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09 December 2021
580440

Equites Property Fund Limited
14th Floor Portside Tower
4 Bree Street
Cape Town
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Attention: To Who it May Concern

Dear Sir/Madam

Groundwater Impact Investigation for Proposed Underground Diesel Storage at Shoprite, Wells Estate, Nelson Mandela Bay, Eastern Cape – Revision 1

1. Introduction

SRK Consulting South Africa (Pty) Ltd (SRK) was appointed by Equites Property Fund Limited (the Client) to conduct a groundwater investigation at a site where a diesel storage facility is planned. The diesel storage facility is planned for Shoprite in Wells Estate, Gqeberha, Eastern Cape. SRK understands that the investigation is required to assess the potential impact that such a storage facility may have on the groundwater environment.

Please refer to Figure 1 for a location map of the Site.

2. Scope of Work

For this assessment, the following scope of work was given and accepted, quoted from the document "*Proposal – Groundwater Impact Investigation for Proposed Underground Diesel Storage at Shoprite, Wells Estate, Nelson Mandela Bay, Eastern Cape – Revision 2*" dated 18 August 2021:

2.1 Baseline Study

- *A desktop assessment of the hydrogeology of the Site and surrounding area (approximately 1 km radius). This will include:*
  - *Studying and summarising the geology, hydrogeology and topography;*

- *Querying available databases (NGA, NGDB or GRIP) of the Department of Water and Sanitation (DWS), which contains information on boreholes that have been registered or licensed with the DWS;*
- *Surface drainage will be studied based on contours, as well as the Average Groundwater Exploitation Potential (AGEP), the catchment areas and rainfall data for the area (if available).*
- *Identifying existing potential contamination sources (visible from satellite imagery or aerial photographs); and*
- *Assessing historical reports (if available, e.g., geotechnical or hydrogeological reports) and summarising the relevant components of these reports, in order to determine the nature of the soils or aquifers underlying the Site.*

- *A Site visit will be conducted where any geological features, including outcrop, surface water, etc. will be recorded.*
- *GIS maps will be compiled to illustrate findings.*
- *A report will be written summarising the finding of the investigation. Comments will be made on the suitability of the Site for the development.*

2.2 Installation of Piezometers and Sampling

It is recommended that two shallow piezometers (maximum 5 m deep) be installed for monitoring purposes around the proposed development. The piezometers will be installed in the excavated test pits, which are planned as a part of the geotechnical investigation. Currently the positions of the test pits are unknown, but the following is envisaged for the piezometers:

- *One piezometer to be installed hydrogeologically up-gradient of the Site. This will monitor the quality of shallow groundwater entering the Site.*
- *One piezometer to be installed hydrogeologically down-gradient of the Site. This will monitor the quality of shallow groundwater exiting the Site.*

Once the piezometers have been installed, water samples will be collected from each of them, and submitted to a SANAS accredited laboratory for analysis of a standard suite of parameters.

2.3 Groundwater Impact Assessment

- *A hydrocensus will be conducted, where owners of relevant properties within a 1 km radius of the Site will be contacted to enquire if there are boreholes on their properties. Information on existing boreholes, including borehole depth, water use, water level, the aesthetic character of the water and borehole position will be gathered where available. This census is intended to provide information where possible, but SRK cannot guarantee that all boreholes will be surveyed within the mentioned area.*
- *Potential impacts of the proposed development on the general hydrogeological regime will be assessed. A conceptual site model will be included, and data gaps identified.*
- *GIS maps will be compiled to illustrate findings.*
- *A report will be compiled, summarising the findings of the investigation. Recommendations on appropriate mitigatory measures will be made, where required, to reduce the impact (if any) on the groundwater environment.*

2.4 Public Participation

SRK will respond to queries from the Environmental Assessment Practitioner (EAP) following public participation process, via email.

Figure 1: Location

3. Project Results

3.1 Baseline Study

3.1.1 Desktop Assessment

Geology

According to the publication "*The Geology of the Port Elizabeth-Uitenhage Area*" by F.G le Roux of the Council for Geoscience (2000), the geology underlying the Site is mainly the Alexandria Formation of the Algoa Group. The Alexandria Formation is underlain by the older Sundays River Formation of the Uitenhage Group, which is exposed in the northern section of the Site.

The Alexandria Formation consists of alternating layers of calcareous sandstone, conglomerate and coquinite and has an average thickness of 9 m. The conglomerates contain pebbles and cobbles that are set in a fine to medium-grained sand matrix. The coquinites are pebbly in places and consist of 70% invertebrate shell remains that is commonly recrystalised.

The Sundays River Formation comprises grey to bluish green mudstone, siltstone and sandstone. The thickest known intersection of this formation is 1 863 m near Addo.

Hydrogeology

According to the publication "*An Explanation of the 1:500 000 General Hydrogeological Map of Port Elizabeth 3324*" by P.S Meyer of the Department of Water Affairs and Forestry (1998), the Algoa Group aquifer (which includes the Alexandria Formation) is a unique intergranular aquifer, where water seeps through the porous, sandy and pebbly material until it comes into contact with underlying, usually impervious pre-Algoa rocks (e.g. the Sundays River Formation). From here, it moves in the basal Alexandria conglomerate towards the sea, where it may daylight as springs at the coast. There is hardly any build-up in groundwater level (due to its high permeability) and the water level encountered within the conglomerate is likely its true piezometric level.

