SASOL SOUTH AFRICA LIMITED

SASOL WETLAND RE-INSTATEMENT AND DEVELOPMENT OF VBC08 WETLAND PROJECT

HYDROPEDOLOGICAL ASSESSMENT

30 JUNE 2021

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HYDROPEDOLOGICAL ASSESSMENT

SASOL SOUTH AFRICA LIMITED

FINAL

PROJECT NO.: 41102282
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1 INTRODUCTION

WSP Environmental (Pty) Ltd (WSP) was appointed by Sasol Chemical Operations "Sasol" (Applicant), to undertake a Hydropedological Assessment for a Water Use License Application (WULA). Sasol is proposing to reinstate and develop the existing wetland system VBC08 (see **Figure 1**), located adjacent to the Sasol Nitro Fertiliser Plant, Secunda in the Mpumalanga Province. The development includes the installation of eighteen wetland rehabilitation structures throughout the wetland system in order to facilitate nitrate removal and mitigate nutrient and salt load into the Groot Bossiespruit (see **Figure 1**).

A hydropedological assessment was conducted to evaluate the hydropedological characteristics of the landscape and associated soils within the focus area. A soil classification exercise was undertaken to infer the wetland recharge potential and identify the anticipated hydropedological impacts on the wetland resources.

1.1 ASSUMPTIONS AND LIMITATIONS

Accurate mapping and interpretation of the identified soils' morphological properties has been used to characterise flowpaths, storage mechanisms and the connectivity between different flowpaths. Hydrological mechanisms are, however, difficult to observe in the field owing to their dynamic nature and variation spatially and temporally.

2 PROJECT DESCRIPTION

Sasol is implementing an instream constructed/artificial wetland (passive system) which could augment the existing natural wetland system. The objectives of the system are to:

- Reduce downstream impacts of high nutrient and salt load on the Groot Bossiespruit after rain events, and
- Endeavour to attain the Upper Vaal Resource Water Quality Objectives (RWQO) or Water Use Licence (WUL) water quality objectives at surface water monitoring locations in streams (RESM) 12 (see **Figure 1**).

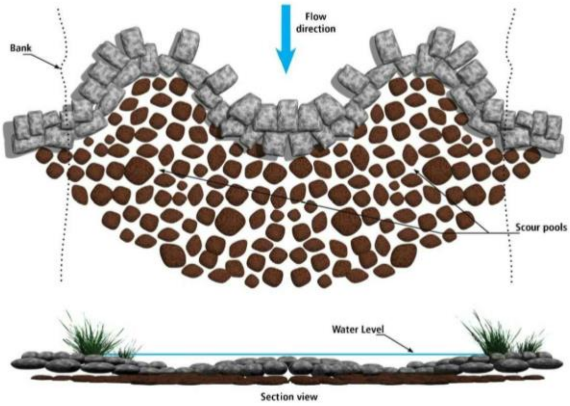
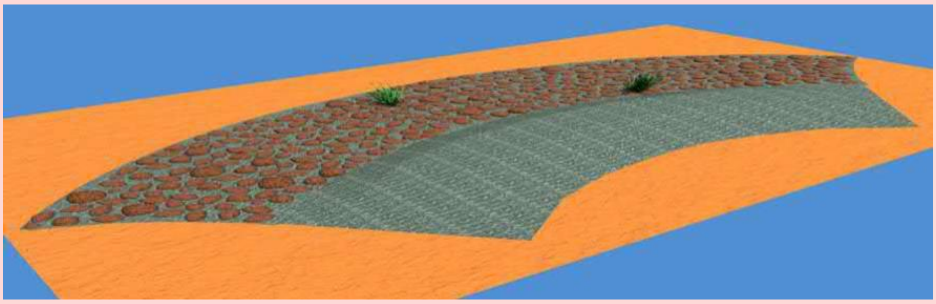
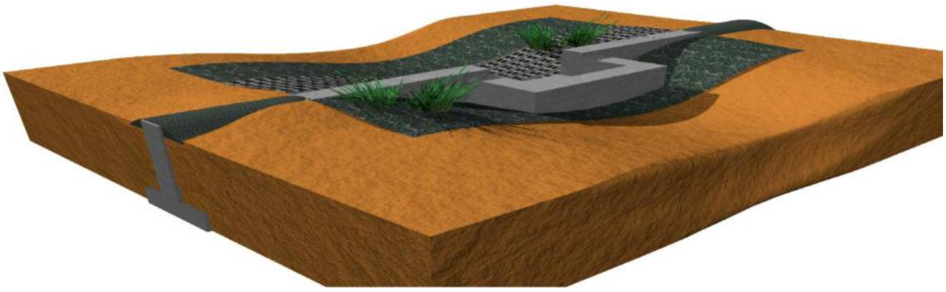
The proposed rehabilitation intervention measure are categorised as:

- Direct interventions; these relate to specific instream measures that have specific functions given their respective locations; and
- Indirect interventions; these relate to ancillary measures to improve the overall wetland conditions, contributing to the success of the rehabilitation effort.

2.1 DIRECT MEASURES

Direct measures involve the addition of up to 18 wetland rehabilitation structures proposed throughout the wetland system. Of the 18 structures, 13 are definite and five are proposed for future use, if they are required. The weirs main functions are to raise the water table, yet allow sufficient water to move through the weir to not cut off the water source completely. The structure will also slow down water velocities in the system thereby reducing the potential for valley bottom erosion. The proposed designs for these interventions are shown in **Table 1** and the location of these are shown in **Figure 1**.

Table 1: Proposed deigns for the Interventions

Name	Design
Bio-reactor	
W1 **W-Shaped Weir**	
W2 **Low level berm**	
W3- W18 **Concrete weir structure**	

Sasol Wetland Re-instatement

Wetland Intervention Map

Legend

- Future Use Wetland Interventions
- Definite Wetland Interventions
- Non-Perennial Streams
- Sasol Wetland (VBC08)
- Provincial Roads
- Rivers
- Site Boundary

N

0 300 600 900

Meters

DISCLAIMER

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DATA SOURCE:

SOUTH AFRICAN DEPARTMENT OF RURAL DEVELOPMENT AND LAND REFORM-
CHIEF DIRECTORATE: NATIONAL GEO SPATIAL INFORMATION

PROJECTION: GCS_WGS_1984

PROJECT TITLE:
Sasol Wetland Rehabilitation BA and WULA

SCALE: 1:30 000	DRAWN BY: TUMELO TSEPHE
DATE: 2020/06/04	REVIEWED BY: HASSEN KHAN

FIGURE NO: 1	PROJECT NO: 41102282	REV: 0

2.2 INDIRECT MEASURES

Indirect rehabilitation/rehabilitation measures for augmentation of the direct measures are key to the rehabilitation effort. **Table 2** indicates typical indirect rehabilitation/rehabilitation measures.

