DRAFT HYDROGEOLOGICAL REPORT FOR THE SITING OF BOREHOLES, MIDDELBURG EC

JUNE 2021

Prepared by

CONTACT DETAILS:
Fax: (086) 716 5576
Cell: 082-376-6277
PO Box 72313
Lynnwood Ridge
0040

rudy@atox.co.za

Contents

List of Figures

1 BACKGROUND

Aquatox Consulting (Pty) Ltd (Aquatox) was approached to assist with the siting of boreholes and application of potential water use authorizations that could be required by the De Heus project to obtain water on PTN 15 of PTN 1 of the FARM BULTFONTYN, Middelburg, Eastern Cape. Two options were considered:

1. Abstraction from the ground water resource via boreholes; and
2. Municipal water piped for approximately 4km. The pipe diameter is expected to be less than 150mm.

During the initial investigation it was determined that De Heus-project site is situated in Middelburg, Q94B Quaternary catchment area. This commercial use is excluded from the General Authorization for abstraction of water from a water resource. Thus, a water use license application must be lodged with the Department of Water and Sanitation (DWS).

The town of Middelburg is located approximately 94 km North of Cradock, within the Inxubu Yethemba local municipality of the Chris Hani District Municipality in the Eastern Cape Province (Latitude: 31.496229°S Longitude: 25.006753°E - WGS84, Decimal Degrees). The accompanying map delineates the farm boundaries as well as the study area boundary within which the hydro-census was conducted.

1.1 Option 1 - Boreholes

From the information provided the site is situated in the Mzimvubu-Tsitsikamma Water management area (Q94B). From experience in the area, no matter the volume of abstraction a WULA should be submitted after which the WMA will indicate whether this is defined as a General Authorization or if a WULA will continue. Due to the application of the use, all abstractions do however require and Water use license (client demand volume/number =128.8 m^3/day).

The terms of refence for this project include:

a) Determination of borehole location.
   Geophysical techniques (magnetometer) will be used, if needed, to assist in the sighting of boreholes for groundwater extraction. Local knowledge of the position of the water table in the area would also assist in the placement of boreholes.
b) Safe yield of borehole.
   A proper pump test would be conducted on each borehole in order to determine and confirm the yield and sustainability thereof. These tests would include the existing borehole on the golf course.
c) Quality of water.
   Water samples will be collected at the boreholes and submitted to a certified laboratory for major and trace element analyses, as well as bacteriological counts to confirm the potability of the water.

The above-mentioned information we will be able to provide as part of the Geohydrology that would be required for the WULA.

1.2 Option 2 - Pipeline

This option, which involves connecting a pipeline between the study area and the town of Middelburg, is no longer desired, mainly due to the shortage of water as a result of the current drought. The town of Middelburg requires approximately 155 l/s over a 24-hour duty cycle that is exclusively sourced from groundwater.

2 STUDY METHODOLOGY

The following actions were defined prior to commencement of this study and have been completed:

- Performing a feasibility study with the aim of prioritizing proposed target areas;
- Evaluating all existing data and reports;
- Interpretation of aerial photography with the aim of a detailed structure analysis;

- On-site investigation confirming desktop analyses;
- On-site hydro-census, identifying all existing water resources.

The investigation has furthermore incorporated the following procedures:

- Review of all available and applicable groundwater data and geohydrological information;
- National and Provincial databases;
- Aerial photography;
- Site characterization during a site visit conducted 8 – 10 June 2021;
- Identification of all possible boreholes, springs and streams;
- Preliminary water quality assessment and identification of potential sources of pollution.

The above-mentioned procedures were either completed or are in the process of being completed, and the completed results will be presented in due course. The current progress report only focused on the identification of appropriate location of two (2) new boreholes.

