

REPORT ON THE GEOHYDROLOGICAL ASSESSMENT UPDATE AT THE GWAING LANDFILL EXTENSION AREA

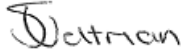
Technical Report



DISCLAIMER

Veltwater exercises due care and diligence in rendering services and preparing documents. However, Veltwater accepts no liability, and the client, by receiving this document, indemnifies Veltwater and its members, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages, and expenses arising from or in connection with services rendered, directly or indirectly by Veltwater and by the use of the information contained in this document.

This document contains confidential and proprietary information of Veltwater and is protected by copyright in favour of Veltwater and may not be reproduced, or used without the written consent of Veltwater, which has been obtained beforehand. This document is prepared exclusively for our client (UMD Environmental Services) and is subject to all confidentiality, copyright and trade secrets, rules, intellectual property law and practices of SOUTH AFRICA.

Report Version	Final Draft		
Title	Report on the Geohydrological Assessment Update at the Gwaing Landfill Extension Area – Technical Report		
Author	Jorette van Rooyen		18 December 2025
Document Reviewer & Sign Off	Sonia Veltman		19 December 2025

QUALIFICATIONS AND EXPERIENCE OF THE AUTHORS

Jorette van Rooyen is a qualified hydrogeologist (M.Sc. Environmental Sciences – Hydrogeology & Hydrology, North-West University) and registered with The South African Council for Natural Scientific Professions: Professional Earth Scientist.

Jorette has 15 years' experience in various aspects of hydrogeology, including mine and smelter related groundwater assessments, routine surface and groundwater monitoring, emergency environmental impact and groundwater risk assessments, groundwater resource assessment, management and planning, site characterisation and development of monitoring networks. Specialist functions include conceptual and numerical modelling of groundwater systems, borehole specific evaluations and sustainable yield recommendations. Field experience in groundwater investigations include hydrocensus, geophysics, aquifer testing, drilling supervision, geological logging, auguring, soil (geotechnical) sampling, groundwater monitoring and sampling, soil vapour surveys, in-situ compaction testing, free phase bail down testing and trial pit design and excavation supervision and profiling.

Sonia Veltman is a qualified hydrogeologist (M.Sc. Geohydrology, University of the Free State) and registered with The South African Council for Natural Scientific Professions: Professional Natural Scientist.

Sonia has 20+ years' experience in various aspects of hydrogeology, including groundwater resource assessment, management and planning, site characterisation, environmental impact assessments, monitoring networks and data, geochemical characterisation, and numerical modelling. Field experience in groundwater investigations include remote sensing, ground truthing, sampling, geochemical sampling, geophysical surveys, site selection, drilling support, geological logging, and reporting.

DECLARATION OF INDEPENDENCE

I, Jorette van Rooyen, declare that I am an independent specialist consultant and have no financial, personal, or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of hydrogeological services. There are no circumstances that compromise the objectivity of my performing such work.

I, Sonia Veltman, declare that I am an independent specialist consultant and have no financial, personal, or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of hydrogeological services. There are no circumstances that compromise the objectivity of my performing such work.

TABLE OF CONTENTS

1	Introduction	1
1.1	Scope of Work	1
2	Site Investigation Results	2
2.1	Auger & Soil Sampling Procedure	2
2.2	Auger & Soil Sampling Results	2
2.3	Quality Discussion	6
3	Expected Environmental Impacts	7
3.1	Mitigation Strategies	7
3.1.1	Source Control	7
3.1.2	Soil Stabilisation	7
3.1.3	Contamination Containment	7
3.2	Management	7
3.3	Monitoring Plan	8
3.3.1	Soils	8
3.3.2	Groundwater	8
3.3.3	Surface Water	9
4	Conclusions & Recommendations	10
4.1	Soils	10
4.2	Recommendations	10
4.3	No-Go Option	12
4.3.1	Description	12
4.3.2	Soils	12
4.3.3	Groundwater	12
4.3.4	Surface Water (Gwaing River)	12
4.3.5	Summary	13
5	References	14
6	ANNEXURES	15

LIST OF TABLES

Table 2-1: Auger Details	3
Table 2-2: Soil Quality Results	4
Table 2-3: Soil Migration Potential	5

LIST OF APPENDICES

A – FIELD NOTES AND SOIL DESCRIPTIONS

B – PHOTOGRAPHIC REPORT

C – LABORATORY CERTIFICATES

D – TABULATED SOIL QUALITY DATABASE

E – MAPS

LIST OF MAPS

Dwg No. 1 – Soil Sampling Plan

Dwg No. 2 – Additional Monitoring BH Plan

NOTE: All Maps have been included as Drawings in Appendix E.

1 INTRODUCTION

Veltwater Groundwater Specialists (Veltwater) was contracted by UMD Environmental Services (hereafter also referred to as the “client”) to update the existing geohydrological site assessment with additional soil sampling at the proposed extension area of the Gwaing Landfill, George, Western Cape Province.

Previous reports at this site include:

- “Letter Report for the Desktop Review of the Gwaing Landfill Site – George – Western Cape Province”, dated 25 October 2024.
- “Report on the Geohydrological Assessment at the Gwaing Landfill Site: Technical Report”, dated 29 December 2025.
- “Report on the Geohydrological Assessment at the Gwaing Landfill Site: Monitoring and Impact Assessment Report”, dated 06 October 2025.

All relevant site information is provided in the referenced reports and are not restated in this document. The findings and recommendations, based on the results of the recent soil sampling event, are contained in this report.

1.1 Scope of Work

The scope of work for the monitoring included the following:

- Site walkover, inspection, and reconnaissance of the receiving environment.
- Advancement of six hand auger holes to the depth of refusal or to a maximum depth of 2 m, and soil sample collection from each auger hole.
- Submission of the samples to the SANAS-accredited EPL Laboratory for analysis.
- Analysis of the results of the soil sample analysis results received from the laboratory.
- Updating the geohydrological assessment report to incorporate the latest site understanding, including expected environmental impacts, mitigation strategies, management measures, and a monitoring plan.

2 SITE INVESTIGATION RESULTS

2.1 Auger & Soil Sampling Procedure

As this assessment serves as a continuation of the first, auger and soil sampling labels were marked sequentially from where the previous ones left off.

The soil sampling points (SS6 – SS11) were located within a vegetated area situated between the Gwaing Landfill to the north and the Gwaing Wastewater Treatment Works (WWTW) to the east and south. The area showed no signs of active waste disposal, with only informal settlement activity and light cattle grazing observed.

The on-site hydrogeologist selected auger hole locations to maximise area coverage and account for groundwater movement direction and surface water runoff.

The collected soil samples were submitted to Environmental Pollution Laboratory (EPL), a SANAS-accredited laboratory, for analysis.