A borehole yield analysis revealed that 60% of boreholes in this formation yields less than 0.5 L/s, which implies that 40% of boreholes yield more than 0.5 L/s.

Groundwater quality is generally regarded potable, with conductivity measuring <300 mS/m. Sodium, calcium and chloride often exceeds maximum recommended limits.

The water level in an intergranular aquifer, such as this one, is often directly dependent on rainfall and may change depending on the volumes of rainfall received.

According to the above-mentioned document, the Uitenhage Group (of which the Sundays River Formation forms a part) is a dense mass of rock with generally low permeability, with a limited groundwater potential. Many boreholes have been drilled unsuccessfully into this formation. The groundwater quality is also considered poor, with conductivity commonly measuring above 300 mS/m. Sodium, calcium, chloride and magnesium is also normally above the allowable limits for drinking water.

Please refer to Figure 2 for the geology of the Site.

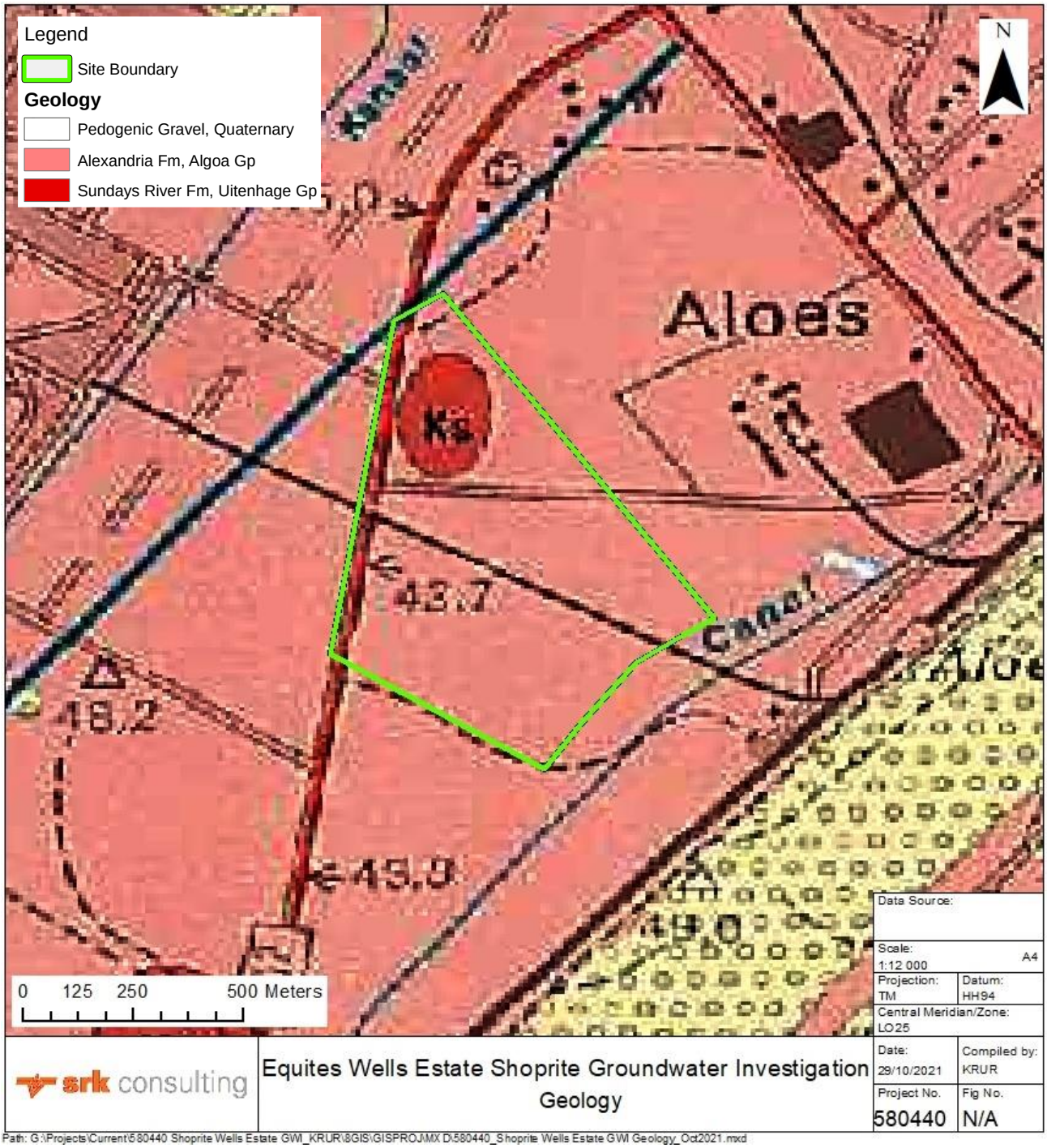

Figure 2: Geology

Surface Water and Groundwater Drainage

Elevations range between 45 and 40 mamsl. Higher elevations are present towards the north of the Site, and lower elevations in the centre and towards the south. There are higher elevations of around 48 mamsl to the northwest and southeast of the Site. Refer to Figure 3 for a contour map with surface water flow directions

Surface water will accumulate in the lowest lying areas, towards the centre and south of the Site.

Deeper groundwater will most likely move towards the Swartkops River in the southwest; and the sea in the southeast. Refer to Figure 4 for a map with estimated deeper groundwater flow directions.

