Bi-annual Groundwater Monitoring Report – November 2023

FFS Refiners – Evander Facility

FFS Refiners (Pty) Ltd

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REPORT SIGN OFF & APPROVALS

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EXECUTIVE SUMMARY

SLR Consulting (South Africa) (Pty) Ltd (SLR) was appointed by FFS Refiners (Pty) Ltd to perform groundwater monitoring at the FFS Refiners Evander Facility (referred to in this report, as "the Site"). The investigation included a desk study, groundwater sampling, laboratory analysis, and reporting. This groundwater monitoring program forms part of FFS's environmental risk management program. This report presents the findings of the groundwater monitoring assessment completed in November 2023.

Seven monitoring wells were monitored and sampled for the analyses of the following determinants: Volatile organic compounds (VOCs) (benzene, toluene, ethylbenzene, xylenes, naphthalene), semi-volatile organic compounds (SVOCs) (polycyclic aromatic hydrocarbons [PAHs] and phenols), gasoline range organics (GRO), and extractable petroleum hydrocarbons (EPHs).

Physical water quality parameters, i.e., pH, temperature, oxidation-reduction potential (ORP) and electrical conductivity (EC) were recorded during the sampling exercise:

- pH ranged between 6.76-7.80. The average is 7.27.
- Electric conductivity ranged between 982 µS/cm and 2394 µS/cm. The average EC is 1354.14 µS/cm.
- Oxidation reduction potential ranged between -271.8 mV and 37.7 mV. The average ORP is -82.04 mV.
- Temperature ranged between 18.44 ºC and 22.31 ºC, with similar temperatures between shallow and deep borehole pairs indicating potential mixing between the shallow and deeper-lying aquifers.
- Dissolved oxygen ranged between 2.28 mg/l and 3.51 mg/l. The average DO is 2.75 mg/L.

Groundwater Levels

Groundwater levels ranged between 0.39 m – 1.77 m bgl, with an average depth to water of 1.18 m bgl. The direction of groundwater flow is inferred to occur towards the west.

Groundwater levels are broadly consistent with previous events and align with typical fluctuations between wet and dry seasons, while a pattern of longer-term, gradual shallowing of groundwater. For a more comprehensive and accurate analysis, more data points are required.

Groundwater Quality Assessment

Groundwater quality was assessed against the Tier I Risk-Based Screening Levels (RBSLs) in a commercial/industrial setting.

The results indicate potential contamination in the groundwater, warranting further investigation and monitoring.

Overall, the assessment of data from FFS Evander indicates that monitoring wells MW1, MW3 and MW7 have been impacted, due to a historical spill event that occurred in 2006. The COPCs demonstrate an increase in concentrations in these locations, as they fall above the Tier 1 groundwater ingestion for commercial screening guidelines. VOCs were detected in monitoring wells, MW2S and MW9 at concentrations below the Tier 1 commercial screening guidelines.

Risk Summary

In summary, based on the water quality screening results, the risk profile for the site is characterised by elevated concentrations of COPCs in the monitoring wells, MW1, MW3 and

MW7. It is important to note that groundwater at the Site is not utilised for drinking purposes. As such, the operation poses an acceptable risk to human health.

Recommendations

Based on the findings of this assessment, it is recommended that bi-annual groundwater monitoring program continues to collect data at regular intervals throughout the year to provide essential data to support informed decision-making processes, aiming to manage and mitigate potential environmental impacts and risks to human health.

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
BDL	Below Detection Limit
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes, and Naphthalene
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
EC	Electrical Conductivity
EPH	Extractable Petroleum Hydrocarbons
FFS	FFS Refiners (Pty) Ltd
GRO	Gasoline Range Organics
H&S	Health and Safety
HASP	Health and Safety Plan
km	Kilometre
L/s	Litres per Second
LNAPL	Light Non-Aqueous Phase Liquid
m	Meters
m amsl	Metres above mean sea level
m bgl	Meters below ground level
MDL	Method Detection Limit
mg/L	Milligrams per litre
MNA	Monitoring Natural Attenuation
MTBE	Methyl Tertiary Butyl Ether
NGA	National Groundwater Archive
ORP	Oxidation Reduction Potential
PAH	Polycyclic Aromatic Hydrocarbons
ppm	Parts per million
QA/QC	Quality Assurance and Quality Control
RBCA	Risk-Based Corrective Action
RBSL	Risk-Based Screening Levels
RPD	Relative Percent Difference
SANAS	South African National Accreditation System
SLR	SLR Consulting South Africa (Pty) Ltd
SVOC	Semi-Volatile Organic Compounds
TAME	tert-Amyl methyl ether
TPH	Total Petroleum Hydrocarbons
ug/L	Micrograms per litre
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 Introduction

1.1 Terms of Reference

SLR Consulting South Africa (Pty) Ltd (SLR) was appointed by FFS Refiners (Pty) Ltd (Pty) Ltd (FFS) to perform bi-annual groundwater monitoring FFS Refiners production facilities in Evander (Mpumalanga) (hereafter referred to as "the Site") in support of their environmental management programme.

The assessment was conducted in accordance with South African legislation, namely Sections 28 and 30 of the National Environmental Management Act (Act No. 107 of 1998), Sections 35 to 39, 41 and 67 to 78 of the National Environmental Management Waste Act (Act No. 59 of 1998), and the National Water Act (Act No. 36 of 1998).

1.2 Objectives

The objective if this environmental assessment was to report on findings of groundwater monitoring, interpret the significance of any groundwater contamination. To provide recommendations (if applicable) to any additional work required if there are serious contamination to groundwater encountered.

The groundwater monitoring exercise will aim to evaluate the impact of these operations on the groundwater system, identify potential contaminants, and implement appropriate measures to mitigate risks.

The primary objectives of the bi-annual groundwater assessment are as follows:

- To assess the quality and quantity of groundwater in relation to fuel handling and storage.
- To identify potential sources of contamination and assess their impact on the groundwater system.
- To monitor changes in groundwater conditions over time and detect any emerging concerns.
- To establish trends in water levels and hydrocarbon concentrations for effective long-term management and mitigation strategies.
- To ensure compliance with regulatory standards and guidelines pertaining to groundwater protection.

1.3 Scope of Work

The technical scope of work was based on SLR's Land Quality & Remediation Group – Africa Region (LQR) SOP for groundwater monitoring included the following:

Before a site visit,

- Obtain permission for site access.
- Contact the site owner/representatives to confirm visit date and time and discuss any site issues.
- Get specific instructions on what activities are allowed at the site.

Before beginning fieldwork,

- Ensure all required documents (Job Card, Proposal, Sample Plan, historical reports showing last known well data, Purchase Order etc., the correct sampling equipment including enough bailers or low-flow pump with a charged battery and sufficient tubing, and laboratory sample containers, plus extras), an updated site plan, the necessary field data sheets, and H&S documents.

- Ensure all equipment has been calibrated before use and a record of the calibration has been appropriately noted and available for inspection on-site. (The analysis to be done determines the type of sampling bottles, preservatives, holding time, and filtering requirements).

On arrival,

- Introduce oneself to the site representative and obtain a permit to work (PTW) if applicable.
- Agree on timing and system sampling that will suit both the consultant and site management.
- Ensure all work area is cordoned off with appropriate barriers/traffic control devices and the person doing the work is wearing appropriate Personal Protective Equipment (PPE).
- Generate field records (it is essential to record procedures used and measurements immediately after being completed whilst still fresh in the memory i.e., notes should not be taken after returning from the field).

Data collection,

- All monitoring and sampling data collected during field work is recorded in the Field Data Sheets, using the appropriate naming protocol for samples. The original hard copies should be saved in the project file on return to the office, and scanned copies of the Field Data Sheets should be on the server.
- Groundwater samples should be collected directly from the sampling bailer or low-flow pump tubing into appropriate sampling containers. A sample label identification should be attached. Complete field data sheet, a chain of custody form, and record all pertinent data in the Field Data Sheets.
- Samples should be placed in a cooler and maintained at 4°C, and ideally shipped withing 24hours of sample collection. If large numbers of samples are being collected shipment may occur regularly.

Table 1-1: Summary of Scope of Work

Item	Description
Project Management	Project initiation, planning, H&S, administration.
Site Reconnaissance	Site visit and walkover.
Groundwater Assessment	• Sample the existing monitoring wells. • Submit all groundwater samples to Element Materials Technology[1] for targeted hydrocarbon analyses according to site requirements.
Reporting	• Update the Conceptual Site Model (CSM) for the site based on available information to qualitatively evaluate the potential risks to receptors. • Compile a report summarising observations from site visits and detailing the findings of the groundwater assessment. • Propose recommendations for the Site based on findings of the assessment/outcomes of the CSM.

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[1] United Kingdom Accreditation Service (UKAS) and South African National Accreditation System (SANAS) accredited.