The results received from the laboratory were compared to the 2013 Department of Environmental Affairs (DEA) National Norms and Standards for the Remediation of Contaminated Land and Soil Quality in the Republic of South Africa (RSA) Soil Screening Values (SSVs) for All Land Uses Protective of a Water Resource as well as the United States (US) Environmental Protection Agency (EPA) Soil Screening Levels (SSLs) for industrial soils. These screening levels were chosen as the Gwaing River is deemed as a sensitive receptor.

2.2 Auger & Soil Sampling Results

A total of 6 auger holes (AH 6 – AH 11) were excavated at the proposed extension area at the Gwaing Landfill site to depths of between 0.34 and 1.15 metres below ground level (mbgl).

No groundwater was intersected during augering; therefore, no groundwater samples were collected.

A total of 6 soil samples were collected from the auger holes at various depths as detailed in Table 2-1 and the locations are shown in the attached Soil Sampling Plan – Dwg No. 1. The relevant field notes and soil descriptions were provided in Appendix A. A complete photographic report is available in Appendix B.

Table 2-1: Auger Details

Auger Hole ID	Total Depth	Groundwater Encountered	Sample No.	Additional Comments or Observations
	(mbgl)	Yes/No		
AH6	1.15	No	SS6	Downstream of WWTW, open area, yellow-brown clay
AH7	0.65	No	SS7	Downstream of WWTW, open area, loose sand, refusal reached
AH8	0.34	No	SS8	Downstream of landfill and WWTW, open area, near the treeline, shallow drainage line, sand & gravel
AH9	0.99	No	SS9	Natural woodland area, drainage line, dark brown topsoil
AH10	0.64	No	SS10	A few metres from the Gwaing River. Riverine and woodland area with thick wood carpet, refusal - weathered granite
AH11	0.85	No	SS11	Natural woodland area, thick wood carpet, refusal - weathered granite

The results returned are summarised in Table 2-2 with the laboratory certificates of analyses provided in Appendix C. The complete tabulated database of the available soil quality results is provided in Appendix D.

Table 2-3 provides a summary of the underlying subsurface conditions at each soil sampling location collected. The soil profiling information and the soil quality results were integrated to provide an indication of contaminant migration potential at the site.

Table 2-2: Soil Quality Results

Sample ID	Units	SS6	SS7	SS8	SS9	SS10	SS11	RSA DEA SSVs	RISC Tier I RBSLs
Sample Depth (m)		1.15	0.65	0.34	0.99	0.64	0.85		
Inorganics: Cations and Metals									
Aluminium as Al	mg/kg	11485	5583	19744	22044	7857	12785	ns	10 000 - 300 000*
Arsenic as As	mg/kg	3.53	3.75	26.14	4.62	<3	<3	5.80	10.81
Barium as Ba	mg/kg	33.32	23.57	32.06	53.93	13.60	30.10	ns	2608.97
Boron as B	mg/kg	<30	<30	<30	<30	<30	<30	ns	ns
Cadmium as Cd	mg/kg	<3	<3	<3	<3	<3	<3	7.50	22.97
Calcium as Ca	mg/kg	519.80	259.30	312	1213	321.90	401.50	ns	ns
Chromium (III)	mg/kg	59.93	13.93	43.66	20.27	4.97	8.63	46000	3.71E+08
Chromium (VI)	mg/kg	<2	<2	<2	<2	<2	<2	6.50	85.82
Copper as Cu	mg/kg	<3	3.22	<3	3.17	5.48	<3	16	127.82
Cyanide as CN-	mg/kg	<1.55	<1.55	<1.55	<1.55	<1.55	<1.55	14	247.84
Electrical Conductivity (EC)	mS/m	1.00	2.10	0.90	6.30	1.30	1.20	ns	ns
Iron as Fe	mg/kg	15131	19232	103846	19196	7207	13591	ns	7 000 - 550 000*
Lead as Pb	mg/kg	7.72	10.81	48.61	12.69	13.59	6.38	20	44.61
Magnesium as Mg	mg/kg	573.90	228.20	559.70	1175	1126	1451	ns	ns
Manganese as Mn	mg/kg	22.70	15.84	29.31	40.62	69.53	46.99	740	20 - 3 000*
Mercury as Hg*	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.93	406.88
Nickel as Ni	mg/kg	62.41	3.23	3.80	5.96	<3	3.23	91	2181.22
pH	mg/kg	7.04	4.91	6.47	7.23	5.78	6.99	ns	ns
Potassium as K	mg/kg	407.80	399.20	748.60	1421	1727	1416	ns	ns
Selenium as Se	mg/kg	<6	<6	<6	<6	<6	<6	ns	27.30
Sodium as Na	mg/kg	104.00	20.81	190.80	656.30	167.00	320.40	ns	ns
Total Chromium as Cr	mg/kg	59.93	13.93	43.66	20.27	4.97	8.63	80	ns
Total Organic Carbon (TOC)	mg/kg	<6000	<6000	10000	8300	18800	<6000	ns	ns
Zinc as Zn	mg/kg	3.15	15.51	4.78	11.07	15.08	10.03	240	27891
Inorganics: Anions									
Chloride as Cl	mg/kg	377.70	237	375.20	232.10	391.30	151.40	12000	ns
Fluoride as F	mg/kg	22.52	19.92	20.83	38.51	15.44	27.92	30	50 - 500*
Nitrate as N	mg/kg	<5	<5	<5	23.48	<5	<5	120	ns
Nitrite as N	mg/kg	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3		ns
Sulphate as SO4	mg/kg	1478.00	430.40	114.70	525.20	<20	113.60	4000	ns
Phosphate as P	mg/kg	4.80	134.40	3.81	10.58	<2	<2	ns	ns
Microbiological									
Faecal Coliforms	colonies/g	0	0	0	0	0	0	ns	ns
E. coli	colonies/g	0	0	0	0	0	0	ns	ns
Organics									
Total Oil & Grease (TOG)	mg/kg	<100	<100	<100	<100	<100	<100	ns	ns

Table 2-3: Soil Migration Potential

Sample	Depth	Soil Texture	Consistency	Structure	Key Contaminants	Migration Potential	Motivation
SS6	1.15	Clay/silt (fine)	Firm to stiff	Intact, pinholed, shattered	Al, Fe	Low	Dense clay likely restricts vertical migration - acting like a barrier
SS7	0.65	Sand, silt (fine)	Very loose	Intact, no clay	Fe, P	Moderate	Loose sandy texture may allow migration, but no major exceedances
SS8	0.34	Sand, silt (fine)	Very loose	Intact, no clay	As, Pb, Al, Fe, TOC	High	Loose sandy matrix at shallow depth with major exceedances - high migration potential vertically and laterally
SS9	0.99	Sand, silt (fine - medium)	Loose (sand), firm (clay)	Intact, shattered	F, Al, Ca, Fe, Mg, K, TOC	Moderate - High	Mixed texture. Firm clay may slow vertical migration, but shattered structure may allow lateral flow potential along interfaces, especially for F and TOC.
SS10	0.64	Weathered granite cobbles	Very loose	Intact, pinholed, no clay	Fe, Mg, K, TOC	High	Very loose, coarse matrix with abundant clasts - leachate migration
SS11	0.85	Weathered granite gravel	Very loose	Intact, pinholed, no clay	Al, Fe, Mg, K	High	Very loose gravelly matrix promotes contaminant movement