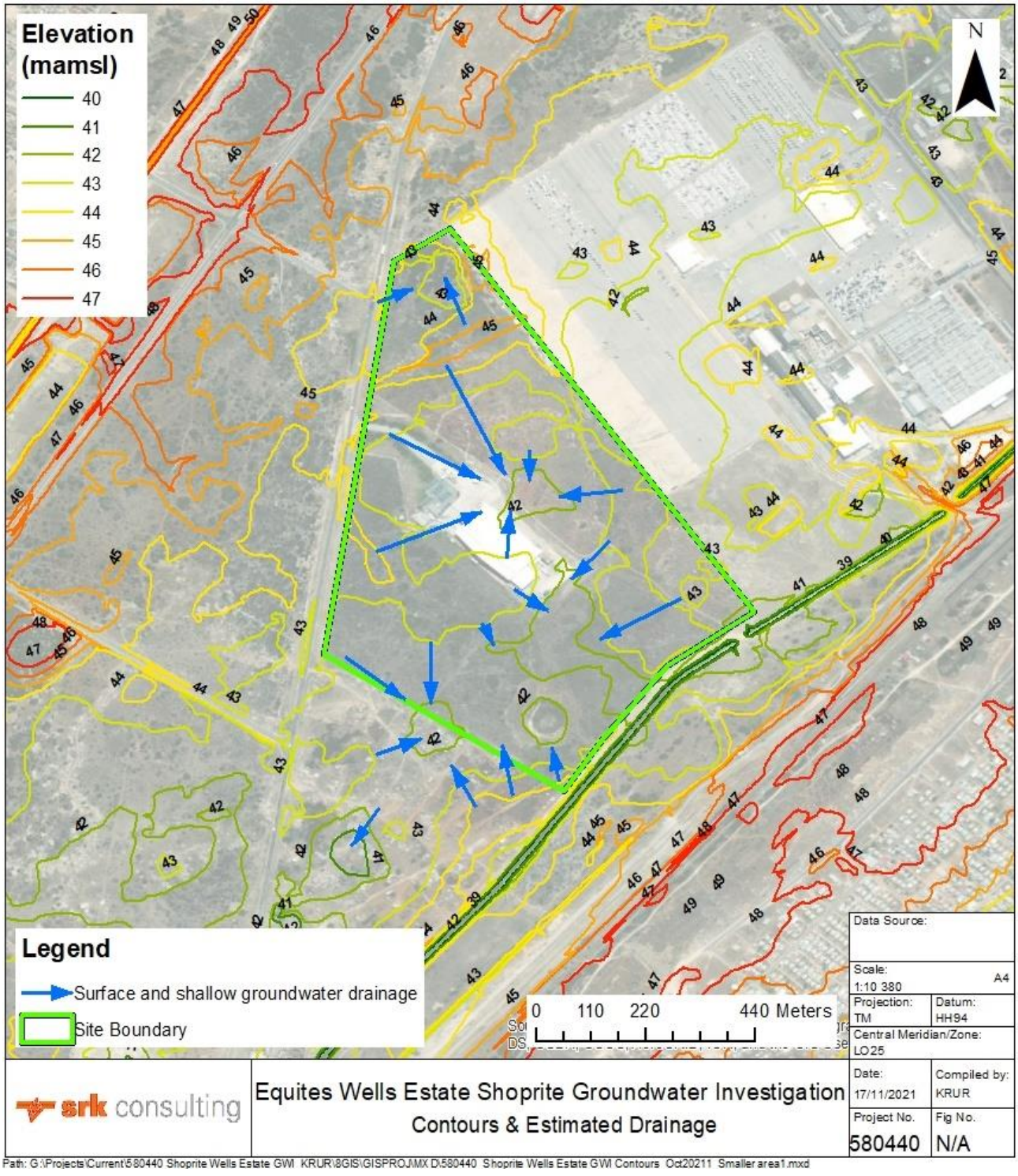

Figure 3: Contours and Drainage

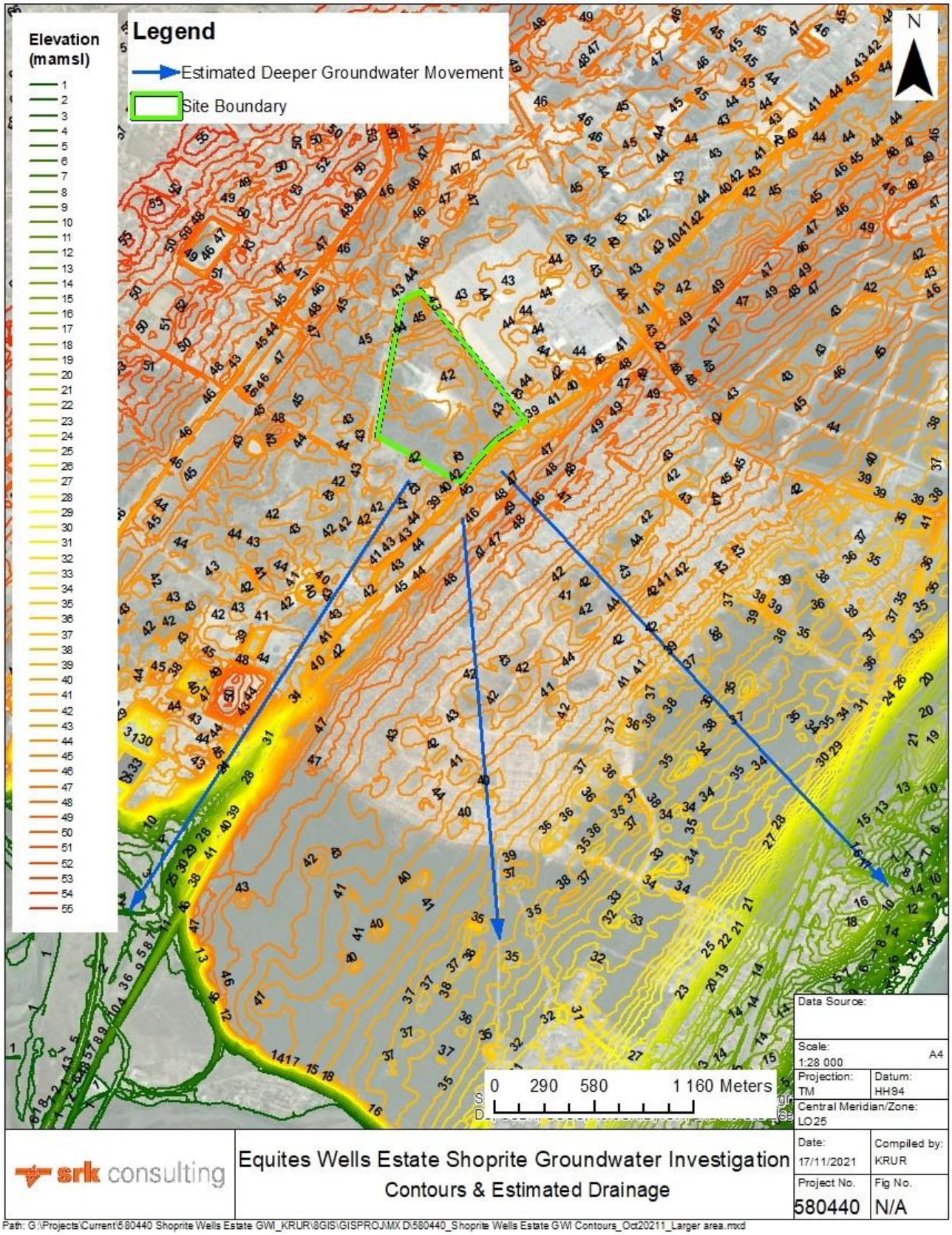

Figure 4: Estimated Deeper Groundwater Flow

Borehole Databases

The National Groundwater Archive (NGA), National Groundwater Database (NGDB) and Groundwater Information Project (GRIP) was queried for any existing information on boreholes. Within a 1 km radius of the Site, only one borehole was located. Within a 2 km radius, two more boreholes were located. Two of the boreholes appears to have high discharge rates. Both of these were drilled to a shallow depth of about 16 m. These are shown in Figure 5 and their details given in Table 1.

Table 1: Borehole Database Information

Borehole ID	Latitude	Longitude	Discharge Rate (L/s)	Depth (m)	Airlift Yield (L/s)
3325DC00066	-33.81688	25.60408	1.67 - 13.2	16.7	N/A
3325DC00024	-33.81628	25.60676	N/A	208.9	0.0001
3325DC00065	-33.81019	25.59830	0.6 - 12.8	16.0	N/A
Notes: N/A: Not Available					

Figure 5: NGA Database Boreholes

Average Groundwater Exploitation Potential (AGEP)

The AGEP is the total volume of groundwater available for abstraction under normal rainfall conditions, as calculated by the DWS and given on their map "*Average Groundwater Exploitation Potential of South Africa*" DWAF GRA2 Project (2005). The AGEP for the Site is given in Figure 6 below.

The majority if the Site has an AGEP of between 2 501 and 6 000 $m^3/km^2/a$. This translates to a maximum abstraction rate of 0.2 L/s per km^2. Towards the southwest, the potential is slightly increased to an AGEP ranging between 6 001 and 10 000 $m^3/km^2/a$. This translates to a maximum abstraction rate of 0.32 L/s.