Table 2: Indirect rehabilitation measures

Rehabilitation measure	Purpose of improvement/intervention	Description of improvement/intervention
Dam wall **Removal only at dams above fertiliser plant**	To allow a more regular/consistent flow through the wetland system	Breach dam wall and stockpile material for mixing with sediment. Mix sediment in a ratio of 1 to 5. Re-establish the natural vegetation.
Earthworks	General earthworks are used to reshape uneven ground this allows a more natural slope on the topography	Routine shaping and levelling
Removal of alien vegetation	To reinstate natural bio-diversity and functional vegetation communities	The current vegetation community of VBC08 is dominated by dense stands of weed species, some of which are considered invasive. It is understood that a burn regime cannot be introduced due to significant health and safety concerns. Instead, the weeds can be achieved via manual removal, or ideally could be addressed through very low-density grazing i.e. one or two cattle on a seasonal basis (in spring) to prevent new weed growth taking place and assist in breaking down old dense stands of weed material, thereby providing opportunity for wetland plant species to take hold.
Re-establishment of vegetation	To reinstate natural bio-diversity and functional vegetation communities	Conduct hydro-seeding with appropriate seeds mix over the Dongalock portions. Seed bed harvesting to be used in areas of shaping and levelling as well as in area where alien vegetation is removed

3 PROJECT SITE INFORMATION

3.1 LOCATION

The study area is located in Mpumalanga in and adjacent to the town of Secunda (**Figure 2**). It falls within the Gert Sibande District Municipality, Govan Mbeki Local Municipality, Mpumalanga Province. The site is located within the C12D catchment. The relative locations of the wetland and fertilizer plant area are shown in **Figure 3**.

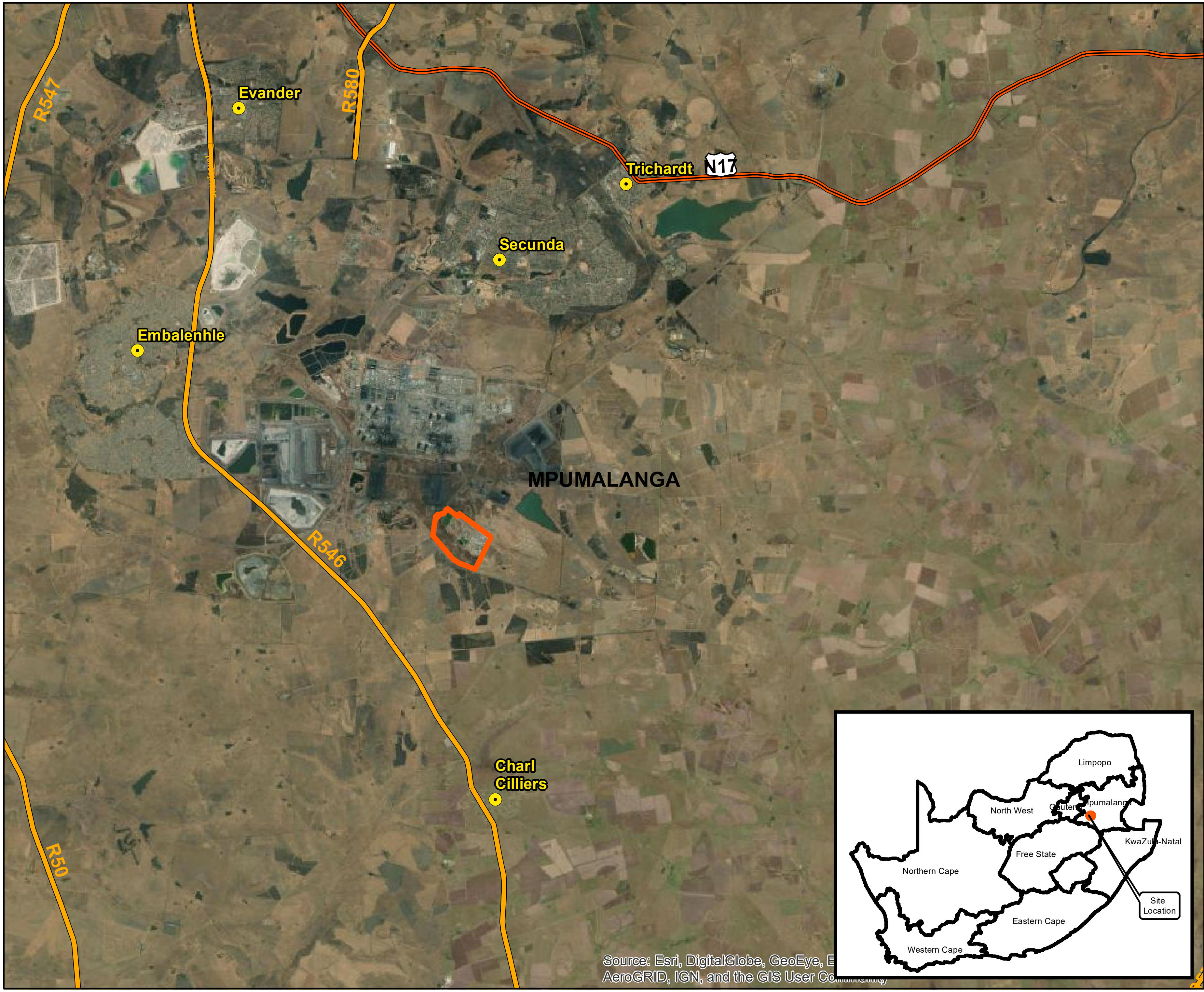
3.2 ENVIRONMENTAL ATTRIBUTES

The climate of the area can be described as warm and temperate. The temperatures on site are relatively mild, with a rainy summer and dry winter months. The average annual rainfall for the site is about 684 mm. The evaporation at the site is far higher than rainfall, at 1529.7mm/annum.

The area is zoned as an industrial area and there are several industrial and mining operations within the area. There are several wetlands in the areas surrounding the study site. The elevation of the site varies from 1595 m to 1630 m. The wetland system, which runs in a westerly direction through the site, has a slope of 1.2%. The site flows into the Groot Bossiespruit, which leads into the Bossiespruit, which then flows into the Waterval River and eventually into the Vaal River.

The geology of the study area mainly consists of the Vryheid formation, which is part of the Ecca Group (Karoo Supergroup). The dominant lithologies are sandstone, siltstone and mudstone. There are also dolerite sills and in places dykes from the Jurassic period, as well as, younger alluvial deposits within the study area.