2.3 Quality Discussion

From the results summarised in Table 2-2, the following were observed:

- The concentrations of Arsenic (As) in sample SS8, Lead (Pb) in sample SS8, and Fluoride (F) in sample SS9 were elevated, exceeding either the adopted RSA DEA SSVs, or both RSA DEA SSVs and RISC RBSLs.
- The concentrations of Aluminium (Al) for SS6, SS8, SS9, and SS11, Iron (Fe) for all samples, Calcium (Ca) for sample SS9, Magnesium (Mg) for SS9, SS10, SS11, Potassium (K) for SS9, SS10, SS11, Total Organic Carbon (TOC) for SS8, SS9, SS10, and Phosphate (P) for SS7 was also elevated although there are no screening values/levels available for these determinants.
- Even with no standardised screening levels, the concentrations remain a cause for concern, as it indicates a level of impact typically associated with solid waste leachate contamination.

SS8 and SS9 showed the most evident contamination, suggesting surface or near-surface leachate impact. SS8 was sampled at a shallow depth of 0.34 mbgl within a shallow drainage line and shows the highest concentrations of As, Pb, Al, Fe, and TOC, and SS9 was sampled at a depth of 0.99 mbgl with elevated concentrations of F, Al, Ca, Fe, Mg, K, and TOC. These elevated concentrations could be attributed to increased infiltration from overland flow during rainfall events, due to position of SS8 within the drainage line.

The elevated As, Cu, F, Pb observed in SS2 to SS4 (previously), SS8 and SS9 are likely granite-derived exceedances rather than landfill leachate.

Downslope samples (SS10 and SS11) towards the river, didn't show any exceedances and were found compliant compared to the chosen standards.

Integrated with chemical data, SS8, SS10, SS11 consist of loose, sandy to gravelly horizons with minor to abundant clasts, which are permeable and conducive to leachate migration. SS6 and SS9 show clay- and silt-rich horizons with firmer consistency, which may act as partial vertical barriers, but fractured structures could still allow for lateral flow.

Although permeable soils in SS8, SS10 and SS11 are conducive to migration, the absence of a consistent downslope plume or typical leachate indicators (e.g., high ammonia, chloride, organics) indicates no significant landfill-derived contamination influence.

3 EXPECTED ENVIRONMENTAL IMPACTS

This impact assessment is an addition to the impacts assessment already stated in “Report on the Geohydrological Assessment at the Gwaing Landfill Site: Monitoring and Impact Assessment Report”, dated 06 October 2025.

Typical landfill leachate indicators include high concentrations of EC/TDS, Cl, Ammonia as N, COD/BOD/TOC, Na Ca, Mg, heavy metals (Fe, Mn, Pb, As, Hg, Cr), Nitrates, SO₄, and faecal coliforms.

The low levels observed at this site, suggest minimal leachate impact.

Elevated As, Pb, and F pose risks to human health, if soils are disturbed, or leach into potable water sources. Proximity to the Gwaing River could impact aquatic ecosystems from any contaminant migration in the future.

Based on the recent and previous soil quality results, spatially, there is currently no measurable contaminant plume, therefore, there is a low/minor risk to groundwater or the Gwaing River.

3.1 Mitigation Strategies

3.1.1 Source Control

- Improve landfill capping/cover integrity to reduce leachate generation.
- Divert stormwater away from waste cells into stormwater retention dams to minimise infiltration and reduce potential soil and groundwater impact.

3.1.2 Soil Stabilisation

In the event of expansion for sloping, install engineered liners and leachate collection systems to prevent subsurface migration of contaminants.

3.1.3 Contamination Containment

Install shallow interception trenches or barriers downslope to capture potential leachate before reaching the Gwaing River.

3.2 Management

Various management actions need to be considered before landfill disturbance as a result of remediation or rehabilitation occur, such as:

- Clearly distinguish between granite-derived exceedances from landfill-related impacts in reporting, to avoid misinterpretations. This is achieved through a weathered granite baseline characterisation – a formal baseline for granitic

groundwater quality to contextualise future exceedances and guide interpretation needs to be established.

- Source attribution – Apply microbial source tracking markers to distinguish sewage from landfill-derived pathogens by augmenting the analytical suite with conservative tracers or stable isotopes or an expanded ionic suite to quantify contributions from each source.
 - Microbial source tracking (MST) is done by sending water samples to a specialised laboratory that tests for human- or sewage-specific genetic markers in faecal bacteria, which confirms whether contamination comes predominantly from wastewater effluent rather than diffuse animal or landfill sources. In parallel, geochemical fingerprinting is applied by expanding the routine ionic suite (e.g. Cl, Na, K, Ca, Mg, SO₄, alkalinity, nutrients) and, where acceptable, using conservative tracers or stable isotopes (e.g. $\delta^{15}\text{N}$ in nitrate/ammonia) to distinguish typical WWTW effluent chemistry from landfill leachate profiles and to estimate their relative contributions.
- To prevent contamination of soil and groundwater, waste management improvements should be implemented to strengthen landfill operational controls, such as increased soil cover, better surface water drainage and control, as well as dedicated leachate collection to monitor changes.
- Adaptive management is essential; if any new exceedances appear downslope, immediate containment and/or rehabilitation/remediation measures should be implemented.

3.3 Monitoring Plan

3.3.1 Soils

Annual soil sampling should be undertaken at the identified hotspots (SS8 and SS9) and downslope locations (SS10 and SS11) to confirm the absence of plume migration. This monitoring will track changes in As, Pb, F, Al, Fe, and TOC concentrations over time and will allow early detection of any lateral or vertical contaminant movement. Results will be used to verify that no new risks to groundwater or surface water are developing and to trigger additional investigation or mitigation if upward trends or exceedances are observed.

3.3.2 Groundwater

Continue quarterly monitoring to track seasonal variation.

Establish a leachate monitoring point – Addition of a dedicated leachate borehole at the extension area will improve source differentiation between the Landfill and the Gwaing WWTW. However, this may not be practical due to landfill compaction, slope stability concerns, and potential exposure risks. As an alternative, shallow interception trenches or lysimeters installed near the landfill toe or downgradient boundary could capture leachate migration at the interface between waste and natural soils. These systems are

less invasive and can still provide representative samples for chemical profiling and trend analysis.