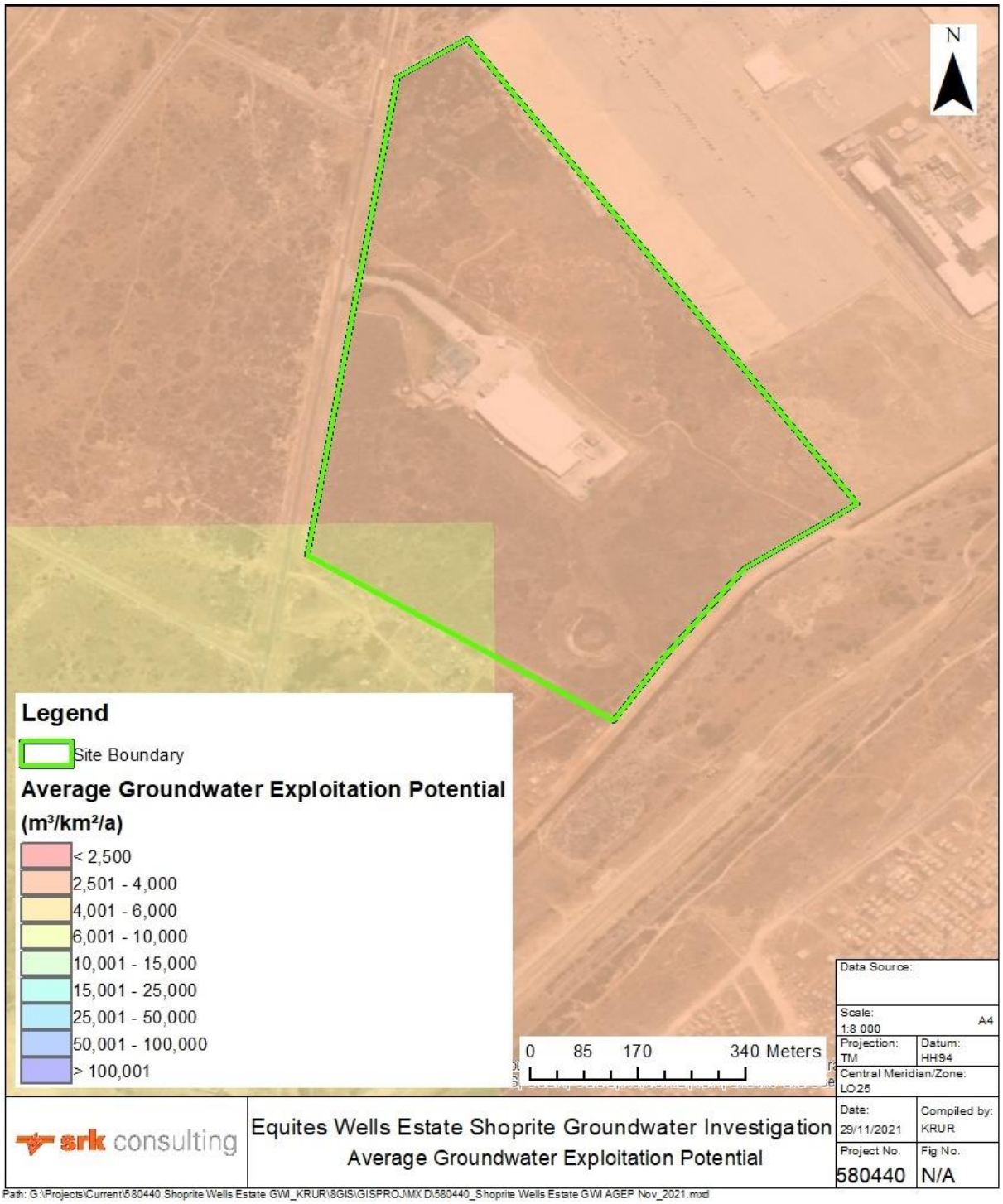

Figure 6: Average Groundwater Exploitation Potential

Potential Sources of Contamination

The following potential sources of contamination has been noticed within a 500 m radius of the Site:

- On the Site itself, fuel spillages have occurred where trucks are parked.
- Immediately to the north-east – car manufacturing company(ies), which will likely have fuel storage facilities.
- Along the south-eastern boundary – the Markman Canal. During fieldwork, a strong sewage odour emanated from the canal.
- To the south-west – an informal settlement with no services (including sanitation)
- On and around the Site – dumping of unidentified rubble.

These do not necessarily include all possible pollution sources but are highlighting the most obvious ones. The locations are shown in Figure 7.

