:18	2024/06/05 08:01	2024/06/05 07:53	2024/06/05 08:09	2024/06/05 08:15	2024/06/05 11:03
Remarks			Yellowish	Yellowish	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	66,3	86,2	75,0	0,00	110	105	88,4	16,8	710
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	66,3	86,2	75,0	0,00	110	105	88,4	16,8	710
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	66,3	86,2	75,0	0,00	110	105	88,4	16,8	710
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	25,9	39,6	36,3	159	89,1	64,5	89,9	394	232
pH (Laboratory)		YE030pH	5,87	6,46	6,82	4,28	6,40	6,65	6,78	6,66	8,14
Total Hardness	mg CaCO ₃ /L	YE061H	100	123	126	781	332	205	359	1452	250
Calcium Hardness	mg CaCO ₃ /L	YE061H	45,7	59,7	59,9	380	182	123	194	619	128
Magnesium Hardness	mg CaCO ₃ /L	YE061H	54,8	63,0	65,9	402	150	82,4	166	833	122
Total Dissolved Solids (TDS)	mg/L	Calculation	132	229	214	1280	612	411	625	3431	1510
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	1,19	<0.45	0,71
Calcium	mg Ca/L	YE060ICP	18,3	23,9	24,0	152	72,7	49,3	77,5	248	51,4
Chloride	mg Cl/L	YE070AK	13,9	17,5	16,5	25,4	24,9	13,7	33,3	36,4	63,0
Magnesium	mg Mg/L	YE060ICP	13,3	15,3	16,0	97,5	36,5	20,0	40,2	202	29,6
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Potassium	mg K/L	YE060ICP	2,83	3,49	3,34	9,84	6,87	3,18	8,31	15,7	10,4
Sodium	mg Na/L	YE060ICP	5,83	31,9	23,5	47,8	61,1	51,8	51,9	458	453
Sulphate	mg SO ₄ /L	YE070AK	37,5	84,1	85,5	921	344	209	359	2460	472
Aluminium	mg Al/L	YE060ICP	0,02	0,16	0,05	16,4	0,04	0,09	<0.01	<0.01	0,11
Fluoride	mg F/L	YE070AK	<0.09	0,26	0,16	<0.09	0,25	<0.09	0,32	0,25	3,34
Iron	mg Fe/L	YE060ICP	0,29	0,22	0,14	0,04	0,01	0,29	0,04	0,13	0,08
Manganese	mg Mn/L	YE060ICP	0,01	<0.01	<0.01	9,77	0,05	<0.01	0,14	0,31	0,04
Langelier Index (indicative, not SANS)		Calculation	-2.52	-1.73	-1.43	-17.89	-1.25	-1.17	-0.93	-1.34	1.10
pHs (indicative, not SANS)		Calculation	8.39	8.19	8.25	22.17	7.65	7.82	7.71	8.00	7.04
Sodium Absorption Ratio (indicative)		Calculation	0.25	1.25	0.91	0.74	1.45	1.57	1.19	5.21	12.41
TDS to EC Ratio (indicative, not SANS)		Calculation	5.09	5.77	5.90	8.05	6.87	6.37	6.96	8.71	6.51
Corrosion Ratio (indicative, not SANS)		Calculation	0.89	1.08	1.21	55149145047.77	2.27	1.41	3.18	82.33	0.60
Ryznar Index (indicative, not SANS)		Calculation	10.92	9.92	9.67	40.05	8.90	8.99	8.65	9.33	5.94
Anion Sum			2.50	3.99	3.76	19.91	10.09	6.85	10.22	52.64	26.01
Cation Sum			2.37	3.98	3.65	20.24	9.52	6.49	9.79	49.58	25.07
Difference			-0.14	-0.01	-0.11	0.32	-0.58	-0.36	-0.43	-3.06	-0.94
% Difference			-2.81%	-0.17%	-1.45%	0.81%	-2.93%	-2.70%	-2.14%	-2.99%	-1.84%

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For ranges, uncertainties, etc., please contact us.