The soils typically identified within the area consist of the Rensburg, Arcadia, Mispah, Glenrosa, Katspruit, Bonheim and Sepane forms. The soil textures were estimated to be sandy clays for most of the study area and largely clays in the wetland areas.



SASOL

Sasol Wetlands Rehabilitation

Regional Map

Legend

- Place Name
- Provincial Roads
- National Roads
- Site Boundary
- Provinces of RSA

N

0 1 2 3 4 5 6

Kilometers

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PROJECT TITLE:
Sasol Wetlands Rehabilitation BA and WULA

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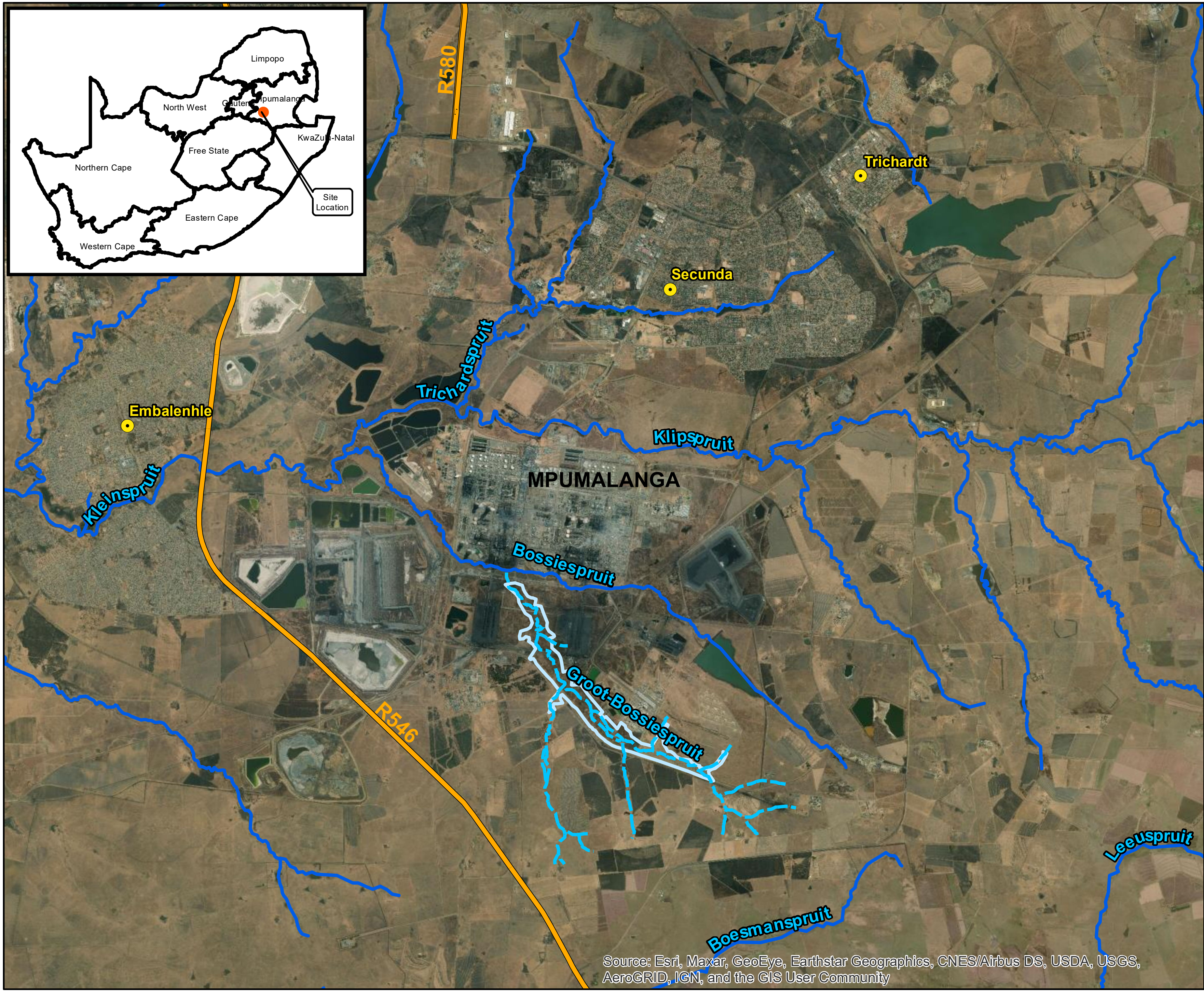

Sasol Wetlands

Re-instatement

Locality Map

Legend

- Place Names
- Non-Perennial Streams
- Sasol Wetland
- Provincial Roads
- Rivers
- Provinces of RSA

N

0 1 2 3 4

Kilometers

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CHIEF DIRECTORATE: NATIONAL GEO SPATIAL INFORMATION

PROJECTION: GCS_WGS_1984

PROJECT TITLE:
Sasol Wetlands Rehabilitation BA and WULA

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4 ASSESSMENT METHODOLOGY

4.1 HYDROPEDOLOGICAL SOIL ASSESSMENT

The field assessment undertaken in June 2020 to investigate the hydropedological properties of the soils at the proposed development site followed the underlying methodology.

Subsurface soil observations were made by means of a standard hand auger and using standard investigation methods.

Field assessment data included descriptions of physical soil properties including the following parameters, in order to characterise the various recharge mechanisms of the investigated wetlands:

— Diagnostic soil horizon sequence;
— Landscape position in relation to the investigated wetlands (recorded on GPS); and
— Depth to saturation (water table), if encountered.

Following this, soil information was attained and extrapolated from previous environmental studies within the study area and surrounding areas. This information was used to carry out the following assessments and investigation:

— Identify the potential impacts of the proposed project on the unsaturated flow processes, and implications to the functionality of the wetland systems;
— Compile a brief report on the conceptual hydropedological regime of the assessed wetlands based on the soil types within the focus area under current conditions, and
— Recommend suitable mitigation and management measures to alleviate the identified impacts on the wetland hydropedological conditions.

4.2 WETLAND IDENTIFICATION AND MAPPING

To identify the wetland types present, a characterisation of hydrogeomorphic (HGM) types was conducted. These have been defined based on the geomorphic setting of the wetland in the landscape (e.g. hillslope or valley bottom wetlands, whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated), how water flows through the wetland (diffusely or channelled) and how water exits the wetland.

4.3 WETLAND INTEGRITY ASSESSMENTS

4.3.1 DETERMINING THE PRESENT ECOLOGICAL STATE (PES) OF THE WETLANDS

WET-Health is a tool designed to assess the health (present state) or integrity of a wetland. Wetland health is defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition (Macfarlane *et al*. 2009). This tool is utilised to assess hydrological, geomorphological and vegetation health in three separate modules.