It is recommended that at least two (2 x down-gradient), additional monitoring boreholes be installed, of which the proposed locations were provided in the attached Proposed Additional Monitoring Borehole Plan – Dwg No. 2. This will allow for the effective monitoring of the groundwater quality.

These additional monitoring boreholes should be drilled to a maximum completion depth of 30 m at a diameter of 165 mm. Once completed, factory threaded plain and slotted 125 mm uPVC casing should be installed in the monitoring wells, whilst 3 to 5 mm gravel pack should be placed between the monitoring borehole walls and the installed uPVC casing, to ensure long-term stability and to prevent the entry of fines into the completed monitoring boreholes. Finally, a bentonite seal should be installed atop the gravel pack, to prevent surface ingress, together with the appropriate headworks to protect the completed monitoring boreholes.

If sufficient groundwater is intercepted during drilling operations, the newly installed monitoring boreholes must be subjected to aquifer testing, under the part time supervision of a qualified and professionally registered geohydrologist followed by monitored recovery readings, to allow the basic characteristics of the underlying aquifer to be determined.

Another monitoring and sampling event should be scheduled to take place once the new monitoring boreholes have been drilled and pump tested, to further aid in establishing representative groundwater quality.

The monitoring of the groundwater and surface water networks should continue throughout the operational phase, to determine the extent of the current impacts, as well as to build a water quality database to indicate water quality trends present at the site. No mitigation for values above the laboratory detection limits is currently required.

3.3.3 Surface Water

Align quarterly sampling with groundwater to capture both dry and post-rainfall conditions to assess dilution effects. Retain and incorporate current monitoring points as these will also address a footprint expansion.

Develop and implement a stormwater control plan to prevent contaminated runoff from reaching the Gwaing River. Include stormwater collection points in the monitoring network.

4 CONCLUSIONS & RECOMMENDATIONS

Veltwater Groundwater Specialists (Veltwater) was contracted by UMD Environmental Services to update the existing geohydrological site assessment and conduct additional soil sampling at the proposed extension area of the Gwaing Landfill, George, Western Cape Province.

Six soil samples (SS6 – SS11) were collected from six auger holes (AH6 – AH11) at predetermined locations that maximised area coverage and accounted for groundwater flow directions and surface water runoff. The soil sampling points were located within a vegetated area situated between the Gwaing Landfill to the north and the Gwaing Wastewater Treatment Works (WWTW) to the east and south.

4.1 Soils

The soil sample results returned indicated that SS8 and SS9 showed the most pronounced contamination, with elevated As, Pb, F, Al, Fe, Ca, Mg, K, and TOC exceeding screening values or showing concerning levels typical of leachate impact. While some exceedances (As, Cu, F, Pb in SS2 – SS4 and SS8 – SS9) are likely granite-derived, SS8 and SS9 suggest shallow, near-surface leachate influence. Downslope samples (SS10 and SS11) remained compliant, showing no plume migration or typical landfill leachate indicators. Soil profiles reveal permeable horizons conducive to migration (SS8, SS10, SS11), but clay-rich horizons at SS6 and SS9 may act as partial barriers. Overall, the data suggest localised contamination with limited landfill-derived influence, rather than widespread leachate migration.

4.2 Recommendations

To mitigate any aggravation of existing impacts or prevent additional impacts to the environment, the following recommendations should be implemented:

1. Mitigation Actions
 - a. Strengthen landfill cover and stormwater controls to reduce infiltration and minimise leachate generation.
 - b. Where reshaping or expansion is planned, install engineered liners and leachate collection systems to prevent subsurface migration.
 - c. Implement shallow interception trenches or subsurface barriers downslope to prevent potential leachate from reaching to Gwaing River.
2. Management Actions
 - a. Establish a granite baseline for soil and groundwater chemistry to clearly differentiate natural geogenic exceedances from landfill-related impacts.
 - b. Implement source attribution tools to distinguish sewage contamination from landfill leachate:
 - i. Use microbial source tracking (MST) to detect human-specific microbial markers.

- ii. Apply geochemical fingerprinting (expanded ionic suite, conservative tracers, and where feasible, stable isotopes such as $\delta^{15}\text{N}$) to characterise and quantify contributions from WWTW effluent versus landfill leachate.
 - c. Improve landfill operational controls (daily cover, drainage, leachate collection) to prevent further soil impacts.
 - d. Apply adaptive management: if new exceedances appear downslope, initiate immediate containment or remediation actions.
 - e. Standardise quarterly water monitoring analytical suite as described in our Monitoring and Impact Assessment Report.
 - f. Data management – Ensure consistent reporting formats and trend analysis across media and monitoring events.
3. Monitoring Actions
- a. Soils
 - i. Conduct annual soil sampling at hotspots (SS8 and SS9) and downslope locations (SS10 and SS11) to confirm the absence of plume migration.
 - ii. Track As, Pb, F, Al, Fe, and TOC to detect early signs of lateral or vertical contaminant movement.
 - iii. Use results to trigger further investigation or mitigation if upward trends or new exceedances occur.
 - b. Groundwater
 - i. Continue quarterly monitoring to capture seasonal variation.
 - ii. Install two additional downgradient monitoring boreholes prior to re-sloping or remediation (locations per Dwg No. 2) to strengthen detection of potential contaminant migration.
 - iii. Construct boreholes to appropriate specifications (30 m depth, 165 mm diameter, 125 mm uPVC casing, gravel pack, bentonite seal, protected headworks).
 - iv. Conduct aquifer testing if groundwater is intercepted to characterise hydraulic behaviour.
 - v. Consider a leachate monitoring point or, if impractical, shallow interception trenches or lysimeters at the landfill toe to capture leachate for chemical profiling.
 - vi. Conduct an additional monitoring event after new boreholes are installed and tested to establish a representative baseline.
 - c. Surface Water
 - i. Align quarterly surface water sampling with groundwater monitoring to capture both dry-season and post-rainfall conditions.
 - ii. Retain all existing surface water monitoring points to support both current operations and future footprint expansion.
 - iii. Implement a stormwater control plan and include stormwater collection points in the monitoring network.

4.3 No-Go Option

4.3.1 Description

Under the No-Go alternative the Gwaing Landfill Site remains in its present condition. No rehabilitation, capping or other source-control measures are implemented. Existing soil, groundwater and surface-water conditions continue without intervention.

4.3.2 Soils

Localised contamination is present in the unsaturated zone. Selected soil samples show elevated concentrations of arsenic, lead, copper, fluoride, aluminium, iron and total organic carbon, with oil & grease detected in one sample.

No consistent downslope contaminant plume has been identified. Metals are largely retained within clay-rich horizons, while more permeable sandy and gravelly units show higher migration potential. Under the No-Go option these existing soil conditions remain unaltered.

However, the clay-rich layers will continue to provide partial attenuation, but long-term accumulation of contaminants in the unsaturated zone is expected.