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CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11	SpGeo 12	SpGeo 13
SAMPLE DESCRIPTION			MPS - S 14	MPS - S 20	MPS - S 21	MPS - S 30
SAMPLE NUMBER			E73978-010	E73978-011	E73978-012	E73978-013
SAMPLED	Test Method **		2024/06/05 08:59	2024/06/05 09:53	2024/06/05 09:22	2024/06/05 09:03
Remarks			Black	Grey	Clear	Greyish
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	948	784	64,5	326
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	948	784	64,5	326
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	948	784	64,5	326
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	292	415	669	529
pH (Laboratory)		YE030pH	8,07	7,72	7,60	7,69
Total Hardness	mg CaCO ₃ /L	YE061H	254	694	2427	1742
Calcium Hardness	mg CaCO ₃ /L	YE061H	142	270	1175	947
Magnesium Hardness	mg CaCO ₃ /L	YE061H	111	424	1253	795
Total Dissolved Solids (TDS)	mg/L	Calculation	2069	3183	6131	4672
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	2,79	0,89	1,60	0,69
Calcium	mg Ca/L	YE060ICP	56,9	108	470	379
Chloride	mg Cl/L	YE070AK	69,6	63,3	56,7	68,4
Magnesium	mg Mg/L	YE060ICP	27,1	103	304	193
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	0,58	<0.35	0,61
Potassium	mg K/L	YE060ICP	11,1	13,4	27,7	25,2
Sodium	mg Na/L	YE060ICP	671	854	969	879
Sulphate	mg SO ₄ /L	YE070AK	655	1560	4241	2927
Aluminium	mg Al/L	YE060ICP	0,61	0,07	<0.01	<0.01
Fluoride	mg F/L	YE070AK	4,24	3,36	<0.09	1,26
Iron	mg Fe/L	YE060ICP	0,35	0,18	0,42	<0.01
Manganese	mg Mn/L	YE060ICP	0,01	4,10	21,1	0,49
Langelier Index (indicative, not SANS)	Calculation		1,18	1,01	0,43	1,13
pHs (indicative, not SANS)	Calculation		6,89	6,71	7,17	6,56
Sodium Absorption Ratio (indicative)	Calculation		18,27	14,04	8,52	9,13
TDS to EC Ratio (indicative, not SANS)	Calculation		7,09	7,67	9,16	8,83
Corrosion Ratio (indicative, not SANS)	Calculation		0,57	1,26	36,70	5,27
Ryznar Index (indicative, not SANS)	Calculation		5,71	5,70	6,74	5,42
Anion Sum			34,82	50,21	91,26	69,56
Cation Sum			34,86	51,68	92,62	73,96
Difference			0,04	1,48	1,36	4,40
% Difference			0,06%	1,45%	0,74%	3,07%

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Job No: **E74908 - W24 _ 5194**
 Report Reference: **ER_GEO_2024-07-12_01082_001**

Enquiries: **Rita Botha**Date: **2024/07/12**

RitaB@yanka.co.za

Job Reference: **W24/5194 - Advice Note 2407W424**Job Description: **22 x Routine Analysis**Project: **MOOPLAATS SW & GROUNDWATER**

TEST RESULTS FOR

Geo Soil - Mooiplaats Surface & Groundwater - 11 July 2024

This report contains results pertaining only to the water/dust samples analysed.

For Standards referenced, and methods base, please see

<http://www.yanka.co.za/TestsAndStandards.htm>

Please contact us if you have any queries concerning the information contained herein. Thank you for your support.