3 GEOLOGY

The Middelburg area is underlain by rocks of the Karoo Supergroup, which covers the larger central portion of South Africa. The current study area is underlain by the Katberg Formation that forms part of the Tarkastad Subgroup. The early Triassic Tarkastad Subgroup is characterized by a greater abundance of both sandstone and red mudstone when compared with the Adelaide Subgroup. The boundary between these two subgroups is the only one in the Beaufort Group that can be traced with certainty throughout the Main Karoo Basin. The subgroup has a maximum thickness of nearly 2 000 m in the south, decreasing to approximately 800 m in the mid-Basin and 50 m or less in the far northern extremity of the Basin. In the south, the Tarkastad Subgroup comprises a lower, sandstone-rich Katberg Formation and an upper, mudstone-rich Burgersdorp Formation. However, the sandstone: mudstone ratio decreases steadily northwards until the Formation becomes indistinguishable from the Burgersdorp Formation. The latter is around 1 000 m thick in the southern outcrop area, with the overall sandstone content diminishing from approximately 50% in the coastal exposures to around 20–30 per cent or less, further north within the main outcrop area.

The geology at the proposed site of the De Heus feedlot, consist of mainly unconsolidated randomly sorted alluvial sediments. The sediments consist of a mixture of cobbles, boulders, gravels and/or clean sands. Several test pits (12 in total) were dug with a TLB to an average depth of approximately 2.8 meters, as part of a geotechnical investigation. Excavation conditions into these alluvium materials were not definitively quantified during this investigation.

According to the 1 : 250,000 scale geological map 3124 Middelburg, the site is underlain by calcrete[1], alluvium[2] and colluvium[3]. This has been confirmed by the above-mentioned geotechnical study. Other geological formations around the site include dolorite and grey mudstones with subordinate sandstone, but do not show to directly underly the site. Duruing the Geotechnical investigation no ground water was encountered with any of the test pit excavations (maximum depth of excavation was approximately 4 meters). In general, the site is underlain by a relative uniform soil profile.

[1] Calcrete – A term suggested by Lamplugh (1902) for a conglomerate consisting of surficial sand and gravel cemented into a hard mass by calcium carbonate precipitated from solution and redeposited through the agency of infiltrating waters. [Lamplugh G.W. 1902. “Calcrete”. Geological Magazine, n.s., dec 4, v.9, no. 462, p. 575.]

[2] Alluvium – A general term for clay, silt, sand, gravel or similar unconsolidated detrital material deposited during comparatively recent geological time by a stream or other body of running water as a sorted or semi-sorted sediment in the bed of a stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope.

[3] Colluvium – A general term applied to any loose, heterogeneous, and incoherent mass of soil material or rock fragments deposited chiefly by mass-wasting, usually at the base of a steep slope or cliff. Alluvium deposited by unconcentrated surface run-off or sheet erosion, usually at the base of a slope.

Figure 1. Aerial view of the De Heus project area.