2.0 Desk Study

2.1 Site Details

Table 2-1 presents the site identification details. The site location is indicated in Figures 1 and 2 whilst a site plan showing site facilities is presented in Figure 3.

Table 2-1: Site Details

<table>
<tr><td>Site Name</td><td colspan="6">FFS Refiners Evander Facility</td></tr>
<tr><td>Address</td><td colspan="6">3 Brunel Rd, Evander, Mpumalanga, South Africa</td></tr>
<tr><td>Co ordinates</td><td colspan="6">26°29’12.60” S, 29°5’53.11” E</td></tr>
<tr><td>Post Code</td><td colspan="6">2280</td></tr>
<tr><td>Site Owner</td><td colspan="3">FFS Refiners (Pty) Ltd</td><td>Period at Site</td><td colspan="2">Unknown</td></tr>
<tr><td>Site Operator</td><td colspan="3">FFS Refiners (Pty) Ltd</td><td>Brand</td><td colspan="2">FFS Refiners</td></tr>
<tr><td>Surrounding land use</td><td>Residential</td><td>Yes</td><td>Commercial</td><td>Yes</td><td>Agriculture/ Vacant</td><td>Yes</td></tr>
<tr><td rowspan="4">Adjacent properties</td><td>North</td><td colspan="5">Commercial: Kinross Tailing Facility</td></tr>
<tr><td>East</td><td colspan="5">Regional Route R58 and Walker Park Golf Club
Evander Sewage works approximately 1 km from the eastern boundary.</td></tr>
<tr><td>South</td><td colspan="5">Vacant land</td></tr>
<tr><td>West</td><td colspan="5">Elikhulu Tailings Facility</td></tr>
<tr><td>Other potential off-site sources</td><td colspan="6">Evander Dam east of southeast of the Site.
Winkelhaak Tailing Facility south of southeast from Site.
Leslie Tailing Facility at the extreme south of southwest from Site.</td></tr>
</table>

2.2 Geophysical Setting

The information in Table 2-2 was derived from a separate desk-based review of published information and site inspection.

Table 2-2: Geophysical Setting

Geography	**Topography and gradient**	The area is characterised by a combination of a gentle and steep slope in the order of 4% towards the west.
	Elevation	The Site is located at an elevation of approximately 1 633 m amsl.
Geology	**Bedrock**	The Site is underlain by Jurassic dolerite. The upper dolerite profile is generally weathered to varying degrees. This overlies the Vryheid Formation of the Ecca Group and Permian Supergroup largely comprising of sandstone, shale and coal seams followed by increasingly fresh rock which extends from approximately 4 30 m bgl.
Hydrogeology	**Aquifer Classification**	According to the 1: 3 000 000 Aquifer Classification Map of South Africa (DWAF, 1998), the aquifer is classified as a minor aquifer of moderate vulnerability and medium susceptibility to groundwater impact via anthropogenic activities.

	Aquifer yield and hydraulic conductivity	According to the DWAF 1:500 000 Hydrogeological Map of Johannesburg (Sheet 2526), the Site is underlain by an intergranular and fractured aquifer yielding between 0.1 – 0.5 L/s of water.
	Groundwater depth and flow	In accordance with the current monitoring event, the groundwater depth is between approximately 0.39 – 1.77 m bgl. Groundwater flows westward, following the moderate dip of the Site's topography.
	Groundwater abstractions	None located within the 1 km radius from the Site.
Hydrology	**Surface water bodies within 300m of the site**	No natural surface water bodies were identified within 300 m of the site. The Evander Dam (Unicor Dam) is located approximately 2.60 km southeast of the site. The Leeupan Dam is located 13.78 km south of southwest of the site.
Meteorological data	The average annual rainfall in Evander is approximately 620 - 1000 mm per annum. Most of the rainfall occurs during the spring to summer months (September – March).	
Protected Biodiversity Zones	No protected biodiversity zones were identified within a 500-m radius.	
Heritage and Archaeological sites	No heritage and archaeological sites were identified within a 500-m radius .	

2.3 Previous Investigations

Bi-annual groundwater monitoring has been conducted at the facility since October 2007. A yearly water quality report was produced by a third-party laboratory in July 2019. Following the issuance of a remediation order by the Department of Forestry, Fisheries and the Environment (DFFE) on 10 September 2019, under order No. 14/11/15/LR68/6, a Remediation Action Plan was devised in December 2019.

Below is a summary of the findings of previous environmental assessments pertaining to groundwater during the July 2023 monitoring event as per WSP, 2023[2]:

Impacts on Aquifers: Groundwater contamination within the deep aquifer is primarily attributed to a historical spill that occurred in 2006. The risk assessment indicated that existing dissolved-phase contamination within both shallow and deep groundwater underlying the north of the site is unlikely to represent a significant source of risk in terms of off-site migration to the then-present nearby dam. This is supported by the general absence of contaminants of concern within monitoring wells MW5, MW8, and MW9, which are down-hydraulic-gradient of the original contamination source. However, the encroachment of a tailings facility onto the area previously occupied by the dam is expected to have a substantial impact on the local hydrogeological regime.

Constituents of Potential Concern (COPC): The COPC in relation to the operation of the site include extractable petroleum hydrocarbons (EPH) indicative of diesel or oil, gasoline range organics (GRO) reflecting lighter petroleum products, volatile organic compounds (VOC) such as benzene and toluene, and semi-volatile organic compounds (SVOC) including polycyclic aromatic hydrocarbons (PAHs) and phenols. These contaminants have been monitored due to their historical presence and potential environmental impact on the site's groundwater quality.

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[2] WSP (Pty) Ltd. (2023). Groundwater Monitoring Report - Dry Season 2023 - Evander. FFS Refiners (Pty) Ltd. Contract Report Nr.: 41104127.

Contaminant Concentration Analysis: BTEX and MTBE concentrations were predominantly below detection limits except in monitoring wells, MW2-S, MW5 and MW9. Analysis in the Evander site's 2023 dry season report highlights elevated levels of VOCs, SVOCs, GRO, EPH, and phenols in groundwater. This analysis, focusing on BTEX-N compounds, PAHs, and phenolic compounds, revealed levels of contamination in groundwater exceeding drinking water standards.

Groundwater Impact and Aquifer Continuity: Historical and recent data indicated a sustained impact on groundwater quality, suggesting interconnectivity between shallow and deep aquifers.

Site-Specific Findings: Monitoring wells, MW3 and MW7 exhibit the most significant impacts, with MW7's condition likely influenced by on-site waste separation activities.

Recommendations for FFS Refiners: It was recommended that FFS should assess its infrastructure and storage facilities, implement corrective actions, and maintain biannual groundwater monitoring in compliance with the amended Remediation Order.

2.4 Site Description

Further description of the Site operation is found on Table 2-3 below.

Table 2-3: Description of Site Operations

Historic	The FFS Refiners Evander Facility is a manufacturing facility that produces Heavy Fuel Oils (HFO) for large industrial customers. The site also produces Creosote Wood Preservative for the timber treating industry. The Site's proprietary VOC scrubbing systems and water treatment plant ensure environmental compliance.
Site Features	The facility manufactures and produces HFO, manages bulk oils and comprises process plants along with bunded Above-ground Storage Tanks (ASTs). The Site also produces Creosote Wood Preservative for the timber treating industry and handle a diverse range of coal-tar derived products, including Coal Tar Fuel (CTF) which are mainly obtained from coal gasification, coking, and char-producing operations. Additionally, the facility houses workshops, a laboratory, and administration buildings.
Reconciliation records	Not available
Any releases or spillages	Previous FFS operations have resulted in subsurface impacts related to a historical spill, occasional minor product spillages and possible influence from wash-bay sumps. Previous reporting has indicated existing groundwater contamination in the deep aquifer which was linked to a spill in 2006. Given the presence of contaminants within boundary monitoring wells, lateral off-site migration to the north and northwest is likely.
Workshop	Available.
Site Surface	Concrete and gravel.
Oil/water separator	Unknown
Infrastructural or operational changes	In 2007, a groundwater monitoring network was initially established at the site, consisting of six monitoring wells. However, due to site expansion activities, MW2S was lost. Following previous recommendations, an additional shallow monitoring well (MW7) was installed to the northwest of the site in October 2012. MW4 was destroyed in 2014 during construction activities. In response to this, FFS acted by commissioning the installation of four supplementary shallow monitoring wells in September 2016. NMW4 (replacement well), was also later destroyed during bund construction.

3.0 Field Methodology

Prior to the commencement of site investigation work, a Health and Safety Plan (HASP) for the planned activities was compiled. SLR HSE protocols were adhered to in the preparation and implementation of the project.

3.1 Groundwater Monitoring & Sampling

A total of seven monitoring wells were gauged to determine the depth to groundwater and borehole. Groundwater levels were measured using Solinst™ oil-water interface meter.