Electronically approved

RITA BOTHA (Technical Signatory)
ENVIRONMENTAL SERVICES

ANALYSED WITHIN 11 July 2024 - 2024/07/31

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ANALYSTS

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YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 1	SpGeo 2	SpGeo 3	SpGeo 4	SpGeo 5	SpGeo 6	SpGeo 7	SpGeo 8	SpGeo 9
SAMPLE DESCRIPTION			VL - S 01	VL - S 02	VL - S 03	WT - S 01	WT - S 02	WT - S 03	WT - S 04	WT - S 05	WT - S 06
SAMPLE NUMBER			E74908-001	E74908-002	E74908-003	E74908-004	E74908-005	E74908-006	E74908-007	E74908-008	E74908-009
SAMPLED	Test Method **		2024/07/10 12:58	2024/07/10 10:25	2024/07/10 12:39	2024/07/10 13:09	2024/07/10 08:02	2024/07/10 07:55	2024/07/10 08:14	2024/07/10 08:22	2024/07/10 08:36
Remarks			Clear	Clear	Clear	Clear	Clear	Clear	Greyish	Clear	Clear
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	83,4	123	119	0,00	134	96,8	127	873	36,0
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	83,4	123	119	0,00	134	96,8	127	873	36,0
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	83,4	123	119	0,00	134	96,8	127	873	36,0
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	25,6	41,8	42,9	245	85,7	64,7	95,6	227	452
pH (Laboratory)		YE030pH	7,27	7,55	7,73	4,26	6,68	6,83	6,92	8,11	7,48
Total Hardness	mg CaCO ₃ /L	YE061H	111	115	119	1443	290	204	349	149	1662
Calcium Hardness	mg CaCO ₃ /L	YE061H	49,4	52,2	55,4	706	166	124	200	55,2	782
Magnesium Hardness	mg CaCO ₃ /L	YE061H	61,7	62,6	63,8	737	124	79,9	150	93,9	880
Total Dissolved Solids (TDS)	mg/L	Calculation	146	246	258	2299	588	426	674	1426	3975
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	<0.45	0,66	<0.45
Calcium	mg Ca/L	YE060ICP	19,8	20,9	22,2	283	66,4	49,8	79,9	22,1	313
Chloride	mg Cl/L	YE070AK	14,6	18,3	18,6	17,7	21,7	15,5	28,4	61,7	46,1
Magnesium	mg Mg/L	YE060ICP	15,0	15,2	15,5	179	30,1	19,4	36,4	22,8	214
Nitrate and Nitrite (TON)	mg N/L	YE070AK	0,93	<0.35	<0.35	<0.35	<0.35	<0.35	0,83	<0.35	<0.35
Potassium	mg K/L	YE060ICP	2,75	3,56	3,91	17,4	5,77	5,95	9,38	8,69	21,8
Sodium	mg Na/L	YE060ICP	7,83	45,3	46,2	56,3	74,3	57,6	74,6	482	586
Sulphate	mg SO ₄ /L	YE070AK	32,0	68,3	80,4	1685	309	220	365	302	2769
Aluminium	mg Al/L	YE060ICP	<0.01	0,02	0,05	41,5	0,02	0,08	0,02	0,40	<0.01
Fluoride	mg F/L	YE070AK	<0.09	0,12	0,17	<0.09	<0.09	<0.09	<0.09	1,61	<0.09
Iron	mg Fe/L	YE060ICP	0,04	0,02	0,04	0,08	<0.01	0,08	<0.01	0,07	0,02
Manganese	mg Mn/L	YE060ICP	<0.01	<0.01	<0.01	19,2	<0.01	<0.01	<0.01	<0.01	3,10
Langelier Index (indicative, not SANS)	Calculation		-1,00	-0,55	-0,36	-17,66	-0,92	-1,02	-0,63	0,79	-0,09
pHs (indicative, not SANS)	Calculation		8,27	8,10	8,09	21,92	7,60	7,85	7,55	7,32	7,57
Sodium Absorption Ratio (indicative)	Calculation		0,32	1,83	1,83	0,64	1,89	1,75	1,73	17,09	6,23
TDS to EC Ratio (indicative, not SANS)	Calculation		5,71	5,87	6,02	9,39	6,86	6,59	7,05	6,28	8,79
Corrosion Ratio (indicative, not SANS)	Calculation		0,69	0,71	0,79	92791267322,60	1,65	1,63	2,13	0,38	43,65
Ryznar Index (indicative, not SANS)	Calculation		9,26	8,65	8,45	39,59	8,52	8,87	8,18	6,52	7,67
Anion Sum			2,82	4,41	4,60	35,62	9,74	6,96	11,01	25,60	59,72
Cation Sum			2,65	4,38	4,52	37,27	9,21	6,78	10,51	24,27	59,63
Difference			-0,17	-0,04	-0,08	1,65	-0,53	-0,19	-0,50	-1,33	-0,09
% Difference			-3,03%	-0,41%	-0,85%	2,27%	-2,81%	-1,35%	-2,32%	-2,66%	-0,08%

Methods adapted to accommodate local laboratory conditions.

SM refers to the Standard Methods for the Examination of Water and Wastewater.

Unless analysis is indicated as "Total", tests are performed on filtered samples as per ISO 11885.

Ion balance is not used as QC check where pH<3.5.