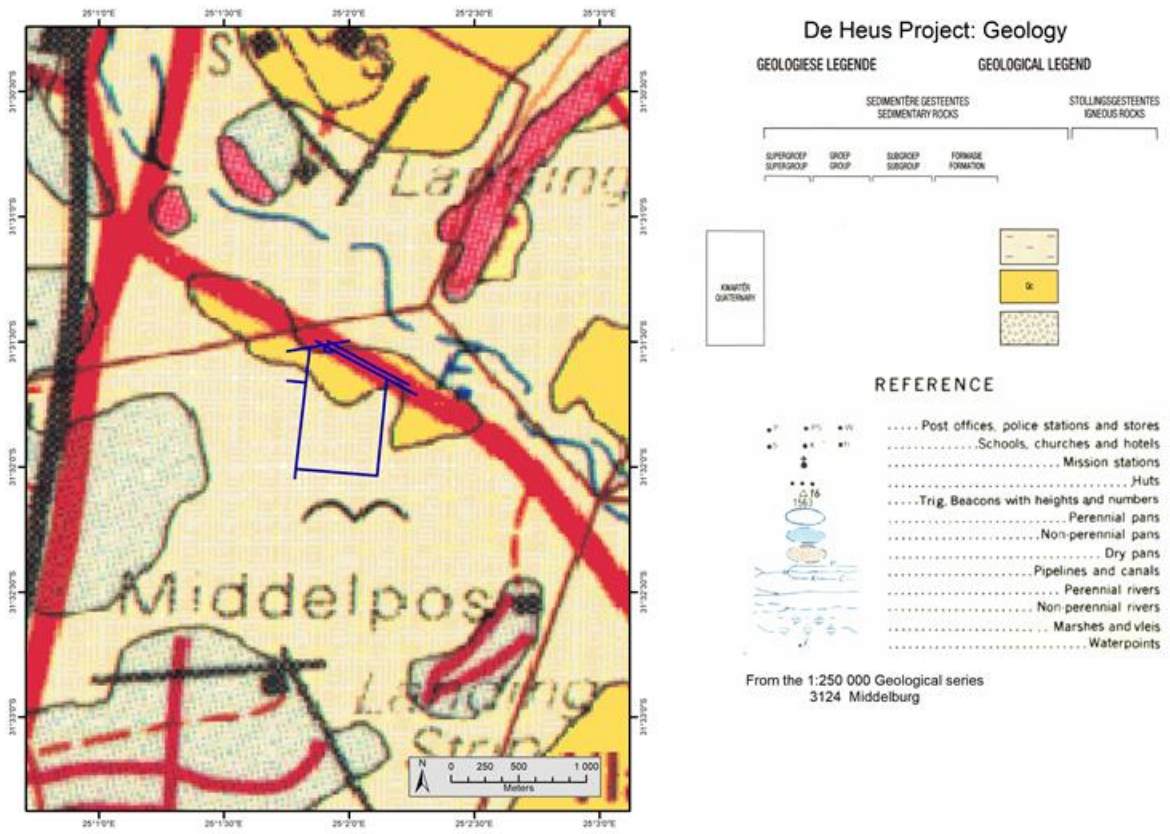

Figure 2. Geology of the De Heus property area.

4 GEOHYDROLOGY

Ground water for municipal water supply to the town of Middelburg has been abstracted from a localized shallow aquifer for numerous years. Ground water is the most prominent water source in the Middelburg region and therefore the first option when considering sustainable water supply. Drilling for water can be a challenging job in many areas due to the uncertainty in the presence of water and the depth of the water table. The first step was to study the local geology using the available geological maps to look for structures that will likely host water. A classic example of such structures is a layer of permeable rock (such as sandstone) underlined by impermeable levels (such as clay), as is the case in the study area with the Katberg Formation. The water will accumulate within the permeable layer, which is sandstone in case of the Katberg Formation and bounded by the clay-containing, less permeable, shale layers.

Geophysics methods can be used to identify the presence of water at depth. These geophysical methods are based on the changes in electric conductivity caused by the water or changes in the magnetic field strength. Due to the absence of detectable geological features that dictate geological anomalies, no geophysical technics were employed. Alternatively, a test borehole should be drilled to assess the geological sequence of the strata and to identify layers potentially able to host an aquifer.

It is fair to admit that some degree of luck is often associated with finding water mostly in complex and challenging geological settings.

5 DRILLING

Information was gathered from the existing boreholes in the study area. Data gathered included the borehole locations, the depth to water, the amount of water pumped, and the kinds of rock they penetrated. These records of the already drilled boreholes were of great value in deciding where to position two additional boreholes for the primary reason of delivering sufficient water as required by De Heus (See Figure 3). Following the positioning of the two additional boreholes, pump tests need to be performed in order to

determine the sustainability and yield of the boreholes. The pump tests need to be performed over a 72-hour timespan. Water samples also need to be collected at this stage and submitted to an accredited laboratory, in order to determine the water quality and to establish the suitability of the ground water for domestic use. The water samples need to be analyzed for both major and trace elements.

The data that needs to be collected during the pump tests include:

- Data and time at commencement of pump test
- The Static Water level at the start of the pump test
- The depth of the borehole
- The distance from the borehole to nearby boreholes (if applicable)
- Pump installation depth
- Water strike depths (if known from drilling/landowner)
- Borehole diameter
- Drawdown of the water level
- Rate of discharge (for Steps and constant Tests)
- Display measurement intervals and other relevant data.