Hydrology is defined in this context as the distribution and movement of water through a wetland and its soils. This module focuses on changes in water inputs as a result of changes in catchment activities and characteristics that affect water supply and its timing, as well as on modifications within the wetland that alter the water distribution and retention patterns within the wetland.

Geomorphology is defined in this context as the distribution and retention patterns of sediment within the wetland. This module focuses on evaluating current geomorphic health through the presence of indicators of excessive sediment inputs and/or losses for clastic (minerogenic) and organic sediment (peat).

Vegetation is defined in this context as the vegetation structural and compositional state. This module evaluates changes in vegetation composition and structure as a consequence of current and historic onsite transformation and/or disturbance. The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. The tool attempts to standardise the way that impacts are calculated and presented across each of the modules. This takes the form of assessing the spatial extent of impact of individual activities and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact.

An overall wetland health score is calculated by weighting the scores obtained for each module and combining them to give an overall combined score using the following formula:

Overall health rating = [(Hydrology*3) + (Geomorphology*2) + (Vegetation*2)] / 7

This overall score assists in providing an overall indication of wetland health/functionality, which can in turn be used for recommending appropriate management measures.

Impact scores obtained for each of the modules reflect the degree of change from natural reference conditions. Resultant health scores fall into one of six health categories (A-F) on a gradient from "unmodified/natural" (Category A) to "severe/complete deviation from natural" (Category F) as depicted in **Table 3**.

Table 3: Health categories used by WET-Health

Impact Category	Description	Range	PES Category
None	Unmodified, natural.	0 – 0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 – 1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 – 3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 – 5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 – 7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 – 10	F

4.4 DETERMINING THE ECOLOGICAL IMPORTANCE AND SENSITIVITY OF WETLANDS

The Ecological Importance and Sensitivity of the wetlands present was determined by utilising a rapid scoring system. The system has been developed to provide a scoring approach for assessing the Ecological and Hydrological Functions, and the Direct Human Benefits of importance and sensitivity of wetlands. These scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze *et al.* (2008) on the assessment of wetland ecological goods and services from the WET-EcoServices tool (Rountree, 2010).

The aspects which are assessed in terms of their importance/sensitivity are indicated in **Table 4**. A rating of 0 (low sensitivity / low importance) to 4 (very high) is allocated to each aspect. An overall score is based on the highest score out of the three categories.

Table 4: Elements assessed to determine the ecological importance and sensitivity (WSP, 2019).

Ecological/Biological Importance	Hydrological/Functional Importance	Importance of Direct Human Benefits
Biodiversity support — Presence of Red Data species — Populations of unique species — Migration/breeding/feeding sites **Landscape scale** — Protection status of the wetland — Protection status of the vegetation type — Regional context of the ecological integrity — Size and rarity of the wetland type/s present — Diversity of habitat types **Sensitivity of the wetland** — Sensitivity to changes in floods — Sensitivity to changes in low flows/dry season — Sensitivity to changes in water Quality	**Regulating and supporting benefits** — Flood attenuation — Streamflow regulation **Water Quality Enhancement** — Sediment trapping — Phosphate assimilation — Nitrate assimilation — Toxicant assimilation — Erosion control **Carbon Storage**	**Subsistence benefits** — Water for human use — Harvestable resources — Cultivated foods **Cultural benefits** — Cultural heritage — Tourism and recreation — Education and research

5 HYDROPEDOLOGICAL BEHAVIOUR OF SOIL TYPES

Soils have different hydropedological behaviours, which can vary significantly with the drainage patterns. The different hydropedological behaviour soils are discussed below and presented in **Figure 4** and **Table 5**.

Responsive shallow soils respond quickly to rainfall and usually generate overland flow. These responsive soils commonly overlie relatively impermeable bedrock, which have limited storage capacity. This limited storage capacity is easily exceeded by a rainfall event.

Recharge soils are likely to recharge groundwater. High chroma red soils are characterised by their deep and well drained profiles. Vertical flow is the main hydrological pathway. Recharge soil systems are very important in terms of recharge over large distances (kilometres) and long time periods (years).

Leached soils are commonly associated with lateral water movement that leaches soil minerals through eluviation. Lateral flow occurs due to the differences in the conductivity of soil horizons and due to the presence of an impermeable subsurface layer. These soils are termed interflow soils. Lateral flow occurs at the A/B horizon interface and/or bedrock interfaces due to the reduced permeability. This reduced permeability prevents vertical movement. The presence of a fluctuating water table in these areas results in the formation of mottles at the level in the profile at which the water fluctuations occur.

Grey colours in soils are predominantly caused by prolonged periods of saturation, which can be attributed to poor soil drainage, as a result of a high clay content (or some other impediment). These soils drive wetlands on a localised scale and use shorter recharge path periods (days to months). Surface runoff occurs rapidly and leads to recharge of soils on a localised level after rainfall events. **Figure 4** depicts a conceptual diagram of the recharge mechanism of different soil types within the landscape and their influence on wetlands.