4.3.3 Groundwater

The weathered granitic aquifer exhibits naturally elevated electrical conductivity, sodium and chloride. Monitoring data show that metals are largely attenuated within the clayey weathered profile, with mobile salts reaching the saturated zone in limited quantities.

Clear landfill-derived plume indicators are largely attenuated or masked by natural poor water quality and the clayey nature of the weathered profile; therefore, no consistent landfill-derived contaminant plume was delineated.

Natural ambient water quality already limits beneficial use, but cumulative loading will not be halted.

Under the No-Go option the current groundwater quality conditions and attenuation processes continue without change.

4.3.4 Surface Water (Gwaing River)

Surface-water quality data indicate that the dominant impacts (elevated microbes, ammonia and organic load) originate from the adjacent wastewater treatment works. The landfill contribution is secondary and limited, consistent with soil attenuation, restricted groundwater discharge and dilution.

Cumulative loading and potential future exceedances of aquatic-ecosystem guidelines (e.g., aluminium) cannot be ruled out.

Under the No-Go option the existing relationship between the landfill and the Gwaing River remains unchanged.

4.3.5 Summary

Under the No-Go option the documented localised soil contamination, attenuated groundwater conditions and secondary landfill contribution to surface water continue without intervention. It is unknown whether these will remain unchanged or alter if the recommended measures are not implemented. The available data, constrained by the limited monitoring currently in place, do not allow quantification of any change over time, but the conceptual site model indicates that the bulk of the impact stays in the soils. Therefore, an increase in groundwater contamination or load to surface water is deemed unlikely.

5 REFERENCES

Department of Environmental Affairs (DEA). (2013). National Norms and Standards for the Remediation of Contaminated Land and Soil Quality in the Republic of South Africa. National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008). Government Gazette No. 36447.

Veltwater Groundwater Specialists. (2024). Letter Report for the Desktop Review of the Gwaing Landfill Site – George – Western Cape Province.

Veltwater Groundwater Specialists. (2024). Report on the Geohydrological Assessment at the Gwaing Landfill Site – Technical Report.

Veltwater Groundwater Specialists. (2025). Report on the Geohydrological Assessment at the Gwaing Landfill Site: Monitoring and Impact Assessment Report.

6 ANNEXURES

- A - FIELD NOTES AND SOIL DESCRIPTIONS
- B - PHOTOGRAPHIC REPORT
- C - LABORATORY CERTIFICATES
- D - TABULATED SOIL QUALITY DATABASE
- E - MAPS

ANNEXURE A

FIELD NOTES & SOIL DESCRIPTIONS



SOIL SAMPLING FORM

Project Details

Project Name:	Gwaing ESA Update	Location:	George, RSA	Project Description:	Groundwater ESA Update
Date Visited:	19/11/2024	Field Work Done By:	JVR, SV	Fieldwork Commencement:	19/11/2024
Client:	UMDES	Name of Assistant:	Blessings, Vusi	Fieldwork Completion:	19/11/2024

Auger Details

Auger Hole ID	Sample Date	Total Depth	Groundwater Encountered	Sample No.	Position of Auger Hole, Additional Comments or Observations
		(mbgl)	Yes/No		
AH6	19/11/2025	1.15	No	SS6	Downstream of WWTW, open area, yellow-brown clay
AH7	19/11/2025	0.65	No	SS7	Downstream of WWTW, open area, loose sand, refusal reached
AH8	19/11/2025	0.34	No	SS8	Downstream of landfill and WWTW, open area, near the treeline, sand & gravel
AH9	19/11/2025	0.99	No	SS9	Natural woodland area, drainage line, dark brown topsoil
AH10	19/11/2025	0.64	No	SS10	A metres from the Gwaing River. Riverine and woodland area with think leaf litter layer, refusal - weathered granite
AH11	19/11/2025	0.85	No	SS11	Natural woodland area, thick leaf litter layer, refusal - weathered granite

Soil Description												
Auger Hole ID	Moisture Condition	Colour		Secondary Colour Patterns	Consistency (Sand & Gravel)	Consistency (Clay & Silts)	Structure (All Soils)	Structure (Clays & Silts)	Texture / Type	Size	Shape (Gravel & Clasts)	Abundance (Gravel & Clasts)
	<i>Dry / Slightly moist / Moist / Very moist / Wet</i>	<i>Primary</i>	<i>Secondary</i>	<i>Speckled / Mottled / Blotched / Banded / Streaked / Stained</i>	<i>Very loose / Loose / Medium dense / Dense / Very dense</i>	<i>Very soft / Soft / Firm / Stiff / Very stiff / Hard</i>	<i>Intact / Pinholed / Honeycombed</i>	<i>Slickensided / Shattered / Micro-shattered</i>	<i>Boulder / Cobble / Gravel / Sand / Silt / Clay</i>	<i>Coarse / Medium / Fine</i>	<i>Angular / Sub-angular / Sub-round / Rounded / Well rounded</i>	<i>Traces <10% / Minor 10-30% / Abundant 30-50% / Closely packed >50% / Tightly packed >50% clast touching</i>
AH6	Dry	yellow	brown	mottled	-	firm to stiff	intact, pinholed	shattered	clay, silt	fine	no gravel	none
AH7	Dry	light brown	brown	speckled	very loose	-	intact	no clay	sand, silt	fine	sub-round, sub-angular	traces
AH8	Dry	dark brown	brown	speckled	very loose	-	intact	no clay	sand, silt	fine	sub-round, sub-angular	minor
AH9	Dry	dark brown	yellow	blotched	loose	firm	intact	shattered	clay, silt	fine to medium	sub-round, sub-angular	traces
AH10	Dry	light grey	light brown	speckled	very loose	-	intact, pinholed	no clay	weathered granite cobbles	medium	sub-round, sub-angular	abundant
AH11	Dry	light grey	brown	speckled	very loose	-	intact, pinholed	no clay	weathered granite gravel	medium	sub-round, sub-angular	abundant

ANNEXURE B

PHOTOGRAPHIC REPORT

Geohydrological Assessment Update Report

Soil Sampling

Photos taken 19/11/2025



SS6



SS7 View to the North



SS7 View to Southeast



SS7 View to the Southwest



SS7 Westerly view



SS7



SS8



SS8 Soil



SS9



SS10 Surrounds



SS10



SS11

ANNEXURE C

LABORATORY CERTIFICATES

TEST REPORT

62229A

Client and Project Information

Client: Veltwater Groundwater Specialists
Address: 1 Falcon Street, Meyersdal
 Alberton
 1477

Attention: Jorette van Rooyen
Tel: (076) 158-0871
Email: jorette@veltwater.com

Project number: N/A
Project name: N/A

Sample Information

Sample ID: SS10
Units: mg/kg [ppm] (unless stated elsewhere)