6 PRELIMINARY FINDINGS

The preliminary findings following the site visit to the study area, resulted in the placement of the proposed boreholes at the following locations (Figure 3):

- Borehole 1 (25°01'59.61"E, 31°31'35.2"S) – near sample site DH2 (Geotechnical test pit), and;
- Borehole 2 (25°02'02.26"E, 31°31'39.8"S) – near sample site DH10 (Geotechnical test pit).

Drilling of the borehole can occur within a 5m radius of the proposed coordinates. The depth of the boreholes would be between 30 to 40 meters and the yield would vary from 3 to 7 liters per second.

A complete set of results and an interpretation of those results would be incorporated in the next report.

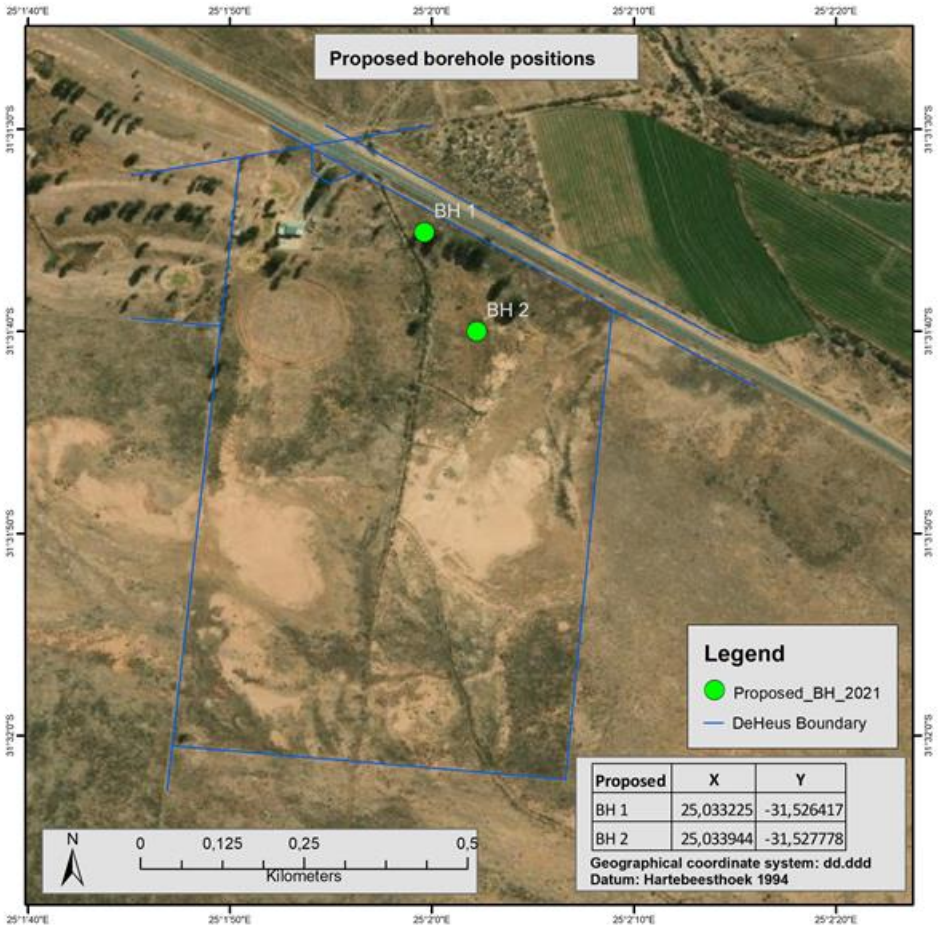

Figure 3. Map indicating the proposed borehole positions.

7 REFERENCES

Oosthuizen Pieter, 2021, Proposed industrial development for De Heus portion 15 of Portion 1 or farm Bultfontyn, Middelburg, EC: Geotechnical Investigation Report.