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SANS, and/or other national or international standards,

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For ranges, uncertainties, etc., please contact us.



YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 10	SpGeo 11	SpGeo 12	SpGeo 13	SpGeo 14	SpGeo 15	SpGeo 16	SpGeo 17	SpGeo 18
SAMPLE DESCRIPTION			GKL-1	GKL-4d	GKL-2s	GAD-2s	GAD-1	GKL-9D	GKL-8M	GKL-5S	GKL-6M
SAMPLE NUMBER			E74908-010	E74908-011	E74908-012	E74908-013	E74908-014	E74908-015	E74908-016	E74908-017	E74908-018
SAMPLED	Test Method **		2024/07/10 11:23	2024/07/10 12:27	2024/07/10 12:33	2024/07/10 10:55	2024/07/10 11:10	2024/07/10 12:01	2024/07/10 12:06	2024/07/10 11:48	2024/07/10 11:52
Remarks			Clear	Brown	Rusty	Rusty	Yellowish	Clear	Rusty	Yellowish	Brownish
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	204	642	225	48,4	141	111	116	177	133
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	204	601	225	48,4	141	111	116	177	133
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	40,8	0,00	0,00	0,00	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	204	622	225	48,4	141	111	116	177	133
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	20,4	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	36,2	232	42,6	15,9	28,1	22,0	23,5	32,6	24,9
pH (Laboratory)		YE030pH	7,44	8,50	7,80	7,72	7,37	7,90	7,76	8,20	7,81
Total Hardness	mg CaCO ₃ /L	YE061H	164	15,5	195	63,2	136	58,2	95,6	64,1	69,0
Calcium Hardness	mg CaCO ₃ /L	YE061H	106	10,2	106	32,5	89,4	40,5	69,9	40,7	50,2
Magnesium Hardness	mg CaCO ₃ /L	YE061H	58,1	5,23	89,8	30,7	46,1	17,8	25,7	23,3	18,8
Total Dissolved Solids (TDS)	mg/L	Calculation	204	1342	229	80,6	147	116	124	186	137
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	<0.45	1,34	<0.45	0,66	<0.45	0,58	<0.45	<0.45	<0.45
Calcium	mg Ca/L	YE060ICP	42,3	4,10	42,3	13,0	35,8	16,2	28,0	16,3	20,1
Chloride	mg Cl/L	YE070AK	1,54	389	4,37	15,8	4,89	3,82	7,32	3,29	3,63
Magnesium	mg Mg/L	YE060ICP	14,1	1,27	21,8	7,46	11,2	4,32	6,23	5,67	4,57
Nitrate and Nitrite (TON)	mg N/L	YE070AK	<0.35	<0.35	<0.35	1,52	<0.35	<0.35	<0.35	<0.35	<0.35
Potassium	mg K/L	YE060ICP	1,09	4,61	1,33	0,81	1,92	1,93	1,65	1,67	1,20
Sodium	mg Na/L	YE060ICP	16,2	539	14,2	3,82	7,65	22,3	11,4	51,1	26,5
Sulphate	mg SO ₄ /L	YE070AK	6,01	11,4	9,82	3,05	<0.5	<0.5	<0.5	1,55	<0.5
Aluminium	mg Al/L	YE060ICP	0,01	0,59	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	mg F/L	YE070AK	<0.09	2,68	<0.09	<0.09	0,26	0,12	<0.09	0,14	0,32
Iron	mg Fe/L	YE060ICP	<0.01	1,85	0,09	0,04	0,17	0,07	0,11	0,39	0,91
Manganese	mg Mn/L	YE060ICP	0,05	0,01	0,03	0,02	0,13	0,08	0,04	0,02	0,07
Langelier Index (indicative, not SANS)	Calculation		-0,13	0,32	0,27	-0,94	-0,42	-0,32	-0,21	0,16	-0,25
pHs (indicative, not SANS)	Calculation		7,57	8,18	7,53	8,66	7,79	8,22	7,97	8,04	8,06
Sodium Absorption Ratio (indicative)	Calculation		0,55	59,47	0,44	0,21	0,29	1,27	0,51	2,77	1,38
TDS to EC Ratio (indicative, not SANS)	Calculation		5,63	5,78	5,37	5,07	5,22	5,28	5,29	5,72	5,51
Corrosion Ratio (indicative, not SANS)	Calculation		0,04	1,72	0,08	0,95	0,10	0,10	0,18	0,06	0,08
Ryznar Index (indicative, not SANS)	Calculation		7,70	7,86	7,27	9,59	8,20	8,54	8,18	7,88	8,31
Anion Sum			4,25	24,33	4,83	1,59	2,97	2,34	2,53	3,67	2,78
Cation Sum			4,03	24,14	4,59	1,51	3,12	2,24	2,46	3,57	2,62
Difference			-0,22	-0,20	-0,24	-0,08	0,15	-0,10	-0,06	-0,10	-0,16
% Difference			-2,71%	-0,40%	-2,55%	-2,68%	2,39%	-2,15%	-1,29%	-1,38%	-2,97%