Matrix: Soil
Container: Glass

Date Received: 2025/11/20
Date Analysed: 2025/11/21
Date Issued: 2025/12/04

Cations and Metals

Al*	7857.00	Cr(III)*	4.97	Ni	<3	As	<3
B	<30	Fe	7207.00	Pb	13.59	Cu	5.48
Ba	13.60	K*	1727.00	Se	<6	Ca	321.90
Cd	<3	Mn	69.53	Zn	15.08	Mg	1126.00
Cr	4.97	Na	167.00	Hg*	<0.3		

Anions (Discrete Analyser)

Cl*	391.30	NO₂ as N*	<1.3	SO₄*	<20
F*	15.44	NO₃ as N*	<5	PO₄ as P*	<2

Other Parameters

pH*	5.78	E.coli (colonies/g)*	0
EC (µs/cm)*	13	Faecal Coliforms (colonies/g)*	0
Total CN*	<1.55		
Cr(VI)*	<2		
TOC**	18800.00		
NH₃ as N*	11.40		

Disclaimers

- 1) The results only relate to the test items provided, in the condition as received.
- 2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
- 3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
- 4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
- 5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
- 6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
- 7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Zelma Weideman
 Authorised Signatory

TEST REPORT

62229A

Client and Project Information

Client: Veltwater Groundwater Specialists
Address: 1 Falcon Street, Meyersdal
 Alberton
 1477

Attention: Jorette van Rooyen
Tel: (076) 158-0871
Email: jorette@veltwater.com

Project number: N/A
Project name: N/A

Sample Information

Sample ID: SS11
Units: mg/kg [ppm] (unless stated elsewhere)

Matrix: Soil
Container: Glass

Date Received: 2025/11/20
Date Analysed: 2025/11/21
Date Issued: 2025/12/04

Cations and Metals

Al*	12785.00	Cr(III)*	8.63	Ni	3.23	As	<3
B	<30	Fe	13591.00	Pb	6.38	Cu	<3
Ba	30.10	K*	1416.00	Se	<6	Ca	401.50
Cd	<3	Mn	46.99	Zn	10.03	Mg	1451.00
Cr	8.63	Na	320.40	Hg*	<0.3		

Anions (Discrete Analyser)

Cl*	151.40	NO₂ as N*	<1.3	SO₄*	113.60
F*	27.92	NO₃ as N*	<5	PO₄ as P*	<2

Other Parameters

pH*	6.99	E.coli (colonies/g)*	0
EC (µs/cm)*	12	Faecal Coliforms (colonies/g)*	0
Total CN*	<1.55		
Cr(VI)*	<2		
TOC**	<6000		
NH₃ as N*	9.40		

Disclaimers

- 1) The results only relate to the test items provided, in the condition as received.
- 2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
- 3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
- 4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
- 5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
- 6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
- 7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Zelma Weideman
 Authorised Signatory

TEST REPORT

62229A

Client and Project Information

Client: Veltwater Groundwater Specialists
Address: 1 Falcon Street, Meyersdal
 Alberton
 1477

Attention: Jorette van Rooyen
Tel: (076) 158-0871
Email: jorette@veltwater.com

Project number: N/A
Project name: N/A

Sample Information

Sample ID: SS6
Units: mg/kg [ppm] (unless stated elsewhere)

Matrix: Soil
Container: Glass

Date Received: 2025/11/20
Date Analysed: 2025/11/21
Date Issued: 2025/12/04

Cations and Metals

Al*	11485.00	Cr(III)*	59.93	Ni	62.41	As	3.53
B	<30	Fe	15131.00	Pb	7.72	Cu	<3
Ba	33.32	K*	407.80	Se	<6	Ca	519.80
Cd	<3	Mn	22.70	Zn	3.15	Mg	573.90
Cr	59.93	Na	104.00	Hg*	<0.3		

Anions (Discrete Analyser)

Cl*	377.70	NO₂ as N*	<1.3	SO₄*	1478.00
F*	22.52	NO₃ as N*	<5	PO₄ as P*	4.80

Other Parameters

pH*	7.04	E.coli (colonies/g)*	0
EC (µs/cm)*	10	Faecal Coliforms (colonies/g)*	0
Total CN*	<1.55		
Cr(VI)*	<2		
TOC**	<6000		
NH₃ as N*	9.27		

Disclaimers

- 1) The results only relate to the test items provided, in the condition as received.
- 2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
- 3) Parameters marked " " are not included in the SANAS Schedule of Accreditation for this laboratory.
- 4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
- 5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
- 6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
- 7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Zelma Weideman
 Authorised Signatory

TEST REPORT

62229A

Client and Project Information

Client: Veltwater Groundwater Specialists
Address: 1 Falcon Street, Meyersdal
 Alberton
 1477

Attention: Jorette van Rooyen
Tel: (076) 158-0871
Email: jorette@veltwater.com

Project number: N/A
Project name: N/A

Sample Information

Sample ID: SS7
Units: mg/kg [ppm] (unless stated elsewhere)

Matrix: Soil
Container: Glass

Date Received: 2025/11/20
Date Analysed: 2025/11/21
Date Issued: 2025/12/04

Cations and Metals

Al*	5583.00	Cr(III)*	13.93	Ni	3.23	As	3.75
B	<30	Fe	19232.00	Pb	10.81	Cu	3.22
Ba	23.57	K*	399.20	Se	<6	Ca	259.30
Cd	<3	Mn	15.84	Zn	15.51	Mg	228.20
Cr	13.93	Na	20.81	Hg*	<0.3		

Anions (Discrete Analyser)

Cl*	237.00	NO₂ as N*	<1.3	SO₄*	430.40
F*	19.92	NO₃ as N*	<5	PO₄ as P*	134.40

Other Parameters

pH*	4.91	E.coli (colonies/g)*	0
EC (µs/cm)*	21	Faecal Coliforms (colonies/g)*	0
Total CN*	<1.55		
Cr(VI)*	<2		
TOC**	<6000		
NH₃ as N*	9.19		

Disclaimers

- 1) The results only relate to the test items provided, in the condition as received.
- 2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
- 3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
- 4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
- 5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
- 6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
- 7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Zelma Weideman
 Authorised Signatory

TEST REPORT

62229A

Client and Project Information

Client: Veltwater Groundwater Specialists
Address: 1 Falcon Street, Meyersdal
 Alberton
 1477

Attention: Jorette van Rooyen
Tel: (076) 158-0871
Email: jorette@veltwater.com

Project number: N/A
Project name: N/A

Sample Information

Sample ID: SS8
Units: mg/kg [ppm] (unless stated elsewhere)