Groundwater samples from the monitoring wells were collected with a low-flow peristaltic pump (Alexis©) using a dedicated set of silicon and polyethylene tubing for each sampling location. Stabilisation of field parameters such as temperature, pH, electrical conductivity (EC), and oxidation-reduction potential (ORP) was used to determine when groundwater pumped from the monitoring well was representative of the aquifer.

All existing monitoring wells were purged of three saturated well volumes before sampling.

Depth to water and water quality parameters were measured in three-minute intervals. A sample was collected once three consecutive readings were within an acceptable variance.

A comprehensive summary of the groundwater sampling methodology in accordance with SLR's standard operating procedure is presented in SOP 4.4, Rev. 17[3].

3.2 Groundwater Laboratory Analysis

All groundwater samples were submitted to Element Materials Technology Laboratory (Somerset West, South Africa)[4] to determine the presence and concentration of various hydrocarbon compounds as follows:

- VOCs (BTEXN)
- SVOCs (PAHs and phenols)
- GRO
- EPHs

All samples were kept under cooled conditions and transported to the analytical laboratory with full chain of custody documentation.

3.3 Quality Assurance & Quality Control Program

A QA/QC program was applied to evaluate if the sampling and analytical data were reliable based on current industry standards. The QA/QC program consisted of two stages, one stage completed by the laboratory and the other as part of the standard field procedures performed by SLR.

Groundwater samples were recovered and handled based on United States Environmental Protection Agency (USEPA) methods and aligned with SLR's Groundwater Sampling SOP. Samples were collected in containers provided by the laboratory, handled, stored, and transported to the laboratory in accordance with established chain-of-custody documentation. Chemical analysis was undertaken by an accredited laboratory. Equipment used was within

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[3] Available on request

[4] United Kingdom Accreditation Service (UKAS), and South African National Accreditation System (SANAS) accredited laboratory.

the manufacturer's service intervals, where relevant, and were checked for calibration where required.

Disposable nitrile gloves were worn during sampling and decontamination activities to minimise the potential for the transfer of contaminants. All disposable materials, such as nitrile gloves and tubing were dedicated to a sampling location and disposed of after each use.

Quality control procedures included the collection of one blind duplicate for every ten groundwater samples collected per sampling event.

Laboratory report 23/1310 for the groundwater sampling events done in November 2023 are attached in Appendix C of this report.

3.4 Laboratory QA/QC Program

All samples were analysed by Element Materials Technology Laboratory. All time-sensitive analysis was endeavoured to be done immediately (where preservation is impossible) or with method-specific holding times to protect the sample's integrity.

Surrogate recoveries for all samples should be within acceptable ranges of 70 130% for most compounds and 50-150% for Volatile Organic Compounds (VOCs).

Laboratory equipment is calibrated and/or verified based on a predetermined maintenance schedule. The quality system is audited by the laboratory's quality manager and externally by the United Kingdon Accreditation System (UKAS) and the South African National Accreditation System (SANAS).

3.5 Field QA/QC Program

To verify the reproducibility of the laboratory analyses and field sampling, SLR collects blind duplicate groundwater samples. The purpose of collecting duplicate samples is to ensure the reliability and accuracy of the analytical data obtained from the monitoring process. The practice of collecting duplicate samples is a standard QA/QC measure employed in environmental monitoring. By analysing duplicate samples, it helps identify any potential sources of errors or inconsistencies in the laboratory analysis, sampling technique, or sample handling process. At least one groundwater blind duplicate was collected and submitted to the laboratory for analysis.

Based on the results of the duplicate analysis, the relative percent difference (RPD) is calculated as a measure of QA/QC. The analytical error increases near the method detection limit (MDL); therefore, the RPD is not generally calculated unless the concentrations of the original and duplicate samples exceed five times the MDL. If the RPD for a sample and its duplicate do not meet acceptable RPD standards for the parameters analysed, an explanation is required to qualify the value difference.

Trip blanks were submitted to the laboratory to undergo the same analysis and calculation procedure to maintain QA/QC protocols. In addition, one trip blank was submitted for each cooler box.

SLR utilises a data quality review program that incorporates both the duplicate and trip blank in assessing the reliability of the field data.

A comprehensive account of the groundwater QA/QC program is presented in SLR SOP 4.16.

4.0 Site Investigation Results

4.1 Groundwater Monitoring Data

As part of the groundwater monitoring assessment all monitoring wells were sampled on 09 November 2023. Monitoring well information is presented in Table 4-1: Summary of Groundwater Monitoring Well Information and displayed spatially in Figure 1. The locality and topographical maps are also attached under Appendix A. Groundwater levels and physico-chemical parameters were measured during the purging process of each monitoring well.

The assessment results indicated that groundwater had a static water level gauged between 0.39 – 1.77 m bgl. The average SWL is 1.18 m bgl. None of the wells gauged showed any signs of free-phase product being present. Groundwater levels are broadly consistent with previous events and align with typical fluctuations between wet and dry seasons, while a pattern of longer-term, gradual shallowing of groundwater.

A summary of the groundwater monitoring well information and physico-chemical parameters are presented in Table 4-1 and Table 4-2 and the following observations were made:

- pH ranged between 6.76-7.80. The average pH is 7.27.
- Electric conductivity ranged between 982 µS/cm and 2394 µS/cm. The average EC is 1354.14 µS/cm.
- Oxidation reduction potential ranged between -271.8 mV and 37.7 mV. The average ORP is -82.04 mV. MW1, MW3, MW7, MW8 and MW9 portrayed a more reducing potential whilst MW2S and MW5 portrayed a more oxidising potential.
- Temperature ranged between 18.44 °C and 22.31 °C, with similar temperatures between shallow and deep borehole pairs indicating potential mixing between the shallow and deeper-lying aquifers.
- Dissolved oxygen ranged between 2.28 mg/l and 3.51 mg/l. The average DO is 2.75 mg/L.

Table 4-1: Summary of Groundwater Monitoring Well Information

Borehole ID	Well Depth (m bgl)	Well Location from source area	Condition/Comments
MW1	>30	Off-site perceived down hydraulic gradient, approximately 8 m north of ASTs.	Clear with sediments and a strong hydrocarbon odour. Oily sheen present
MW2-D	Could not be sampled, waterlogged.		
MW2-S	6.0	On-site along the north-western corner of the property down-gradient of the ASTs	Clear, no odour.
MW3	>30	Off-site perceived down hydraulic gradient, approximately 8 m north of ASTs and water tank	Clear with sediments and a strong hydrocarbon odour.
MW4	Destroyed		
MW5	24.13	Off-site perceived down hydraulic gradient, approximately 23 m west of the water tank	Clear with no sediments and no odour.
MW7	4.35	Off-site perceived down hydraulic gradient, approximately 15 m northwest of the water tank	Clear with a strong hydrocarbon odour.
MW8	8.52	Off-site roughly 15 m north of MW7, perceived down-hydraulic gradient of 2006 spill	Clear with no sediments and no odour,
MW9	7.28	Off-site approximately 30 m downgradient of MW5 and perceived down hydraulic gradient of the 2006 spill	Clear with no sediments and no odour.

Table 4-2: Summary of Field Observations

Borehole ID	SWL (m bgl)	Temperature (°C)	pH	EC (µS/cm)	ORP (mV)	DO (mg/L)
MW1	1.41	18.90	7.80	1374	-217.8	2.48
MW2-D	Could not be sampled (water logged after heavy rainfall)					
MW2-S	1.62	19	6.76	1010	37.7	2.78
MW3	1.77	19.64	7.44	1311	-188.5	2.55
MW4	Destroyed					
MW5	0.85	18.70	7.59	1302	33.6	3.69
MW7	0.39	18.44	6.84	1106	-171.5	2.62
MW8	1.00	19.08	7.02	982	-11.2	2.49
MW9	1.23	19.61	7.45	2394	-156.6	2.58

Figure 1: Monitoring Positions Map

4.2 Groundwater Chemical Results

The groundwater analytical results for the COPCs are discussed below and presented in Table 4-3 shows the COPC results for each well on a site layout figure. The laboratory certificates are attached as Appendix D.

4.2.1 Groundwater Analytical Results

The concentrations of targeted hydrocarbon compounds detected in soil and groundwater samples were compared to Risk Based Screening Levels (Reference: RISC5 Risk Integrated Software for Clean-Ups, Version 5, 2011.) in order to determine the potential health risks posed to human receptors by the contamination. A carcinogenic risk is the probability of incurring cancer as a result of exposure to the contaminants of concern. The Hazard Quotient (Hazard) is associated with non-carcinogenic compounds, which may compromise human health.

The detected hydrocarbon concentrations for groundwater were compared to the Tier I RBSLs for ingestion of groundwater, Tier I for surface water and Tier II Site-Specific Target Levels (SSTLs). Following the tiered approach, petroleum hydrocarbon concentrations are firstly evaluated against the Tier II SSTLs. Where SSTLs are not available, Tier I RBSLs are applied. If the Site is in a mix of a commercial and residential setting, the residential RBSLs are also considered as they are the most sensitive receptor. If the Site is in a commercial or industrial setting and no residential receptors were identified, residential RBSLs will not apply. The results of the laboratory testing of groundwater samples for the current assessment are summarised in Table 4-3 below and the laboratory certificate is attached under Appendix C.