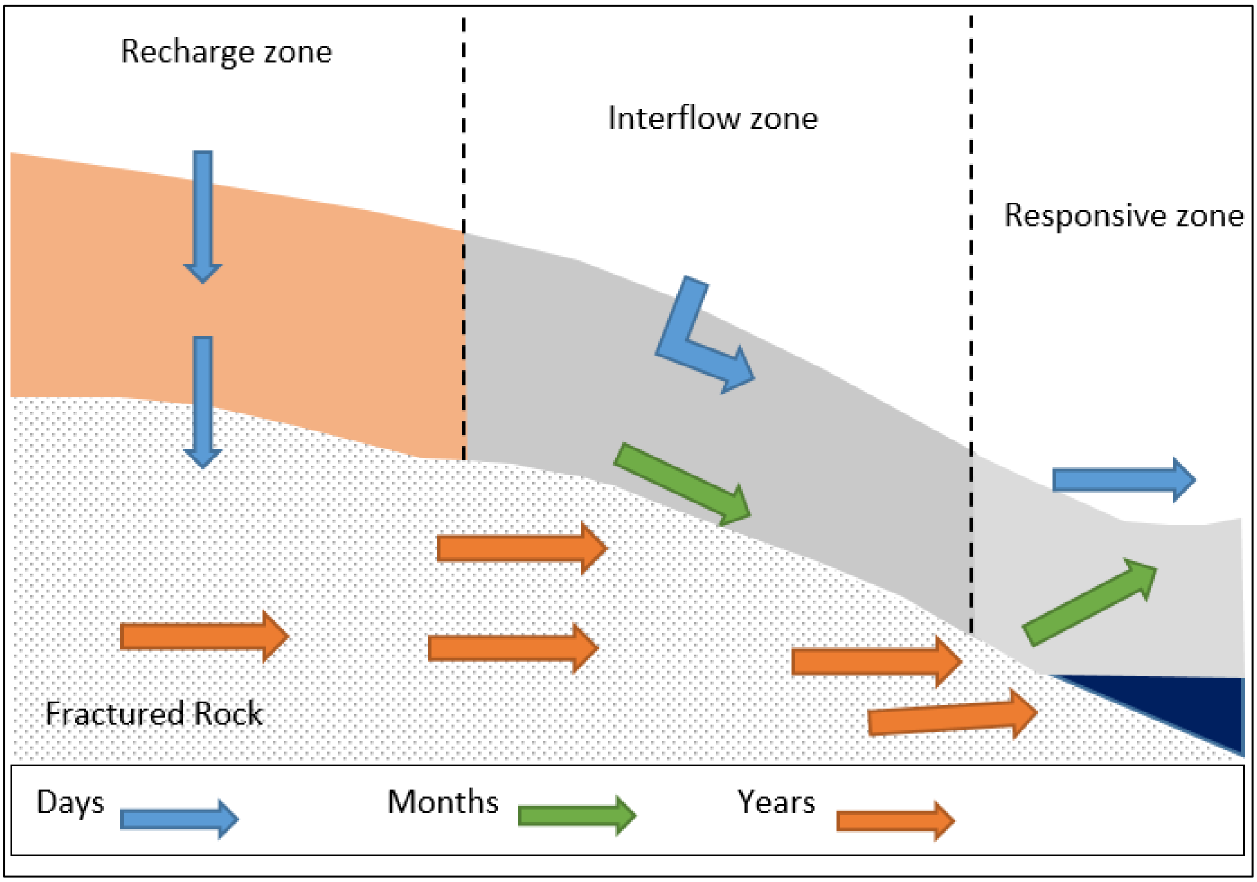

Figure 4: **A conceptual presentation of hydrological flow paths on different hydropedological soil types- hillslope hydropedological behaviour**

5.1 HYDROLOGICAL SOIL TYPES

Table 5: **Hydrological soil types of the studied hillslopes (Le Roux, *et al*., 2015)**

Hydrological Soil Types	Description
Recharge	Soils without any morphological indication of saturation. Vertical flow through and out the profile into the underlying bedrock is the dominant flow direction. These soils can either be shallow on fractured rock with limited contribution to evapotranspiration or deep freely drained soils with significant contribution to groundwater regime.
Interflow (A/B)	Duplex soils where the textural discontinuity facilitates build-up of water in the topsoil. Duration of drainable water depends on rate of evapotranspiration, position in the hillslope (lateral addition/release) and slope (discharge in a predominantly lateral direction).
Interflow (Soil/Bedrock)	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify temporal build-up of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.
Responsive (Shallow)	Shallow soils overlying relatively impermeable bedrock. Limited storage capacity results in the generation of overland flow after rain events.
Responsive (Saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation excess.

The flow paths from the crest of a slope to the valley bottom is assessed and classified. According to Le Roux *et al*. (2015), the classification largely takes into account the flow drivers during a peak rainfall event and the associated flow paths of water through the soil. The hillslope classes are:

- Class 1 – Interflow (Soil/Bedrock Interface);
- Class 2 – Shallow responsive;
- Class 3 – Recharge to groundwater (Not connected);
- Class 4 – Recharge to wetland;
- Class 5 – Recharge to midslope; and
- Class 6 – Quick interflow.

5.2 WETLAND UNIT IDENTIFICATION

The identified systems were classified into respective HGM units. The wetland system within the focus area is a channelled valley-bottom wetland with no channel (Wet Earth Eco-Specs, 2019). The topography of the site was assessed to understand the flow paths of the site. To do this, five transects were evaluated (**Figure 5**).

Figure 5: Transects assessed within the site

The five transects follow the same topographical trend in that they all increase in elevation towards the north-east (**Figure 6**). The left hand side of **Figure 6** is the south west and the right hand side is the north east. The transects aided in understanding the landscape and classifying the topographical units (midslope and valley-bottom) of the site. The crest of each transect occurs beyond the site (towards the North-east).