Matrix: Soil
Container: Glass

Date Received: 2025/11/20
Date Analysed: 2025/11/21
Date Issued: 2025/12/04

Cations and Metals

Al*	19744.00	Cr(III)*	43.66	Ni	3.80	As	26.14
B	<30	Fe	103846.00	Pb	48.61	Cu	<3
Ba	32.06	K*	748.60	Se	<6	Ca	312.00
Cd	<3	Mn	29.31	Zn	4.78	Mg	559.70
Cr	43.66	Na	190.80	Hg*	<0.3		

Anions (Discrete Analyser)

Cl*	375.20	NO₂ as N*	<1.3	SO₄*	114.70
F*	20.83	NO₃ as N*	<5	PO₄ as P*	3.81

Other Parameters

pH*	6.47	E.coli (colonies/g)*	0
EC (µs/cm)*	9	Faecal Coliforms (colonies/g)*	0
Total CN*	<1.55		
Cr(VI)*	<2		
TOC**	10000.00		
NH₃ as N*	12.60		

Disclaimers

- 1) The results only relate to the test items provided, in the condition as received.
- 2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
- 3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
- 4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
- 5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
- 6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
- 7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Zelma Weideman
 Authorised Signatory

TEST REPORT

62229A

Client and Project Information

Client: Veltwater Groundwater Specialists
Address: 1 Falcon Street, Meyersdal
 Alberton
 1477

Attention: Jorette van Rooyen
Tel: (076) 158-0871
Email: jorette@veltwater.com

Project number: N/A
Project name: N/A

Sample Information

Sample ID: SS9
Units: mg/kg [ppm] (unless stated elsewhere)

Matrix: Soil
Container: Glass

Date Received: 2025/11/20
Date Analysed: 2025/11/21
Date Issued: 2025/12/04

Cations and Metals

Al*	22044.00	Cr(III)*	20.27	Ni	5.96	As	4.62
B	<30	Fe	19196.00	Pb	12.69	Cu	3.17
Ba	53.93	K*	1421.00	Se	<6	Ca	1213.00
Cd	<3	Mn	40.62	Zn	11.07	Mg	1175.00
Cr	20.27	Na	656.30	Hg*	<0.3		

Anions (Discrete Analyser)

Cl*	232.10	NO₂ as N*	<1.3	SO₄*	525.20
F*	38.51	NO₃ as N*	23.48	PO₄ as P*	10.58

Other Parameters

pH*	7.23	E.coli (colonies/g)*	0
EC (µs/cm)*	63	Faecal Coliforms (colonies/g)*	0
Total CN*	<1.55		
Cr(VI)*	<2		
TOC**	8300.00		
NH₃ as N*	9.69		

Disclaimers

- 1) The results only relate to the test items provided, in the condition as received.
- 2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
- 3) Parameters marked " * " are not included in the SANAS Schedule of Accreditation for this laboratory.
- 4) A = Concentration outside calibration range, ** = Outsourced analysis, UTD = Unable to Determine, RTF = Results To Follow, NR = Not Requested.
- 5) Methods: EPL-WL-001 (Conductivity), EPL-WL-002 (Alkalinity), EPL-WL-003 (pH), EPL-WL-004 (TDS), EPL-WL-005 (Anions by IC), EPL-WL-006 (Cations by IC), EPL-WL-007 (Metals), EPL-WL-008 (Cr(VI)), EPL-WL-009 (TOC), EPL-WL-010 (Hg by DMA), EPL-WL-011 (Anions by Discrete Analyser), EPL-HPLC-001 (Formaldehyde), EPL-ML-001 (Micro).
- 6) Uncertainty of measurement for all methods included in the SANAS Schedule of Accreditation is available on request.
- 7) Cr(III) and Cr(VI) are assumed to be the two major oxidative states of Chromium.

Zelma Weideman
 Authorised Signatory

TEST REPORT

62229A

Test Description: Total Oil and Grease

Test Method: EPL-T-013

Client and Project Information

Client: Veltwater Groundwater Specialists

Address: 1 Falcon Street, Meyersdal
Alberton
1477

Attention: Jorette van Rooyen
Tel: (076) 158-0871
Email: jorette@veltwater.com

Project number: N/A
Project name: N/A

Sample Information

Matrix: Soil

Storage: Fridge at 0-6°C

Container: Glass

Date Received: 2025/11/20

Date Analysed: 2025/11/25

Date Issued: 2025/11/26

SAMPLE ID

RESULT TOG

SS10	<100 mg/kg
SS11	<100 mg/kg
SS6	<100 mg/kg
SS7	<100 mg/kg
SS8	<100 mg/kg
SS9	<100 mg/kg

Disclaimers

- 1) The results only relate to the test items provided, in the condition as received.
- 2) This report may not be reproduced, except in full, without the prior written approval of the laboratory.
- 3) A = Concentration outside calibration range, O = Outsourced analysis, UTD = Unable to Determine.