The results for the November 2023 sampling event are summarised below:

- The Tier 1 RBSL for Benzene in Groundwater Ingestion – Commercial is 408.8 µg/L, the concentrations observed at monitoring wells MW3 and MW7 were 528 µg/L and 600 µg/L, respectively, which exceeded the screening limit.
- Targeted parameters, including PAHs, MTBE, and TAME, were found to comply with Tier 1 RBSLs across all monitoring wells, with concentrations in MW5 and MW8 below the laboratory's method detection limits.

Table 4-3: Groundwater Analytical Chemistry

Parameters	Tier 1 RBSL GW Ingestion - Commercial	Tier 1 RBSL Indoor Air - Commercial	Tier 1 RBSL Outdoor Air - Commercial	MW1	MW2S	MW3	MW5	MW7	MW8	MW9
Naphthalene	2 044	>Sol	>Sol	80.5	BDL	196.2	BDL	194.9	BDL	BDL
Acenaphthylene	NG	NG	NG	0.67	BDL	1.01	BDL	0.83	BDL	BDL
Acenaphthene	NG	NG	NG	0.88	BDL	0.43	BDL	3.2	BDL	BDL
Fluorene	>Sol	>Sol	>Sol	0.51	BDL	1.07	BDL	0.39	BDL	BDL
Phenanthrene	>Sol	>Sol	>Sol	BDL	BDL	0.39	BDL	0.11	BDL	BDL
Anthracene	>Sol	>Sol	>Sol	BDL	BDL	0.34	BDL	0.11	BDL	BDL
Fluoranthene	>Sol	>Sol	>Sol	BDL	0.12	0.09	BDL	0.07	BDL	BDL
Pyrene	>Sol	>Sol	>Sol	0.18	0.2	0.1	BDL	0.1	BDL	0.11
Benzo(a)anthracene	NG	NG	NG	0.21	0.35	0.13	BDL	0.15	BDL	0.2
Chrysene	NG	NG	NG	0.06	0.15	0.06	BDL	0.06	BDL	0.1
Benzo(bk)fluoranthene	NG	NG	NG	BDL	0.5	0.15	BDL	0.16	BDL	0.36
Benzo(a)pyrene	NG	NG	NG	BDL	0.12	0.04	BDL	0.05	BDL	0.11
Indeno(123cd)pyrene	NG	NG	NG	0.06	0.15	0.03	BDL	0.04	BDL	0.11
Dibenzo(ah)anthracene	NG	NG	NG	0.06	0.14	0.04	BDL	BDL	BDL	0.08
Benzo(ghi)perylene	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene	NG	NG	NG	BDL	0.29	0.09	BDL	0.09	BDL	0.25
Benzo(k)fluoranthene	NG	NG	NG	BDL	0.21	0.06	BDL	0.07	BDL	0.11
Methyl Tertiary Butyl Ether (MTBE)	87 892	38 944	>Sol	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzene	408.8	39 452	>Sol	321	BDL	**528**	BDL	**600**	BDL	BDL
Toluene	20 440	445 730	>Sol	28	BDL	75	BDL	210	BDL	BDL
Ethylbenzene	10 220	>Sol	>Sol	8	BDL	122	BDL	64	BDL	BDL
Xylenes	20 440	131 171	>Sol	21	BDL	656	BDL	182	BDL	BDL
Tert Amyl Methyl Ether (TAME)	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenol	NG	NG	NG	BDL	100	BDL	BDL	BDL	BDL	BDL
2,3,4,6 Tetrachlorophenol	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4 Dimethylphenol	NG	NG	NG	2	1800	BDL	BDL	3	BDL	BDL
2,4,5 Trichlorophenol	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4,6 Trichlorophenol	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,6-Dichlorophenol	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Methylphenol (o-cresol)	NG	NG	NG	BDL	440	1	BDL	BDL	BDL	BDL

Parameters	Tier 1 RBSL GW Ingestion - Commercial	Tier 1 RBSL Indoor Air - Commercial	Tier 1 RBSL Outdoor Air - Commercial	MW1	MW2S	MW3	MW5	MW7	MW8	MW9
2-Nitrophenol	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
3- and 4-Methylphenol (m+p cresol)	NG	NG	NG	2	19000	4	2	BDL	BDL	2
EPH $>C_{10}-C_{16}$	4 088	21 195	>Sol	1 540	BDL	1 450	BDL	2 970	BDL	BDL
EPH $>C_{16}-C_{21}$	NG	NG	NG	450	BDL	470	BDL	BDL	BDL	BDL
EPH $>C_{21}-C_{35}$	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPH $>C_{35}-C_{40}$	NG	NG	NG	BDL	BDL	BDL	BDL	BDL	BDL	BDL
EPH $>C_{10}-C_{40}$	NG	NG	NG	2 300	BDL	3 050	BDL	5 730	BDL	BDL
GRO ($>C_6-C_{10}$)	4 088	239	>Sol	854	BDL	2 470	BDL	1 391	BDL	BDL

Notes:
All values are reported in ug/L
[2] SSTL – Site-Specific Target Levels derived from a previous report (SLR Site Assessment Report, May 2022). SSTLs depict inhalation of indoor air inhalation as a potential pathway.
>Sol – calculated RBSL exceeds aqueous solubility of the compound of concern.
TPH C_6-C_9 – Representative of GRO, TPH $C_{10}-C_{21}$ – Representative of DRO, TPH $C_{22}-C_{35}$ – Representative of heavier carbon fractions
\-   Not Analysed
NG – No Guideline
Bold indicates the sample concentration exceeding Tier I RBSLs
*The clean-up levels set by RISC5 for TPH C_{21-35} is greater than the chemical's solubility. Concentrations exceeding the chemical solubility have been detected at the site in the past without the presence of LNAPL, Clean-up levels will therefore be used as a screening tool for groundwater ingestion, dermal contact, and inhalation in the shower rather than the solubility concentration.

4.3 QA/QC Sample Analysis

4.3.1 Laboratory QA/QC Program

The laboratory certificates are presented in Appendix D. SLR reviewed the laboratory certificates and confirmed that all requested analyses were performed. Furthermore, the groundwater samples analysed did not exceed the acceptable analytical holding time. The laboratory results are considered reliable.

4.3.2 Field QA/QC Program

SLR reviewed the field QA/QC data and the chain of custody documentation. The laboratory did not reveal any anomalies when receiving the samples. The field data is therefore considered reliable.

A duplicate sample was collected as an additional sample collected from the same monitoring well, MW7 (referred to as Dup01 in the analytical results), during the sampling exercise. The duplicate sample from monitoring well MW7 was sent to the laboratory for analysis, specifically to assess the concentrations of the same constituents that were examined in the original groundwater sample. To ensure that laboratory methods of analysis are consistent, the Relative Percentage Difference (RPD) was applied to sample, MW7 (and its duplicate). This measures the variation between results from different samples in a quantifiable manner as per the formula (1) below. By computing RPD values, it is possible to determine the level of similarity between the original and duplicate sample. This assessment is crucial in evaluating the consistency of laboratory analyses, ensuring reliability and accuracy.

RPDs are calculated as the percentage of the difference between two duplicate samples divided by the average of the two duplicate samples and is expressed by the equation below:

$$\% \text{ Difference} = \left| \frac{x_1 - x_2}{(x_1 + x_2) / 2} \right| \text{ x } 100$$

Where: X_1 is sample 1 (MW7)

X_2 is sample 2 (Dup01)

SLR specifies an acceptable RPD level of <100% where analytes are detected in the same order of magnitude as the detection limits. Where analytes are detected at levels greater than an order of magnitude above the detection limits, the acceptable RPD level is specified at < 30%.

A duplicate sample “Dup01 was collected from MW07 and submitted PAHs and VOC (BTEX and MTBE) analyses. The RPD between the duplicate and the corresponding sample are shown in Table 4-4.

Table 4-4: Relative Percentage Difference for MW7 and Dup01.

Parameter	Sample (MW7)	Duplicate (Dup01)	RPD %
Naphthalene	194.9	197.1	1.12
Acenaphthylene	0.83	0.96	14.53
Acenaphthene	3.2	0.4	155.56
Fluorene	0.39	0.98	86.13
Phenanthrene	0.11	0.4	113.73
Anthracene	0.11	0.25	77.78

Parameter	Sample (MW7)	Duplicate (Dup01)	RPD %
Fluoranthene	0.07	0.07	0.00
Pyrene	0.1	0.07	35.29
Benzo(a)anthracene	0.15	0.1	40.00
Chrysene	0.06	0.04	40.00
Benzo(bk)fluoranthene	0.16	0.13	20.69
Benzo(a)pyrene	0.05	0.11	75.00
Indeno(123cd)pyrene	0.04	0.11	93.33
Toluene	210	77	92.68
p/m-Xylene	111	538	131.59
Xylenes	182	717	119.02
o-Xylene	71	179	86.40

SLR reviewed the field QA/QC data to verify that the Relative Percent Difference (RPDs) between the parent groundwater sample MW7 and the duplicate sample Dup01 and confirm that this RPD % is too high for the field precision limit as the values fall outside SLR's QA/QC acceptance limit of 30%.