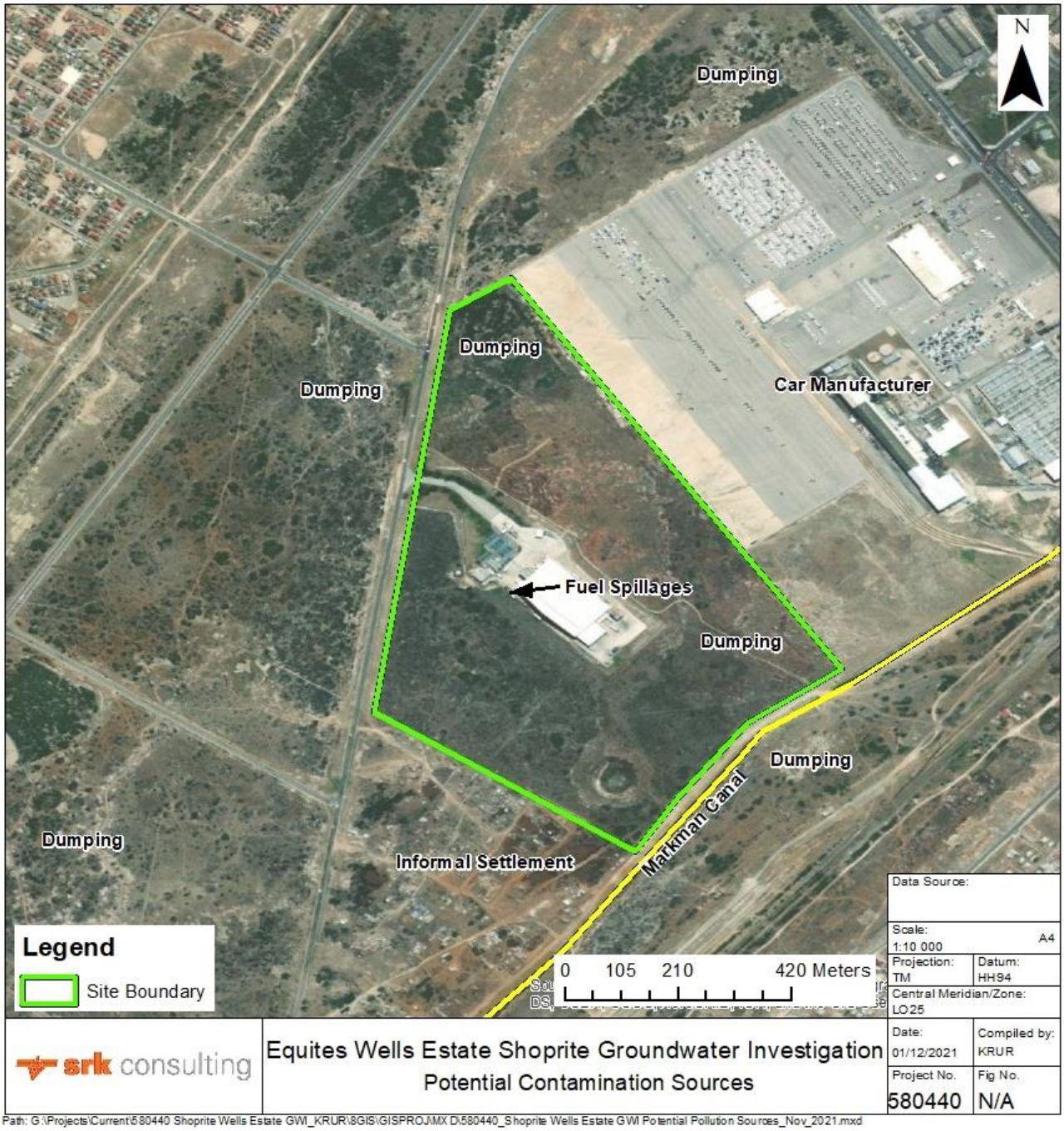

Figure 7: Potential Contamination Sources

Other Reports

According to the information gathered from the geotechnical investigation carried out, the following can be summarised:

- Twelve test pits were excavated in the northern section of the Site which was earmarked for the geotechnical investigation. Two additional pits were excavated in the south-eastern and south-western corners of the Site, for the purposes of installing piezometers.
- The average depth of the test pits (with the exception of two pits), was 4.4 mbgl. Two pits encountered excavation refusal at 2 mbgl (TP 5) and 2.5 mbgl (TP 6).
- The generalised soil profile for the areas comprises of:
  - Topsoil with calcrete fragments;
  - Underlain by underlain by calcrete or sands;
  - Underlain by pedogenic calcrete gravel and/or calcareous sand;
  - Underlain by the Alexandria Formation - sandy clay / sands / gravel limestone / calcareous accretions and shelly fragments;
  - Underlain by the Sundays River Formation – silty clay / silty clay with sand.
- Seepage was encountered in TP 2 at 1.9 m, resulting in sidewall collapse; and TP 3 at 2.9 m.
- The sandy and gravelly nature of the soils and also the Alexandria Formation will result in permeable conditions that promotes the flow of shallow groundwater. The clayey nature of the Sundays River Formation creates zones of very low permeability, and most likely create an aquiclude. Shallow groundwater flow will likely move laterally on top of the Sundays River Formation, ion the permeable Alexandrian Formation, toward lower-lying areas like the Swartkops River and the sea.

During a previous investigation in 2017, a groundwater supply borehole was drilled at the Motherwell NU2 Sports Stadium, situated approximately 1.2 km to the north north-west of the Site. Groundwater was intersected at 8 mbgl in the shelly, pebbly gravel of the Alexandria Formation, and an airlift yield of 1.3 L/s was recorded. The water level in the borehole was 2.37 mbgl. This borehole was drilled to supply the stadium with water for irrigation.

3.1.2 Site Visit and Geological Reconnaissance

During the Site visit, numerous outcrops of calcrete was noticed across the Site. In some areas, large boulders of calcrete were visible on the surface. Calcrete is a calcium-rich hardened layer that forms in or on soil due to shallow seasonal water table fluctuations. No other geological features were noticed. A manmade retention pond is present towards the southern corner of the Site. Please refer to Table 2 for photographs.

Table 2: Site Visit Photographs

3.2 Shallow groundwater Monitoring

3.2.1 Installation of Monitoring Piezometers

Three piezometers were installed across the site – one in geotechnical test pit 12 to the north of the Site, and two in the south-west and south-east of the Site in pits excavated for the piezometers specifically. The piezometers comprise of PVC casing (63mm outer diameter), inserted vertically to a depth of approximately 4 m. The PVC was perforated from 1.5 m to the bottom, and wrapped in permeable Bidum, which allows for the ingress of water into the piezometer pipe, whilst sieving out fine sediments. A concrete collar was installed around the PVC pipe, and a PVC cap was placed on each piezometer.

The locations of the piezometers are given in Figure 8. Table 3 displays information on the piezometers collected during installation and sampling. Table 4 present photographs of the installed piezometers.

Table 3: Piezometer Information

Piezometer ID	Latitude	Longitude	Depth (m)	Water Level (m)	EC (mS/m)	pH
Piezo 1	-33.812554	25.618354	3.9	None	None	None
Piezo 2	-33.818748	25.623931	4.16	3.66	642	7.05
Piezo 3	-33.821089	25.621142	4.02	None	None	None

Figure 8: Piezometer Locations

Table 4: Photographs of Piezometers

3.2.2 Sampling & Laboratory Results

Sampling took place on 16 November 2021. Only one piezometer - Piezo 2 - had water, which could be sampled. The hole was purged before a sample was collected. The sample was sent to Talbot Laboratories, a SANAS accredited laboratory, for analysis. The results are given in Table 5 below.