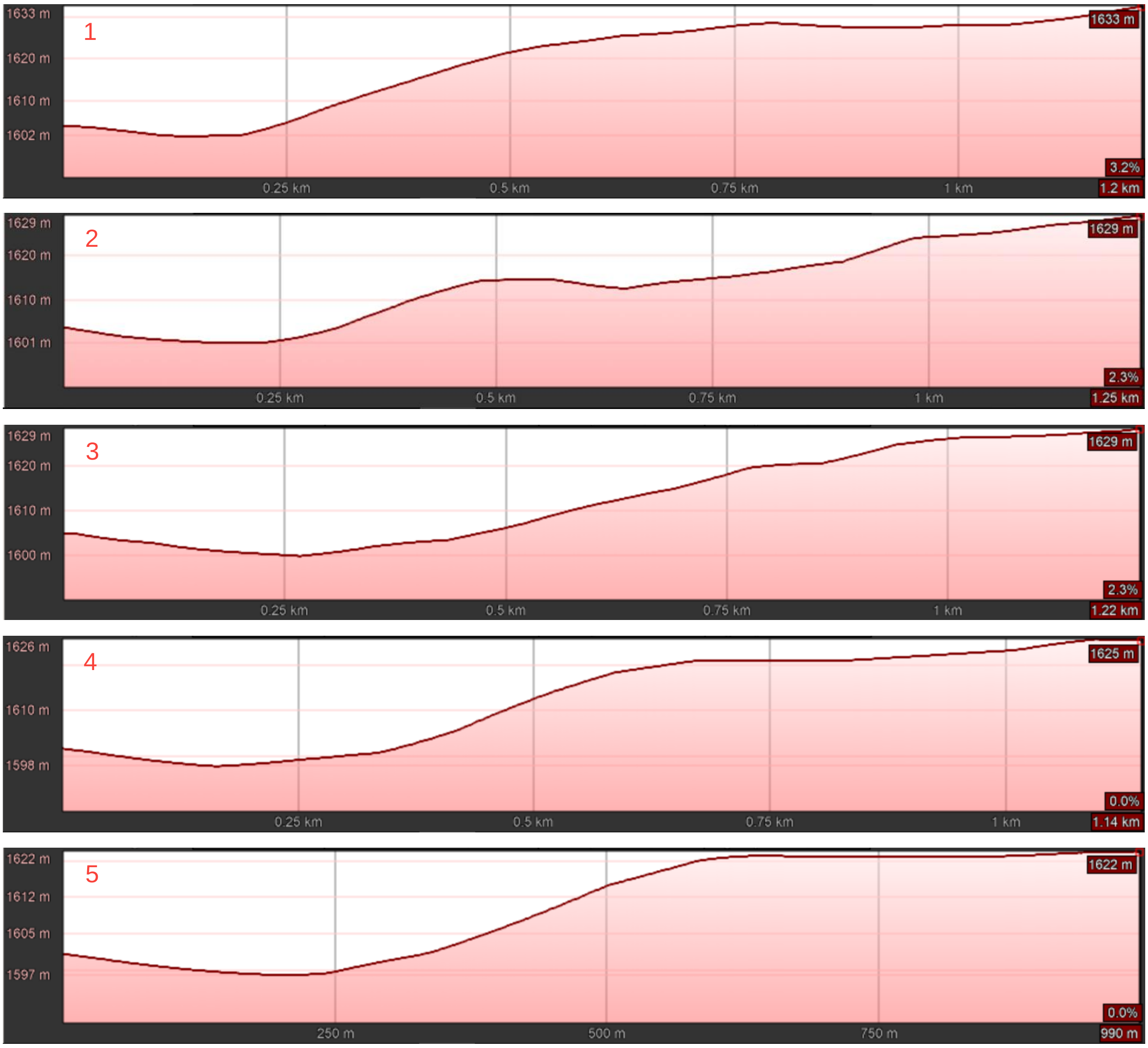

Figure 6: Transects within the study site

5.3 GENERAL FUNCTIONAL DESCRIPTION OF WETLAND TYPES

The typical functionality of channelled valley-bottom wetlands tends to contribute less towards flood attenuation and sediment trapping compared to that of typical floodplain wetland types, but would supply these benefits to a certain extent. The potential for removal of nutrients and toxicants would generally be expected to some degree, particularly from diffuse water inputs from adjacent hillslopes (Kotze *et al.*, 2009). The erosion of a channel through the wetland indicates that sediment trapping is not always an important function of this wetland type. Under low and medium flows, transport of sediment through and out of the system are more likely to be the dominant processes. Erosion is vertical and reflects the attempts of a system to reach equilibrium with the imposed hydrology. As flows become more channel-bound through vertical incision and lateral erosion of the channel, the ability of the wetlands to trap sediments decreases.

5.4 THE PES ASSESSMENT OF THE WETLAND

The assessment of the condition or PES (Present Ecological State) is based on an understanding of both catchment and on-site impacts and the impact that these aspects have on system hydrology, geomorphology and the structure and composition of wetland vegetation. The system is still functioning and providing goods and services within the natural environment. The PES of each of the systems is provided in **Table 6**.

The hydrological functioning and importance of this wetland is considered to be F (8.0). Dams are present in this wetland, with the result that the cumulative effect of the streamflow is reduced. Road and conveyor crossings further impede the natural flow of water, as does the coal stockyard east of the wetland. The hydrology of the wetland is categorised as having an "F" PES category which indicates serious modifications with some natural habitat features still recognisable.

Current impacts to geomorphological integrity are limited to the presence of roads, conveyor belt crossings, and dumped rubble, while it seems that significant portions of the wetland have been landscaped. This contributes towards the deterioration of integrity and this assessment indicating a largely modified "E" PES Category

The state of the vegetation is greatly modified with a substantial change in ecosystem processes and loss of natural habitat and biota though some natural habitat features remain and are still recognisable as described by an "E" Category. Changes in hydrology and flow patterns, roads, and the dumping of material indicate that directional changes in wetland vegetation have occurred. Areas within the wetland have been landscaped and/or disturbed with the resultant infestation of exotic vegetation.

According to the Wet-Health assessment, the wetland can currently be described as having an "E" Category. The change in ecosystem processes and loss of natural habitat and biota is great. It is expected that conditions will deteriorate over time due to the permanent nature of the impacts (Wet-Earth, 2017). The wetland's integrity has remained more or less the same since the previous survey and can currently be described as having an "E" Category.

Table 6: PES assessment of the identified systems (Wet Earth Eco-Specs, 2019)

Hydrology	Geomorphology	Vegetation	Overall
8.0 F: Critically Modified	7.8 E: Seriously Modified	6.7 E: Seriously Modified	7.58 E: Seriously Modified

5.5 THE EIS OF THE WETLAND

The current capacity of the wetland to support biodiversity was determined based on the Department of Water Affairs (1999) Ecological Importance and Sensitivity (EIS) scoring system. A low diversity of wetland plants was recorded, with invasive plant species such as Cosmos and Bidens pilosa dominating. Evidence of presence of several faunal species was detected, including Serval, Wart Hog, Common Duiker, Water Mongoose and tadpoles of an unknown amphibian species. The EIS score was categorised as D (Low/Marginal) (Golder Associates, 2018). Therefore, the wetland is classified as currently not ecologically important or sensitive at any scale. Improvements in wetland health (such as removal of invasive alien plant species, restoration of incised channels and desiccated areas) would enhance the wetland plant diversity within VCB08. These improvements could increase the ecological importance and sensitivity to a level where it would contribute to increased wetland biodiversity value on a local scale (Golder Associates, 2018).

6 RESULTS AND DISCUSSION

6.1 SOIL FORM IDENTIFICATION

The following (nine) soil identification locations were chosen based on the site topography (Figure 7).