5.0 Trend Analysis

Chemical trend analysis is performed to identify trends in the groundwater conditions. All monitoring wells are considered during the time-series trend analysis; however, only monitoring wells that have been sampled for at least four events and have recorded concentrations of the constituent of concern are considered.

It should be noted that a trend analysis for the current monitoring event could not be conducted due to limited data (at least three groundwater sampling events) to conduct a trend analysis.

The trend analysis from the "Groundwater Monitoring Report Dry Season 2023" indicated the following trends for the contaminants of potential concern:

- **Phenols**: An increasing trend was observed for phenolic compounds, particularly at well NMW2-S, where concentrations, especially of 4-methylphenol, were detected at higher levels compared to previous measurements. This trend indicates a recent and significant increase in phenolic contamination at this location.
- **GRO and EPH**: There is no discernible trend for petroleum hydrocarbons as their concentrations were below the detection limit, indicating stable and low levels without significant changes over time.
- **VOCs**: The data does not explicitly outline a clear trend for VOCs in the report, but the presence of elevated concentrations at specific wells suggests localised increases, particularly of benzene and toluene at NMW2-S.
- **SVOCs**: Acenaphthene showed a sporadic presence without a clear increasing or decreasing trend, suggesting fluctuating concentrations over time at the monitored wells.

6.0 Risk Assessment

6.1 Methodology

A conceptual site model (CSM) is the first step in a risk assessment. It identifies potentially complete source–pathway–receptor (SPR) linkages and is used as the basis for the design of any subsequent site investigation. The CSM is a live document and is updated as further information becomes available, for example as a result of the site investigation.

For a risk to exist there must be a source of contamination, a receptor that may be impacted and a pathway connecting the source and receptor. Such a source-pathway-receptor relationship is termed a pollutant linkage. If either the source, pathway or receptor is absent, no linkage exists and thus no likelihood of risk (low risk).

The concentrations of targeted hydrocarbon compounds detected in soil and groundwater samples were compared to Risk Based Screening Levels (RBSLs as determined by BP RISC 4.05) in order to determine the potential health risks posed to human receptors by the contamination. A carcinogenic risk is the probability of incurring cancer as a result of exposure to the contaminants of concern. The Hazard Quotient (Hazard) is associated with non-carcinogenic compounds, which may compromise human health.

The detected hydrocarbon concentrations for groundwater were compared to the Tier I RBSLs for ingestion of groundwater, Tier I for surface water and Tier II Site-Specific Target Levels (SSTLs). Following the tiered approach, petroleum hydrocarbon concentrations are firstly evaluated against the Tier II SSTLs. Where SSTLs are not available, Tier I RBSLs are applied. If the Site is in a mix of a commercial and residential setting, the residential RBSLs are also considered as they are the most sensitive receptor. If the Site is in a commercial or industrial setting and no residential receptors were identified, residential RBSLs will not apply.

6.2 Overall Risk Summary

Overall, the assessment of data from FFS Evander indicates that monitoring wells MW1, MW3 and MW7 have been impacted, likely due to waste handling practices on site. The COPCs demonstrate stable or decreasing trends in these locations, as they fall below the screening guidelines. MW2S and MW9 detected volatile organic compounds below the Tier 1 screening levels. For all the analysed chemical parameters, the results of MW5 and MW8 remained below the laboratory detection.

6.3 Conceptual Site Model

Table 6-1 below lists the potential sources, pathways and receptors identified at this site within the context of possible pollutant linkages i.e., a situation where the source(s), pathway(s) and receptor(s) are all present at a site and therefore a real (as opposed to a perceived) risk of potential impact exists.

Table 6-1: CSM Indicating Potential Sources, Pathways and Receptor Linkages

Source	Pathway			Receptor	Risk Evaluation	
Analytical Results	**Sub-surface conditions**	**Medium**	**Release Mechanism**	**Type**	**Exposure pathway**	**Description**
Groundwater: The current groundwater analytical results indicate hydrocarbon concentrations that are above the Tier 1 RBSLs for groundwater ingestion commercial/industrial properties in monitoring wells MW3 and MW7.	The Site is underlain by the Jurassic dolerite. The static groundwater levels encountered between 0.39 m – 1.77 m bgl indicate heterogeneity in the subsurface structure and the hydraulic properties of the underlying rock formations. Groundwater levels are broadly consistent with previous events and align with typical fluctuations between wet and dry seasons, while a pattern of longer-term, gradual shallowing of groundwater is suggested.	Groundwater	Indoor/Outdoor Inhalation of vapours.	Off-site residential receptors	Incomplete	Tier 1 RBSL Indoor and Outdoor Air - Commercial not exceeded. There are no residential properties within a 500-m radius of the Site.
			Direct contact (dermal contact, & incidental ingestion).	Construction workers	Incomplete	Short-term exposure risks to workers are readily mitigated through administrative controls in-line with the Occupational Health and Safety (OH&S) guidelines.
			Migration of dissolved-phase hydrocarbons within the aquifer.	Aquifer	Potentially complete	Groundwater analytical results showed that the concentrations of COPCs in MW1 show stable or decreasing results whilst MW3 and MW7 showed an increase. This may suggest that the mitigation efforts employed or natural degradation processes occurring within the aquifer are not exerting a beneficial effect in attenuating the COPC concentrations.
			Indoor vapour intrusion of volatiles from a dissolved-phase source.	On-site commercial employees	Incomplete	Tier 1 RBSL Indoor and Outdoor Air - Commercial not exceeded.
			Indoor vapour intrusion of volatiles from a dissolved-phase source.	Off-site residential and commercial properties	Incomplete	Tier 1 RBSL Indoor and Outdoor Air - Commercial not exceeded. There are no residential properties within a 500-m radius of the Site.
			Groundwater Ingestion/ dermal contact.	On-site groundwater users	Potentially complete	MW1, MW3, and MW7 have historically been non-compliant with the Tier 1 RBSL for Groundwater Ingestion – Commercial, however no groundwater use takes place on-site.
			Groundwater Ingestion/ dermal contact.	Off-site groundwater users	Incomplete	No registered external user boreholes were found within the 1 km radius from the Site through an NGA search. No hydrocensus was conducted as part of this monitoring event.
		Surface water	Migration of dissolved phase within aquifer.	Surface Water	Incomplete	The Evander Dam (Unicor Dam) is located approximately 2.60 km southeast and cross gradient of the Site. Based on the distance of the potential receptors from site, it is considered that linkages are unlikely to be complete. This exposure pathway is considered to be incomplete.

7.0 Conclusions and Recommendations

7.1 Groundwater Levels

The groundwater levels at the site ranged from 0.39 m – 1.77 m bgl, with an average depth of 1.18 m bgl. The direction of groundwater flow is inferred to occur towards the west following the moderate dip of the Site’s topography.

Historical groundwater level analysis showed naturally occurring fluctuations in groundwater levels, which could be attributed to seasonal rainfall patterns, indicating a correlation between rainfall and recharge potential. For a more comprehensive and accurate analysis, more data points are required.

7.2 Groundwater Quality Assessment

Groundwater quality was assessed against the Tier I RBSLs in a commercial/industrial setting.

Overall, the assessment of data from FFS Evander indicates that monitoring wells MW1, MW3 and MW7 have been impacted, attributed to a historical spill event that occurred in 2006, other minor spillages.

7.3 Risk Summary

In summary, based on the water quality screening results, the risk profile for the site is characterised by elevated concentrations of COPCs in the monitoring wells, specifically MW1, MW3 and MW7 with lesser impact in MW2S and MW9. In the other monitoring wells, specifically MW5 and MW8, the chemical parameters, including COPCs and targeted contaminants, were not detected during laboratory analysis. It is important to note that groundwater at the Site is not utilised for drinking purposes. As such, the operation poses an acceptable risk to human health.

7.4 Recommendations

Based on the findings of this assessment, it is recommended that bi-annual groundwater monitoring program continues to collect data at regular intervals throughout the year to provide essential data to support informed decision-making processes, aiming to manage and mitigate potential environmental impacts and risks to human health.