Faecal coliforms and *E.coli*, which are both indicators of sewage pollution, was detected in the groundwater. This indicates that there must be a pollution source nearby.

Table 5: Laboratory Results

Parameters	**Results**
mg/L, unless otherwise stated	**Piezo 2**
Conductivity (mS/m)	798
pH	6.9
Colour	90
Turbidity (NTU)	>1000
Total Alkalinity as CaCO3	551
Total Hardness as CaCO3	821
Dissolved Calcium as Ca	185
Dissolved Magnesium as Mg	87
Sodium	1319
Potassium	40
Chloride	1965
Sulphate	447
Fluoride	0.56
Nitrate as N	<0.25
Nitrite as N	<0.05
Ammonia as N	<1.5
Dissolved Aluminium	0.0141
Dissolved Arsenic	0.0122
Dissolved Boron	1.249
Dissolved Barium	0.1
Dissolved Cadmium	<0.001
Dissolved Chromium	0.0037
Dissolved Copper	0.0051
Dissolved Iron	0.08
Total Iron	25.657
Dissolved Mercury	<0.001
Dissolved Manganese	0.711
Total Manganese	0.939
Dissolved Nickel	0.0155
Dissolved Lead	<0.001
Dissolved Antimony	0.0019
Dissolved Selenium	<0.001
Dissolved Uranium	0.002
Dissolved Zinc	<0.001
Cyanide	<0.020
Total Coliforms (colonies/100mL)	>2000
Faecal Coliforms (colonies/100mL)	110
E.coli (colonies/100mL)	98

3.3 Groundwater Impact Assessment

3.3.1 Hydrocensus

A hydrocensus was conducted within a 1 km radius of the Site, to collect hydrogeological information on existing boreholes within the area. No boreholes were found within the 1 km radius. The only borehole that SRK is aware of is at the Motherwell NU2 Sports Stadium, located approximately 1.2 km north-west of the Site. This borehole was drilled to a depth 250m. water was intersected at 8 mbgl in the pebbly, shelly material of the Alexandria Formation. The yield within the Alexandria Formation was 1.3 L/s. The water level in this borehole was 2.37 mbgl.

The boreholes discovered during the hydrocensus are shown in Figure 9 and the results are summarised in Table 6.

Figure 9: Hydrocensus Boreholes

Table 6: Hydrocensus Information

Identification	Latitude	Longitude	Comment
SHS 04	-33.81054	25.62968	Manganese ore storage, no boreholes reported
SHS 01	-33.81417	25.62577	Formex, no boreholes reported
SHS 02	-33.81242	25.62868	Mahle, no one available
SHS 03	-33.81063	25.62614	Isuzu VCDC Markman, no boreholes reported

Identification	Latitude	Longitude	Comment
SHS 05	-33.80982	25.63019	Black Magic (BMLS), no boreholes reported
SHS 06	-33.80833	25.62657	Trentyre (Retreading), no boreholes reported
SHS 07	-33.80653	25.62149	SMD Auctioneers, no boreholes reported
SHS 08	-33.80769	25.62051	Construction Site, no access
SHS 09	-33.82753	25.61507	Scribante Concrete Depot, no boreholes reported
SHS 10	-33.82196	25.63341	Multipurpose Centre, no boreholes reported
SHS 11	-33.82021	25.63488	Coega Primary School, no access
SHS 12	-33.81812	25.63278	Clinic, no access
SHS 13	-33.80247	25.61180	Motherwell NU2 Sports Stadium, one borehole, 250m deep, yield 1.3 L/s at 8m depth. Water level 2.37 mbgl.
SHS 14	-33.81475	25.61889	Shoprite, borehole present. Not in use, water too saline. Approximately 185 m deep.

3.3.2 Assessment of Gathered Information

From the above information, the following can be accentuated with regards to the groundwater impact assessment:

- There is one borehole on Site, but it is not in use due to poor water quality. There are no known groundwater users within a 1 km radius of the Site. However, a borehole is present at the Motherwell NU2 Sports Stadium, which was drilled to supply the field with water for irrigation.
- Four water levels are available, which is the Motherwell Sports Stadium borehole (2.37 mbgl), Piezo 2 on Site (3.66 mbgl) and the seepage in geotechnical test pits TP 2 (1.9 mbgl) and TP 3 (2.9 mbgl). These are considered shallow groundwater.
- Surface water and shallow groundwater drainage appears to be mainly towards the Swartkops River in the south-west, but also to the sea in the south-east.
- The main potential pollutant to groundwater identified for the development is diesel, which will be stored in underground storage tanks (USTs). The location of the proposed diesel tanks is towards the northern corner of the Site, across from the intersection of the R102 and M Kaulela Street, where the truck entrance / exit of the Site is planned.

3.3.3 Impact on Groundwater: Potential Pollutants

Bearing in mind the source - pathway - receptor concept, the following can be concluded for the Site:

- Potential sources of contamination / potential impacts: Hydrocarbons - Diesel
- Potential pathways: Stormwater, permeable topsoils / sands, Alexandria Formation and shallow groundwater
- Potential receptors: Soils on Site, groundwater as a natural resource, potential future groundwater users, the Swartkops River and the sea.

If the RBCA (risk based corrective approach) approach is considered, risk is expected to be present when a complete link exists between the source, pathway and receptor.