Reinardt Cromhout
Authorised Signatory

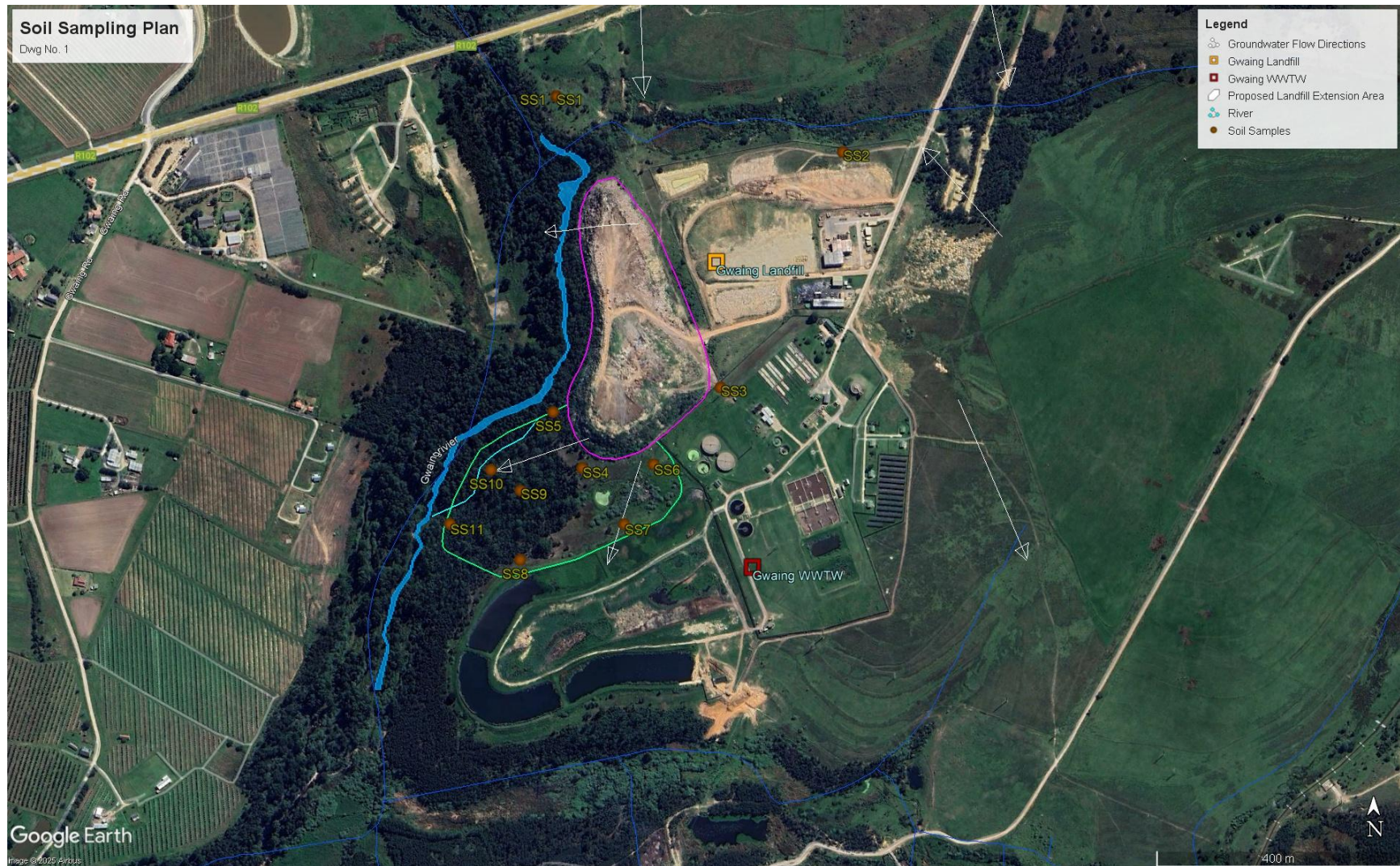
ANNEXURE D

TABULATED SOIL QUALITY DATABASE

Sample ID	Units	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8	SS9	SS10	SS11	RSA DEA SSVs	RISC Tier I RBSLs
Sample Depth (m)		0.76	1	1.97	0.63	1.48	1.15	0.65	0.34	0.99	0.64	0.85		
Inorganics: Cations and Metals														
Aluminium as Al	mg/kg	11494	12862	11433	8064	99610	11485	5583	19744	22044	7857	12785	ns	10 000 - 300 000*
Arsenic as As	mg/kg	3.28	4.32	<3	24.17	3.87	3.53	3.75	26.14	4.62	<3	<3	5.80	10.81
Barium as Ba	mg/kg	17.39	70.34	240.00	20.93	19.61	33.32	23.57	32.06	53.93	13.60	30.10	ns	2608.97
Boron as B	mg/kg	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	ns	ns
Cadmium as Cd	mg/kg	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	7.50	22.97
Calcium as Ca	mg/kg	590.40	727.50	4201	248.30	166.40	519.80	259.30	312	1213	321.90	401.50	ns	ns
Chromium (III)	mg/kg	15.37	27.33	51.12	29.49	4.22	59.93	13.93	43.66	20.27	4.97	8.63	46000	3.71E+08
Chromium (VI)	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	6.50	85.82
Copper as Cu	mg/kg	<3	<3	116.10	<3	4.50	<3	3.22	<3	3.17	5.48	<3	16	127.82
Cyanide as CN-	mg/kg	<1.55	<1.55	<1.55	<1.55	<1.55	<1.55	<1.55	<1.55	<1.55	<1.55	<1.55	14	247.84
Electrical Conductivity (EC)	mS/m	1.60	3.90	2.50	1.70	11.00	1.00	2.10	0.90	6.30	1.30	1.20	ns	ns
Iron as Fe	mg/kg	15823	16682	35091	89258	27980	15131	19232	103846	19196	7207	13591	ns	7 000 - 550 000*
Lead as Pb	mg/kg	11.75	44.13	27.20	43.17	11.62	7.72	10.81	48.61	12.69	13.59	6.38	20	44.61
Magnesium as Mg	mg/kg	235.60	814	2849	301.90	2366	573.90	228.20	559.70	1175	1126	1451	ns	ns
Manganese as Mn	mg/kg	17.37	12.90	88.41	9.53	134.50	22.70	15.84	29.31	40.62	69.53	46.99	740	20 - 3 000*
Mercury as Hg*	mg/kg	<0.3	0.66	0.61	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.93	406.88
Nickel as Ni	mg/kg	<3	5.71	35.98	<3	<3	62.41	3.23	3.80	5.96	<3	3.23	91	2181.22
pH	mg/kg	6.56	8.01	5.83	6.47	6.05	7.04	4.91	6.47	7.23	5.78	6.99	ns	ns
Potassium as K	mg/kg	169.40	553.40	2066	269.10	3693	407.80	399.20	748.60	1421	1727	1416	ns	ns
Selenium as Se	mg/kg	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	ns	27.30
Sodium as Na	mg/kg	60.15	704.40	216.80	137.10	695.80	104.00	20.81	190.80	656.30	167.00	320.40	ns	ns
Total Chromium as Cr	mg/kg	15.37	27.33	51.12	29.49	4.22	59.93	13.93	43.66	20.27	4.97	8.63	80	ns
Total Organic Carbon (TOC)	mg/kg	<6000	6000	6600	<6000	<6000	<6000	<6000	10000	8300	18800	<6000	ns	ns
Zinc as Zn	mg/kg	12.57	3.24	108.00	<3	39.28	3.15	15.51	4.78	11.07	15.08	10.03	240	27891
Inorganics: Anions														
Chloride as Cl	mg/kg	168.40	146.50	89.39	198.30	513.20	377.70	237.00	375.20	232.10	391.30	151.40	12000	ns
Fluoride as F	mg/kg	15.89	30.95	23.45	12.43	13.08	22.52	19.92	20.83	38.51	15.44	27.92	30	50 - 500*
Nitrate as N	mg/kg	<1.3	<1.3	<1.3	<1.3	<1.3	<5	<5	<5	23.48	<5	<5	120	ns
Nitrite as N	mg/kg	<5	<5	<5	<5	<5	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3		ns
Sulphate as SO4	mg/kg	193.30	361.80	83.99	<20	263.90	1478.00	430.40	114.70	525.20	<20	113.60	4000	ns
Phosphate as P	mg/kg	<2	<2	138.60	4.18	12.14	4.80	134.40	3.81	10.58	<2	<2	ns	ns
Microbiological														
Faecal Coliforms	colonies/g	0	260	0	0	0	0	0	0	0	0	0	ns	ns
E.coli	colonies/g	0	260	0	0	0	0	0	0	0	0	0	ns	ns
Organics														
Total Oil & Grease (TOG)	mg/kg	<100	<100	180	<100	<100	<100	<100	<100	<100	<100	<100	ns	ns

ANNEXURE E

MAPS





Final Page