Record of Report Distribution

SLR Reference:	715.000003.00001
Title:	Groundwater Monitoring Report - 2023
Report Number:	01
Client:	FFS Refiners (Pty) Ltd (Pty) Ltd

Name	Entity	Copy No.	Date Issued	Issuer
Ms. N. Biyase	FFS Refiners	01	19 February 2024	A. Gemmell

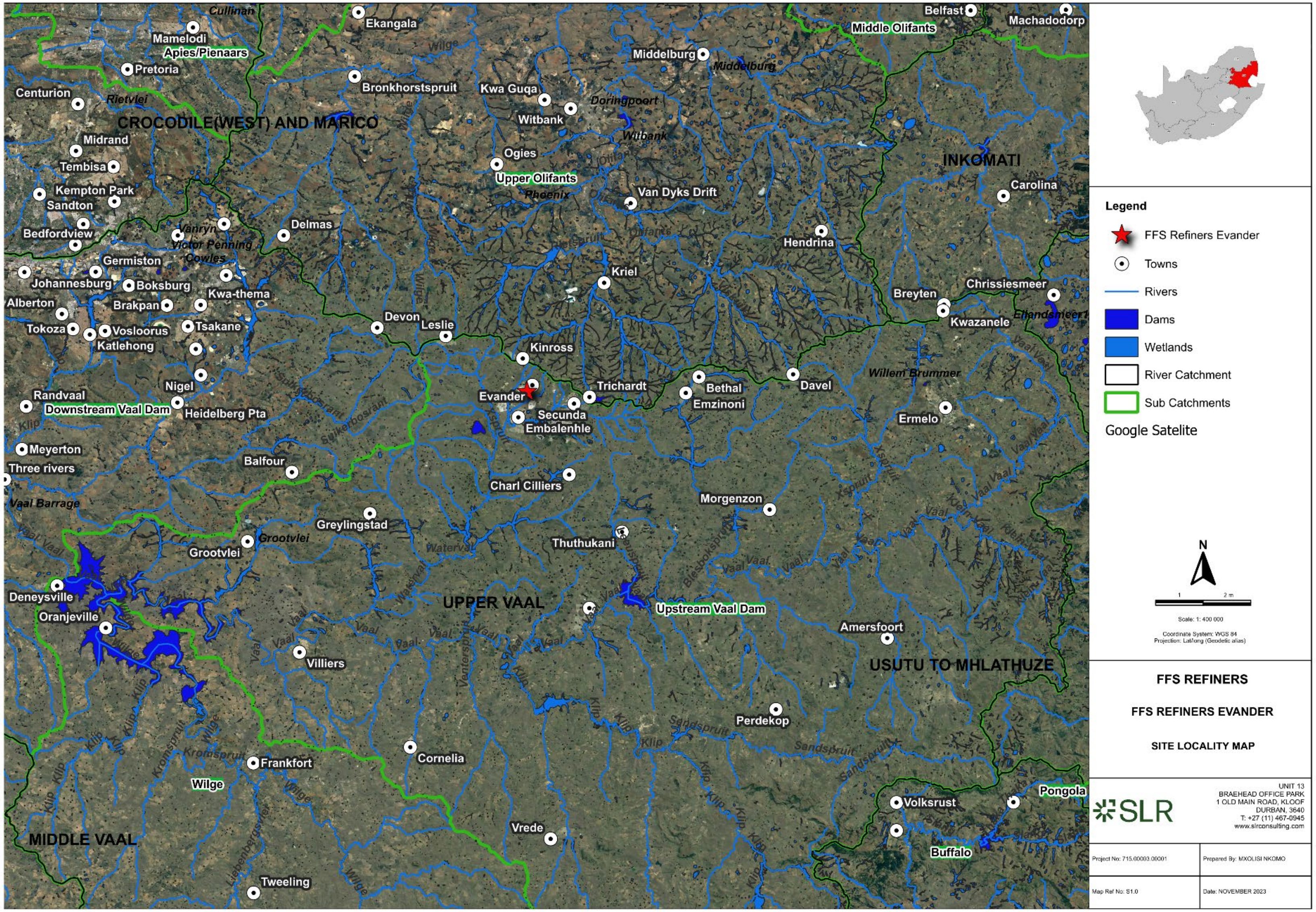
8.0 STATEMENT OF LIMITATIONS

The investigation undertaken by SLR concerning this report and any conclusions or recommendations made in this report reflect SLR's judgment based on visual observation of the Site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the Site which were unavailable for direct investigation, subsurface locations that were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the Site; substances addressed by the investigation may exist in areas of the Site not investigated, and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken. The methodology in acquiring samples and the laboratory analysis methodology were instructions from the client; therefore, SLR expresses no warranty concerning the accuracy of the laboratory analyses, methodologies used, or presentation of analytical results by the laboratory. Actual concentrations of the substances identified in the samples submitted may vary according to the extraction and testing procedures used.

The age and construction of the fuel storage tanks and known releases have been reported herein based on information provided by the client or its site representative. An assessment of the integrity, suitability and longevity of the current fuel storage and delivery system infrastructure and the wet stock gauging and monitoring methodology is not within SLR's scope of work and has not been considered.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or that variations of conditions within the Site may be possible, this report should be used for informational purposes only. It should not be construed as a comprehensive hydrogeological or chemical characterisation of the Site. If site conditions change or any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Appendix A   Site Figures



FFS REFINERS

FFS REFINERS EVANDER

SITE LOCALITY MAP

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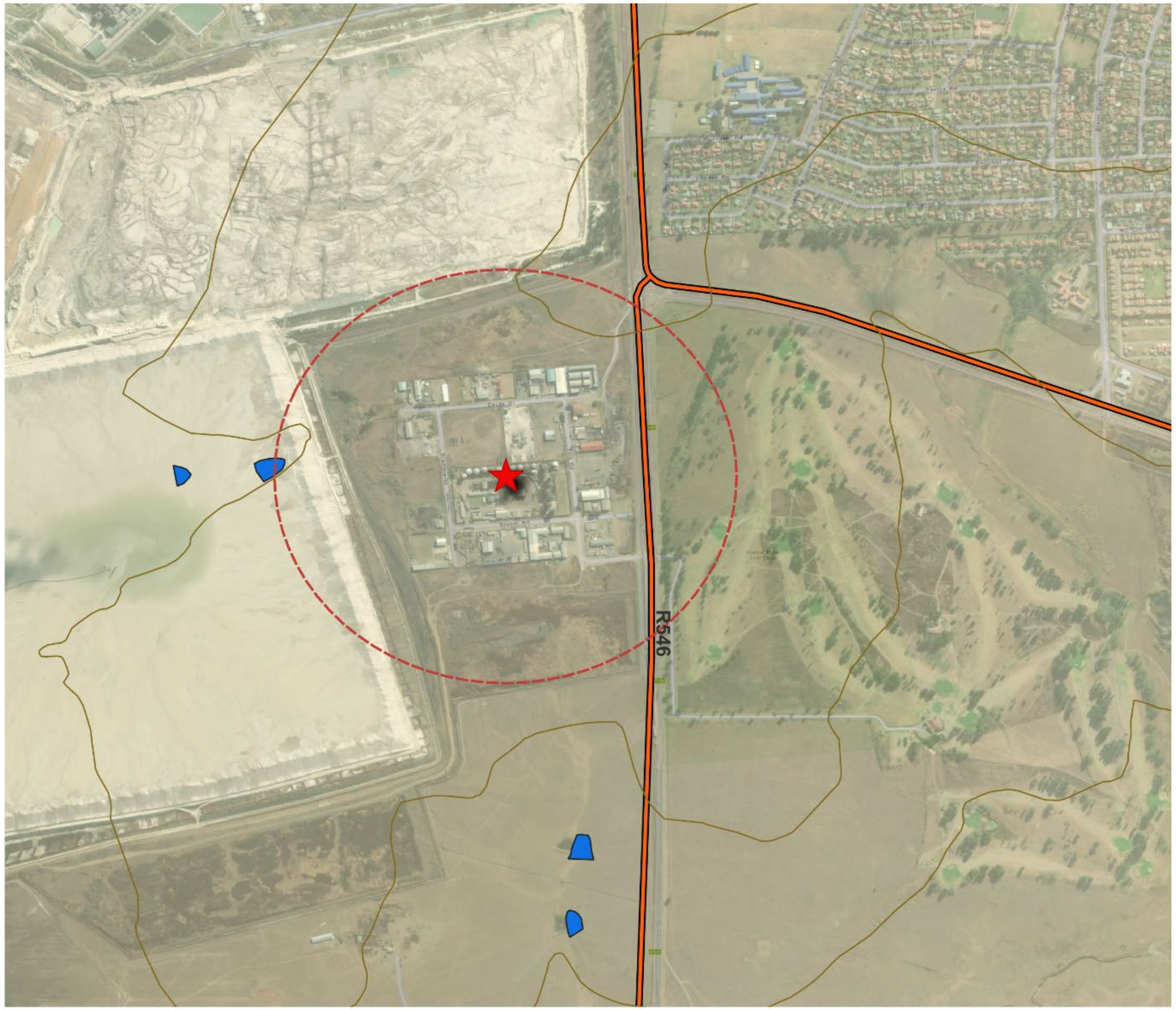
DURBAN, 3640
T: +27 (11) 467-0945
www.slrconsulting.com