The National Water Act (NWA) states that no groundwater sources must be polluted. From previous interactions with the Department of Water and Sanitation (DWS), SRK understands that the DWS sees all groundwater as a natural resource that must be protected, irrespective of the current water quality. No contamination or further contamination is allowed.

3.3.4 Conceptual Site Model (CSM)

Please refer to Figure 10 for a generalised conceptual site model of the underground conditions and groundwater setting within the project area. The CSM reflects (amongst others) the underlying geology, the estimated / approximate shallow groundwater level, and the estimated flow direction of potential pollutants that may be released into the groundwater environment.

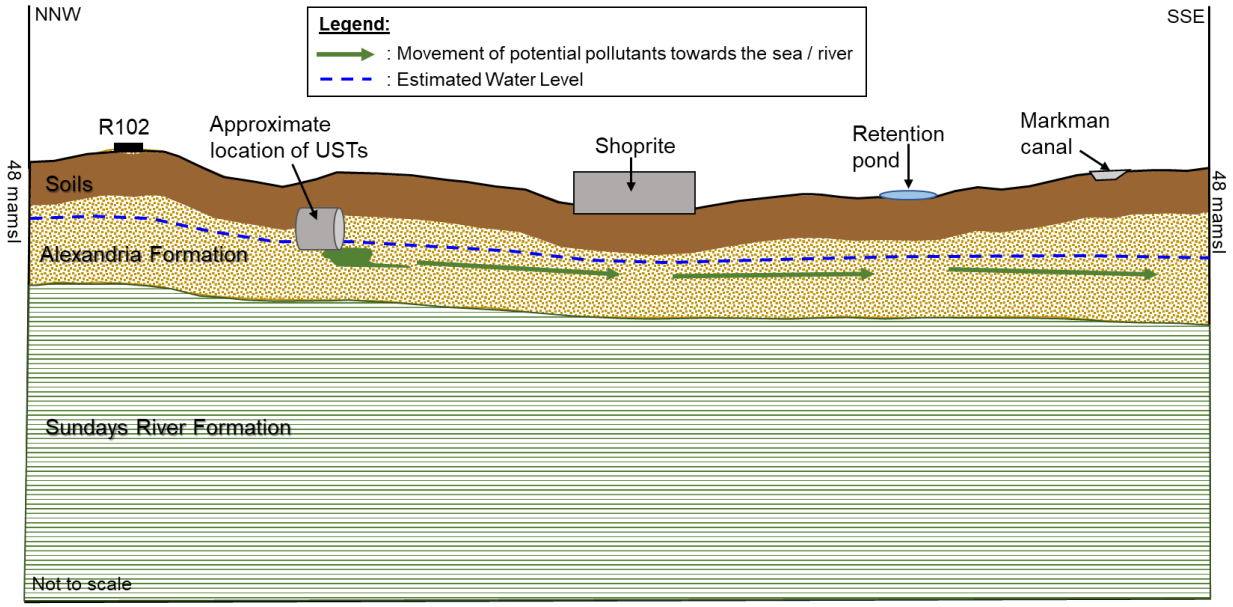

Figure 10: Conceptual Site Model

The following data gaps are identified:

- Calculated groundwater flow direction
- Flow paths beneath the Site;
- Hydraulic conductivity of the sediments through which potential pollutants may move; and
- The extent of water level fluctuation that may occur during periods of high rainfall - i.e., the water level will most likely rise (closer to the surface) during rainfall periods.

3.3.5 Potential Impacts

Due to the nature of the geological formations on which the fuel station will be established, and the encounter of shallow / seasonal groundwater beneath the Site, the risk to pollution of groundwater, should a fuel leak or spillage occur, is considered high.

It is advised that the pollutants (fuel) should not come into direct contact with the ground surface beneath the Site; and also, should not leak into the permeable soils and Alexandria Formation (from the USTs). Once pollutants have come into contact with the Alexandria Formation, it could come into contact with shallow groundwater table (directly or within rainwater or storm water) and migrate towards the Swartkops River and / or the sea.

Mitigation:

- Because of the perceived high risk to contamination of groundwater for this area, the USTs and all holding and working areas of the fuels must be contained and lined so that no pollutants can come into contact with the underlying soils or geology. If this is done, the risk of pollutants getting into the groundwater environment is greatly reduced, under normal conditions.
- It is standard practice to install small diameter monitoring wells in the excavations where USTs are installed, so that leakage of fuel can be detected.

- If a spillage or leakage event occurs, it should be reported to the relevant authorities and the necessary actions taken to contain the fuel and reduce any negative impact.

4. Conclusions and Recommendations

The following conclusion and recommendations can be made:

- The Site is underlain by geological formations that carries shallow groundwater, and shallow water levels have been measured on Site. Therefore, the perceived risk to groundwater contamination is high.
- There are no know significant groundwater users currently in the immediate area around the Site.
- Because of the perceived high risk to contamination of groundwater for this area, the USTs and all holding and working areas of the fuels must be contained and lined so that no pollutants can come into contact with the underlying soils or geology. If this is done, the risk of pollutants getting into the groundwater environment is greatly reduced, under normal conditions.
- It is standard practice to install small diameter monitoring wells in the excavations where USTs are installed, so that leakage of fuel can be detected.
- If a spillage or leakage event occurs, it should be reported to the relevant authorities and the necessary actions taken to contain the fuel and reduce any negative impact.

Yours faithfully,

SRK Consulting - Certified Electronic Signature
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