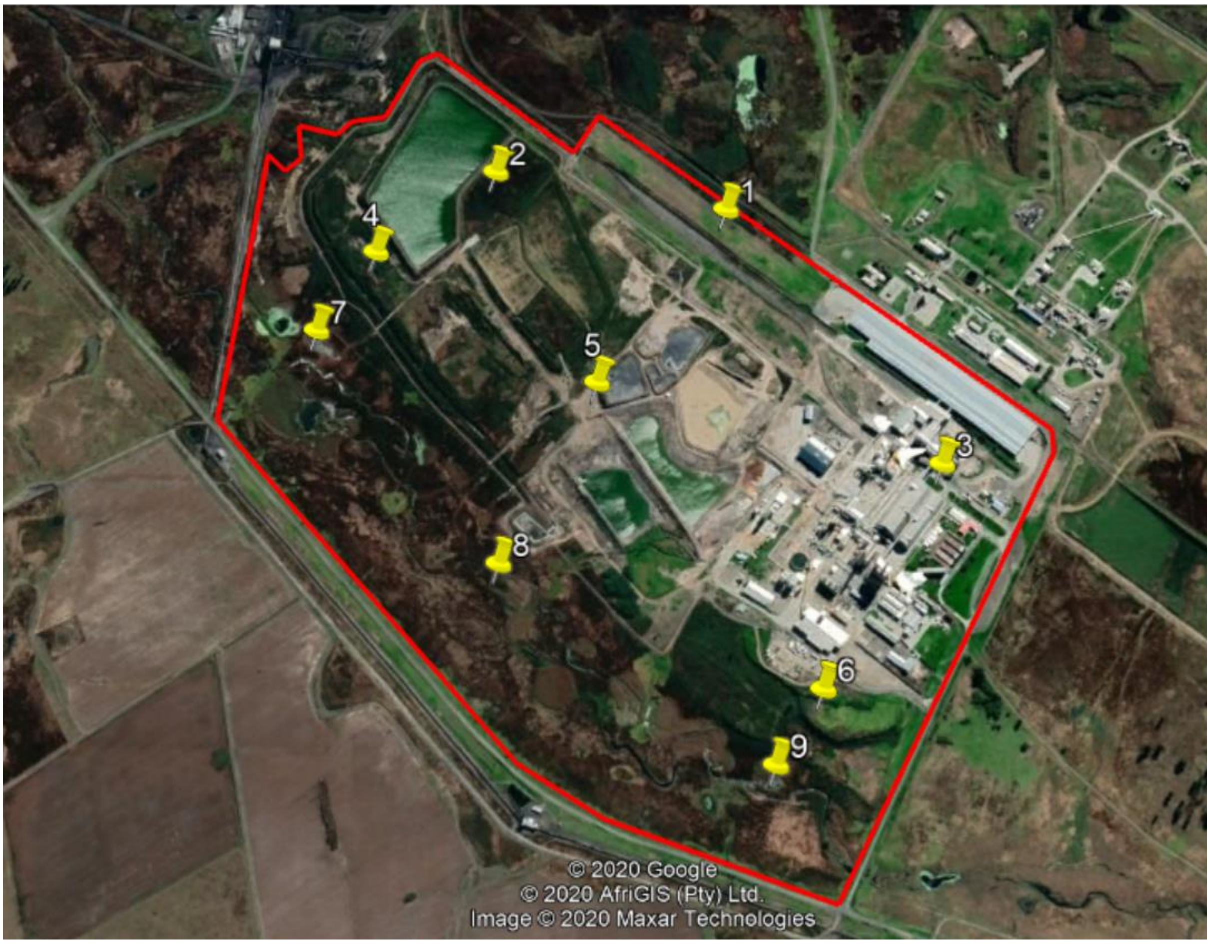

Figure 7: Soil form identification locations

The soil forms identified at each location are shown in Table 7. When classifying the soil forms, Point 2 could not be accessed. Therefore, due to the surrounding soil forms, desktop information and the position of the point in the catena, the soil form was inferred to be a Bonheim. Point one, which occurred on a small "plateau" in the midslope, was classified as a Katspruit soil form.

Table 7: Soil forms

Point	Latitude	Longitude	Soil form	
1	-26.58527	29.17939	Katspruit Orthic A-horizon overlying a G-horizon	

2	-26.58448	29.17443	Bonheim Melanic A-horizon overlying a pedocutanic B-horizon	-NA
3	-26.59031	29.18389	Bonheim Melanic A-horizon overlying a pedocutanic B-horizon	
4	-26.58608	29.17186	Bonheim Melanic A-horizon overlying a pedocutanic B-horizon	
5	-26.58870	29.17663	Bonheim Melanic A-horizon overlying a pedocutanic B-horizon	
6	-26.59460	29.18134	Bonheim Melanic A-horizon overlying a pedocutanic B-horizon	
7	-26.58763	29.17061	Rensburg Vertic A-horizon overlying a G-horizon	

8	-26.59221	29.17457	Rensburg Vertic A-horizon overlying a G-horizon	
9	-26.59602	29.18035	Rensburg Vertic A-horizon overlying a G-horizon	

6.2 MORPHOLOGICAL AND HYDRAULIC PROPERTIES OF WETLAND SOILS WITHIN THE FOCUS AREA

The typical area catena is shown in the **Figure 8** below. The hillslope units that occur within the study site are the midslope and valley-bottom. The Katspruit and Bonheim soil forms on the midslope and the Rensburg soil form on the valley-bottom.

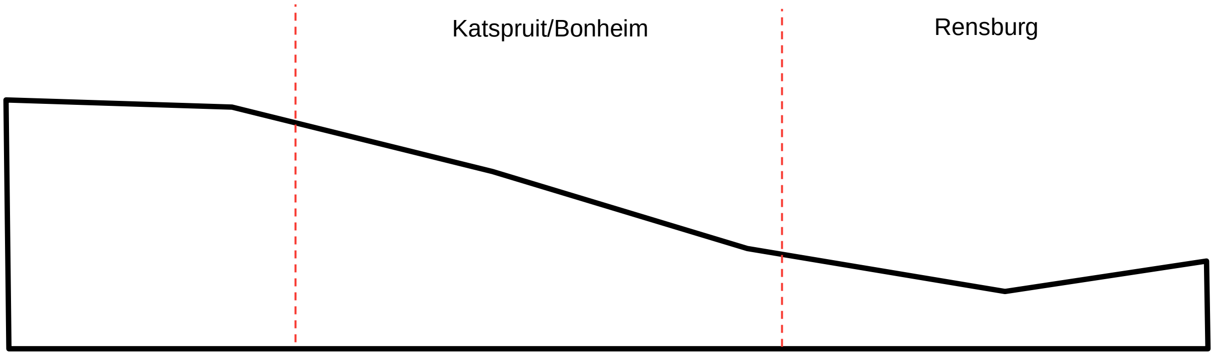

Figure 8: Soil forms within the catena

The soil forms within the study area are illustrated in **Figure 9**. "Wet" and "dark clay" soils occur throughout the area and their distribution is determined by the topography. Deep and waterlogged soils occupy the valley bottom areas of the landscape.

The Katspruit and Bonheim soil forms are found on the midslope. The Katspruit can be classified as a "wet soil", while the Bonheim can be classified as a "dark clay or "intermediate" soil. The Katspruit soil form is commonly found in the valley-bottom of the hillslope, however it occurs in the midslope of the catena, where there is a slight "plateau" in the topography. The Bonheim soil form dominates the midslope of the catena.