Project No: 715.00003.00001	Prepared By: MXOLISI NKOMO
Map Ref No: S1.0	Date: NOVEMBER 2023



Legend

★ Site Location
⊙ Towns
— 20 m Contours
- - - 500 m Radius
▬ Roads

Esri Imagery

Esri Street

Scale: 1: 6 000 @ A4
Coordinate System: WGS 84
Projection: Lat/long (Geodetic alias)

FFS REFINERS

FFS REFINERS, EVANDER

TOPOGRAPHIC MAP

SLR

UNIT 13 BRAEHEAD
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1 OLD MAIN ROAD,
KLOOF
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www.slrconsulting.com

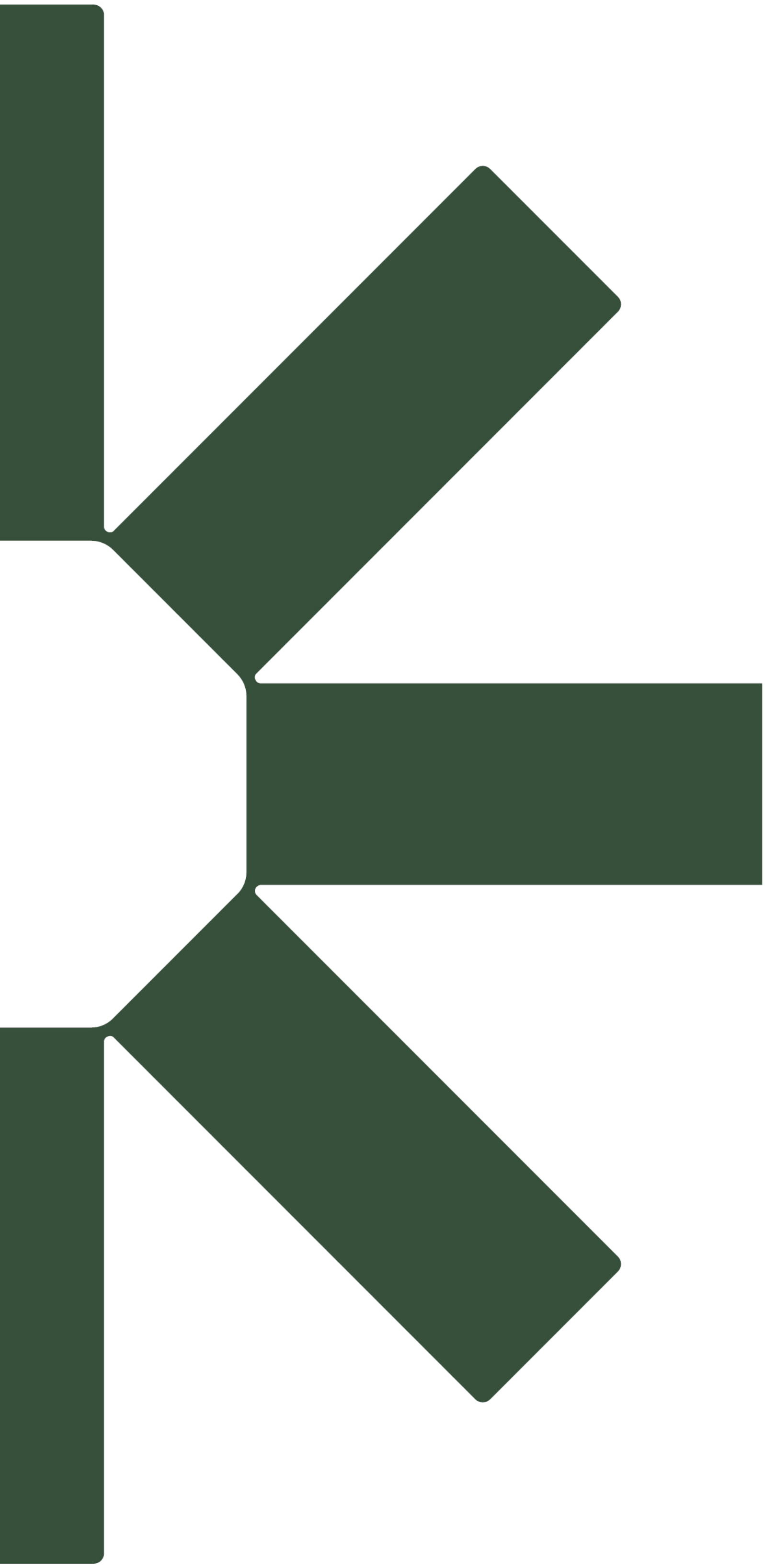
Project No: 715.00003.00001	Prepared By: MXOLISI NKOMO
Map Ref No: 1.1	Date: FEBRUARY 2024

Appendix B List of Previous Assessments

Date	Author	Report Ref.	Report Title
July 2023	WSP (PTY) LTD	41104127	Groundwater Monitoring Report - Dry Season 2023 - Evander
July 2021	WSP (PTY) LTD	41103519	FFS Evander Groundwater Monitoring Report: Dry
March 2020	WSP (PTY) LTD	41102256	FFS Evander Groundwater Monitoring Report: Wet
December 2019	WSP (PTY) LTD	41102284	FFS Evander Remediation Action Plan, FFS Evander
July 2019	Aquatico Science (Pty) Ltd		FFS Evander Annual Water Quality Report
February 2019	WSP (PTY) LTD	41101585	FFS Evander Groundwater Monitoring Report: Wet
October 2018	WSP (PTY) LTD	41101107	FFS Evander Groundwater Monitoring Report: Dry Season
February 2018	WSP (PTY) LTD	41100702	FFS Evander Groundwater Monitoring Report: Wet Season
August 2017	WSP (PTY) LTD	48960/1	FFS Evander Groundwater Monitoring Report: Dry Season
February 2017	WSP (PTY) LTD	48532/1	FFS Evander Groundwater Monitoring Report: Wet Season
October 2016	WSP (PTY) LTD	48163/1	FFS Evander Groundwater Monitoring Report: Dry Season
October 2016	WSP (PTY) LTD	48163/2	FFS Evander Monitoring Well Installation Report
March 2016	WSP (PTY) LTD	47874/1	FFS Evander Groundwater Monitoring Report: Wet Season
August 2015	WSP (PTY) LTD	46950/1	FFS Evander Groundwater Monitoring report: Dry Season
February 2015	WSP (PTY) LTD	44365/6	FFS Evander Groundwater Monitoring Report: Wet Season
June 2014	WSP (PTY) LTD	44365/1	FFS Evander Groundwater Monitoring Report: Dry Season 2014
February 2014	WSP (PTY) LTD	37400/3	FFS Evander Groundwater Monitoring Report: Wet Season 2013

September 2013	WSP (PTY) LTD	37400/2	FFS Evander Groundwater Monitoring Report: Dry Season 2013
June 2013	WSP (PTY) LTD	37401/1	FFS Evander Groundwater Contamination Risk Assessment
February 2013	WSP (PTY) LTD	28394/6	FFS Evander Groundwater Monitoring Wet Season Report
August 2012	WSP (PTY) LTD	28394/5	FFS Evander Groundwater Monitoring Dry Season Report
January 2012	WSP (PTY) LTD	23661	FFS Evander Groundwater Monitoring Wet Season Report
November 2011	WSP (PTY) LTD	23661	FFS Evander Groundwater Monitoring Dry Season Report
May 2011	WSP (PTY) LTD	101032CL	FFS Evander Groundwater Monitoring Wet Season Report
July 2010	WSP (PTY) LTD	100614CL	FFS Evander Groundwater Monitoring Report
March 2010	WSP (PTY) LTD	90212CL	FFS Evander Groundwater Monitoring Report
October 2007	WSP (PTY) LTD	1654CL	FFS Evander Groundwater Investigation

Appendix C Laboratory Certificate of Results



Making Sustainability Happen

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178 Montecasino Boulevard
Fourways
Johannesburg
South Africa
2191

Attention : Collen Nkosi

Date : 5th December, 2023

Your reference : 715.000003.00001

Our reference : Test Report 23/1310 Batch 1

Location : Evander

Date samples received : 15th November, 2023

Status : Final report

Issue : 1

Eight samples were received for analysis on 15th November, 2023 of which eight were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Analysis was undertaken at either Element Materials Technology UK, which is ISO 17025 accredited under UKAS (4225) or Element Materials Technology (SA) which is ISO 17025 accredited under SANAS (T0729) or a subcontract laboratory where specified.

NOTE: Under International Laboratory Accreditation Cooperation (ILAC), ISO 17025 (UKAS) accreditation is recognised as equivalent to SANAS (South Africa) accreditation.