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YANKA LABORATORIES

CHEMISTRY TEST RESULTS

LABORATORY NUMBER			SpGeo 19	SpGeo 20	SpGeo 21	SpGeo 22
SAMPLE DESCRIPTION			MPS - S 14	MPS - S 20	MPS - S 21	MPS - S 30
SAMPLE NUMBER			E74908-019	E74908-020	E74908-021	E74908-022
SAMPLED	Test Method **		2024/07/10 09:14	2024/07/10 10:04	2024/07/10 09:42	2024/07/10 09:19
Remarks			Clear	Clear	Clear	Black
Total Alkalinity (pH>4.5)	mg CaCO ₃ /L	YE010Alk	106	938	105	437
Bicarbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	106	938	105	437
Carbonate Alkalinity	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
M Alkalinity (8.3>pH>4.5)	mg CaCO ₃ /L	YE010Alk	106	938	105	437
P Alkalinity (pH>8.3)	mg CaCO ₃ /L	YE010Alk	0,00	0,00	0,00	0,00
Conductivity (Laboratory)	mS/m	YE020CON	222	346	713	448
pH (Laboratory)		YE030pH	8,10	8,21	7,84	7,92
Total Hardness	mg CaCO ₃ /L	YE061H	170	265	2735	784
Calcium Hardness	mg CaCO ₃ /L	YE061H	100	90,9	1254	369
Magnesium Hardness	mg CaCO ₃ /L	YE061H	70,0	174	1481	415
Total Dissolved Solids (TDS)	mg/L	Calculation	937	2267	7189	3513
Temperature	°C	Thermometer	21,0	21,0	21,0	21,0
Ammonia and Ammonium	mg N/L	YE070AK	4,67	0,78	1,47	0,50
Calcium	mg Ca/L	YE060ICP	40,2	36,4	502	148
Chloride	mg Cl/L	YE070AK	72,8	75,7	66,9	73,0
Magnesium	mg Mg/L	YE060ICP	17,0	42,3	360	101
Nitrate and Nitrite (TON)	mg N/L	YE070AK	0,63	0,69	0,50	<0.35
Potassium	mg K/L	YE060ICP	11,5	12,6	11,8	19,6
Sodium	mg Na/L	YE060ICP	245	701	1152	867
Sulphate	mg SO ₄ /L	YE070AK	476	827	5020	2040
Aluminium	mg Al/L	YE060ICP	0,01	0,05	<0.01	<0.01
Fluoride	mg F/L	YE070AK	2,43	4,62	0,30	1,34
Iron	mg Fe/L	YE060ICP	0,05	<0.01	0,05	<0.01
Manganese	mg Mn/L	YE060ICP	0,03	0,03	9,27	0,20
Langelier Index (indicative, not SANS)		Calculation	0,16	1,12	0,90	1,09
pHs (indicative, not SANS)		Calculation	7,94	7,09	6,94	6,83
Sodium Absorption Ratio (indicative)		Calculation	8,14	18,64	9,55	13,42
TDS to EC Ratio (indicative, not SANS)		Calculation	4,22	6,55	10,08	7,84
Corrosion Ratio (indicative, not SANS)		Calculation	4,27	0,69	26,58	2,90
Ryznar Index (indicative, not SANS)		Calculation	7,78	5,97	6,03	5,74
Anion Sum			14,29	38,45	108,65	53,39
Cation Sum			14,72	36,20	105,92	54,05
Difference			0,43	-2,25	-2,73	0,67
% Difference			1,47%	-3,01%	-1,27%	0,62%

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