The most common soil found in the wetlands of the study area is the Rensburg soil form, which is a dark strongly structured clay soils that have a high base status. Red and dark clays occur on the dolerite parent material, which provides the basic cations needed for clay formation. The Rensburg soil form is a hydromorphic soil, which is characterised by its vertic A horizon topsoil overlaying a G horizon. It is a typically poorly drained soil which often has a sandy-clay-loam topsoil and a sandy-clay to clay subsoil. The underlying hydromorphic G horizon occurs at shallow depths and forms owing to either a fluctuating water table or a permanent water table.

Figure 9: Map depicting dominant soil forms in the focus area

6.2.1 INTERFLOW (SOIL/BEDROCK) SOILS

These soils are generally characterised by hydromorphic properties particularly mottling (red, yellow and grey colours) which signify temporal build-up of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction. However, the soils present do not exhibit the aforementioned general soil characteristics. The horizons are indicative that the underlying bedrock is slowly permeable and periodic saturation in the rainy season is likely, which may lead to lateral flow at the soil bedrock interface. The drainage may be restricted by a shallow impermeable rock layer (Le Roux *et al.*, 2015). The interflow (soil/bedrock) soils within the focus area comprised of the Katspruit and Bonheim soil forms.

6.2.2 RESPONSIVE (SATURATED) SOILS

Responsive saturated soils within the focus area were classified as Rensburg soil forms, which occur in the valley bottom areas. In the valley bottom area an impermeable rock layer largely controls the formation of the wetlands. The wetland is a saturated flow responsive area. Rain and overland flow that arrives here will continue as overland flow, whereas the water that enters the fractured rock from the recharge area will feed the wetland over a long period of time. Although the vertic A horizon of these soils can serve as preferential flowpaths during the dry season, these cracks are expected to close due to swelling during the rainy season. The high shrink-swell clay content in the vertic A horizons are associated with low conductivities, and overland flow is expected to be dominant in this landscape position. These soils behave differently due to their soil water status. When these soils are wet, the clay minerals absorb water molecules and expand. When these soils are dry, they shrink, which leaves large voids in the soil.

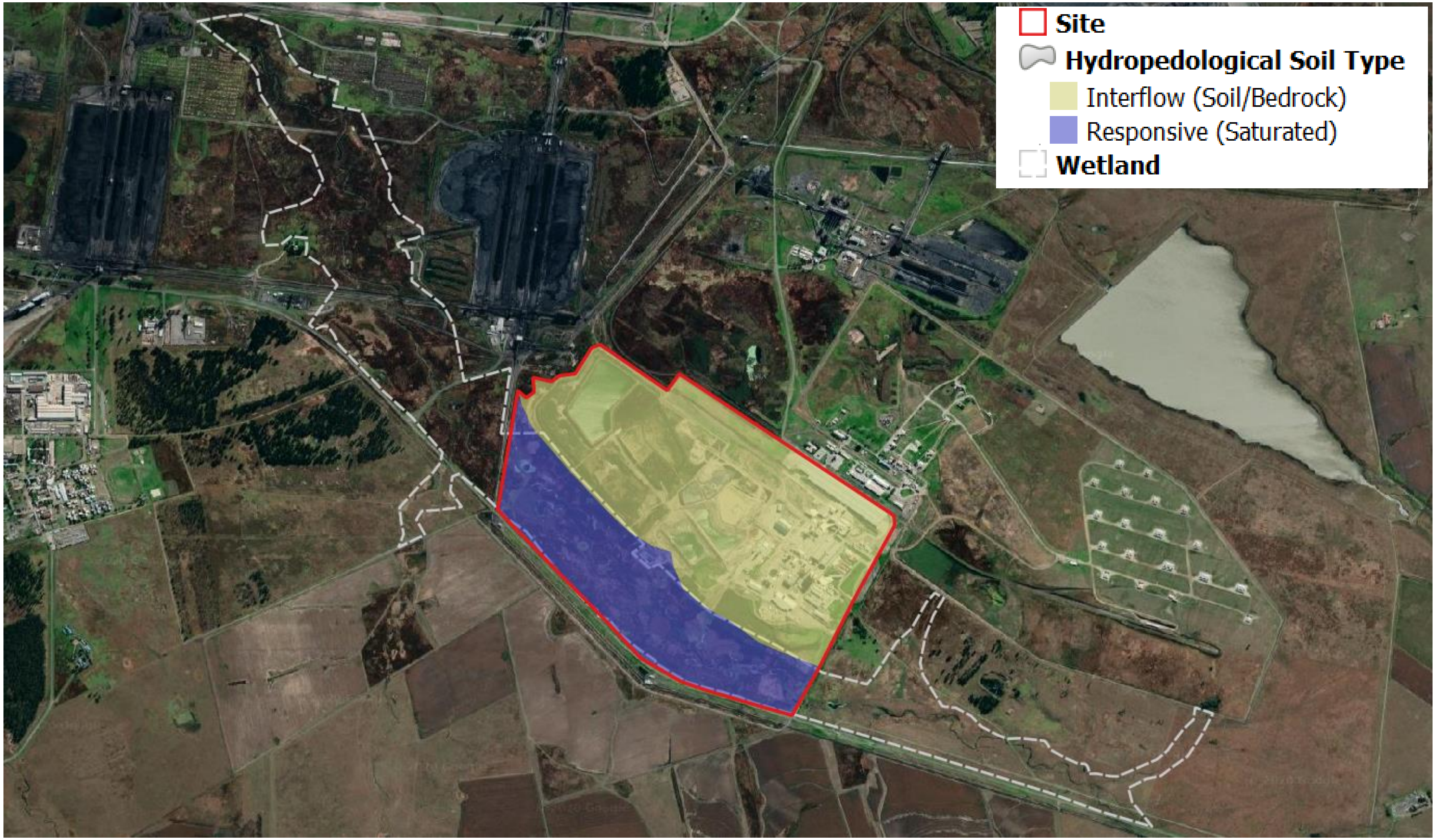

Figure 10: Hydrological soil types within the focus area

6.3 HYDRO-PEDOLOGICAL IMPLICATIONS

The proposed re-instatement and development on the wetland would result in the improvement of the currently poor PES and EIS scores. To date, the study site has been significantly modified by the current and past land use activities.

The implementation of the weirs will result in an increase in the water level and therefore would increase the spatial extent of the permanent wetland zone.

7 CONCLUSIONS AND RECOMMENDATIONS

The hydropological soil types within the study area are primarily dependent on the topography. Katspruit and Bonheim soil forms were identified on the midslopes, where they are classified as interflow soils. The soils that occupy the valley-bottom of the hillslope profile are the Rensburg soil form. These soil forms are shrink-swell soils, which have a high clay percentage. The flow paths of these soils are primarily overland flow, as these soils are predominantly saturated during the wet period.

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