Authorised By:

Debbie van Wyk

Organics Laboratory:

Paloma Booi

Technical Signatory (Organics)

Client Name: SLR Consulting (South Africa) (Pty) Ltd
Reference: 715.000003.00001
Location: Evander
Contact: Collen Nkosi
EMT Job No: 23/1310

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16			LOD/LOR	Units	Method No.
Sample ID	MW1	MW2-S	MW3	MW5	MW7	MW8	MW9	DUP-1					
Depth	1.27	1	1.47	1.17	0.35	8.9	1.1						
COC No / misc													
Containers	V G	V G	V G	V G	V G	V G	V G	V G					
Sample Date	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023					
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023					
PAH MS													
Naphthalene ^{SA}	80.5	<0.1	196.2	<0.1	194.9	<0.1	<0.1	197.1			<0.1	ug/l	SA_TM4/SA_PM30
Acenaphthylene ^{SA}	0.670	<0.013	1.010	<0.013	0.830	<0.013	<0.013	0.960			<0.013	ug/l	SA_TM4/SA_PM30
Acenaphthene ^{SA}	0.880	<0.013	0.430	<0.013	3.200	<0.013	<0.013	0.400			<0.013	ug/l	SA_TM4/SA_PM30
Fluorene ^{SA}	0.510	<0.014	1.070	<0.014	0.390	<0.014	<0.014	0.980			<0.014	ug/l	SA_TM4/SA_PM30
Phenanthrene ^{SA}	<0.011	<0.011	0.390	<0.011	0.110	<0.011	<0.011	0.400			<0.011	ug/l	SA_TM4/SA_PM30
Anthracene ^{SA}	<0.013	<0.013	0.340	<0.013	0.110	<0.013	<0.013	0.250			<0.013	ug/l	SA_TM4/SA_PM30
Fluoranthene ^{SA}	<0.012	0.120	0.090	<0.012	0.070	<0.012	<0.012	0.070			<0.012	ug/l	SA_TM4/SA_PM30
Pyrene ^{SA}	0.180	0.200	0.100	<0.013	0.100	<0.013	0.110	0.070			<0.013	ug/l	SA_TM4/SA_PM30
Benzo(a)anthracene ^{SA}	0.210	0.350	0.130	<0.015	0.150	<0.015	0.200	0.100			<0.015	ug/l	SA_TM4/SA_PM30
Chrysene ^{SA}	0.060	0.150	0.060	<0.011	0.060	<0.011	0.100	0.040			<0.011	ug/l	SA_TM4/SA_PM30
Benzo(bk)fluoranthene	<0.02	0.50	0.15	<0.02	0.16	<0.02	0.36	0.13			<0.02	ug/l	SA_TM4/SA_PM30
Benzo(a)pyrene ^{SA}	<0.016	0.120	0.040	<0.016	0.050	<0.016	0.110	0.030			<0.016	ug/l	SA_TM4/SA_PM30
Indeno(123cd)pyrene ^{SA}	0.060	0.150	0.030	<0.011	0.040	<0.011	0.110	0.030			<0.011	ug/l	SA_TM4/SA_PM30
Dibenzo(ah)anthracene ^{SA}	0.06	0.14	0.04	<0.01	<0.01	<0.01	0.08	0.03			<0.01	ug/l	SA_TM4/SA_PM30
Benzo(ghi)perylene ^{SA}	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011			<0.011	ug/l	SA_TM4/SA_PM30
PAH 16 Total	83.130	1.730	200.080	<0.283	200.170	<0.283	1.070	200.590			<0.283	ug/l	SA_TM4/SA_PM30
Benzo(b)fluoranthene ^{SA}	<0.01	0.29	0.09	<0.01	0.09	<0.01	0.25	0.09			<0.01	ug/l	SA_TM4/SA_PM30
Benzo(k)fluoranthene ^{SA}	<0.01	0.21	0.06	<0.01	0.07	<0.01	0.11	0.04			<0.01	ug/l	SA_TM4/SA_PM30
PAH Surrogate % Recovery	100	77	90	86	106	72	74	86			<0	%	SA_TM4/SA_PM30
VOC MS													
Surrogate Recovery Toluene D8	87	91	92	90	97	100	94	97			<0	%	SA_TM15/SA_PM10
Surrogate Recovery 4-Bromofluorobenzene	85	86	94	84	99	93	92	100			<0	%	SA_TM15/SA_PM10
Methyl Tertiary Butyl Ether ^{SA}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	ug/l	SA_TM15/SA_PM10
Benzene ^{SA}	321	<2	528	<2	600	<2	<2	522			<2	ug/l	SA_TM15/SA_PM10
Toluene ^{SA}	28	<5	75	<5	210	<5	<5	77			<5	ug/l	SA_TM15/SA_PM10
Ethylbenzene ^{SA}	8	<1	122	<1	64	<1	<1	133			<1	ug/l	SA_TM15/SA_PM10
p/m-Xylene ^{SA}	10	<2	492	<2	111	<2	<2	538			<2	ug/l	SA_TM15/SA_PM10
o-Xylene ^{SA}	11	<1	164	<1	71	<1	<1	179			<1	ug/l	SA_TM15/SA_PM10
Tert Amyl Methyl Ether (TAME)	<100	<100	<100	<100	<100	<100	<100	<100			<100	ug/l	SA_TM15/SA_PM10
EPH >C10-C12 ^{SA}	760	<10	1600	<10	2760	<10	<10	2010			<10	ug/l	SA_TM5/SA_PM30
EPH >C12-C16 ^{SA}	1090	<10	980	<10	2970	<10	<10	1260			<10	ug/l	SA_TM5/SA_PM30
EPH >C16-C21 ^{SA}	450	<10	470	<10	<10	<10	<10	360			<10	ug/l	SA_TM5/SA_PM30
EPH >C21-C35 ^{SA}	<10	<10	<10	<10	<10	<10	<10	<10			<10	ug/l	SA_TM5/SA_PM30
EPH >C35-C40	<10	<10	<10	<10	<10	<10	<10	<10			<10	ug/l	SA_TM5/SA_PM30
EPH >C10-C40	2300	<10	3050	<10	5730	<10	<10	3630			<10	ug/l	SA_TM5/SA_PM30
GRO (>C5-C6)	<10	<10	<10	<10	<10	<10	<10	NDP			<10	ug/l	SA_TM36/SA_PM12
GRO (>C6-C8)	614	<10	860	<10	891	<10	<10	NDP			<10	ug/l	SA_TM36/SA_PM12
GRO (>C8-C10)	240	<10	1610	<10	500	<10	<10	NDP			<10	ug/l	SA_TM36/SA_PM12
GRO (>C5-C10)	854	<10	2470	<10	1391	<10	<10	NDP			<10	ug/l	SA_TM36/SA_PM12

Client Name: SLR Consulting (South Africa) (Pty) Ltd
Reference: 715.000003.00001
Location: Evander
Contact: Collen Nkosi
EMT Job No: 23/1310

Report : **Liquid**

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

EMT Sample No.	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16					
Sample ID	MW1	MW2-S	MW3	MW5	MW7	MW8	MW9	DUP-1					
Depth	1.27	1	1.47	1.17	0.35	8.9	1.1						
COC No / misc													
Containers	V G	V G	V G	V G	V G	V G	V G	V G					
Sample Date	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023	09/11/2023					
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water					
Batch Number	1	1	1	1	1	1	1	1			LOD/LOR	Units	Method No.
Date of Receipt	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023	15/11/2023					
Phenols													
Phenol SA	<2	100	<2	<2	<2	<2	<2	<2			<2	ug/l	SA_TM4/SA_PM30
2,3,4,6 Tetrachlorophenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2,4,5 Trichlorophenol SA	2	1800	<1	<1	3	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2,4,6 Trichlorophenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2,4-Dichlorophenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2,6-Dichlorophenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2-Chlorophenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2-Methylphenol (o-cresol) SA	<1	400	1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2-Nitrophenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
4-Chloro-3-methylphenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
Pentachlorophenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30
3- and 4-Methylphenol (m+p cresol) SA	2	19000	4	2	<1	2	<1	<1			<1	ug/l	SA_TM4/SA_PM30
2,4 Dimethylphenol SA	<1	<1	<1	<1	<1	<1	<1	<1			<1	ug/l	SA_TM4/SA_PM30

Please see attached notes for all abbreviations and acronyms

Client Name:	SLR Consulting (South Africa) (Pty) Ltd
Reference:	715.000003.00001
Location:	Evander
Contact:	Collen Nkosi

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 23/1310						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/1310

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

EMT Job No: 23/1310

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
SA_TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds by Headspace GC-MS.	SA_PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.				
SA_TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds by Headspace GC-MS.	SA_PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
SA_TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12, MTBE and BTEX by headspace GC-FID.	SA_PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.				
SA_TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	SA_PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
SA_TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	SA_PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
SA_TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	SA_PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
SA_TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	SA_PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			