Wetland Baseline & Risk Assessment for the proposed Soventix Solar Photovoltaic (PV) Facility

Springs, Gauteng Province, South Africa

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CLIENT

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1 Introduction

1.1 Background

The Biodiversity Company was appointed by Ecoleges Enviromental Consultants to undertake a wetland baseline and risk assessment for the proposed development of a 1.8 MWp Solar PV Facility at Element Six facility, Springs, Ekurhuleni Metropolitan Municipality, Gauteng Province (Figure 1-1 & Figure 1-2). A 500 m buffer has been assigned to the project to facilitate the identification of wetlands within the regulated area, this buffer is referred to as the Project Area of Influence (PAOI) from hereon.

The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). The National Web based Environmental Screening Tool has characterised the aquatic theme sensitivity of the project area as "Low" and "Very High".

This assessment has been completed in accordance with the requirements of the published General Notice (GN) 509 by the Department of Water and Sanitation (DWS). This notice was published in the Government Gazette (no. 40229) under Section 39 of the National Water Act (Act no. 36 of 1998) in August 2016, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 509 process provides an allowance to apply for a WUL for Section 21(c) & (i) under a General Authorisation (GA), as opposed to a full Water Use Licence Application (WULA). A water use (or potential) qualifies for a GA under GN 509 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM). This assessment will implement the RAM and provide a specialist opinion on the appropriate water use authorisation.

The purpose of the assessment is to provide relevant input into the environmental application process. This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making as to the ecological viability of the project and the impacts that its implementation may have on the natural environment.

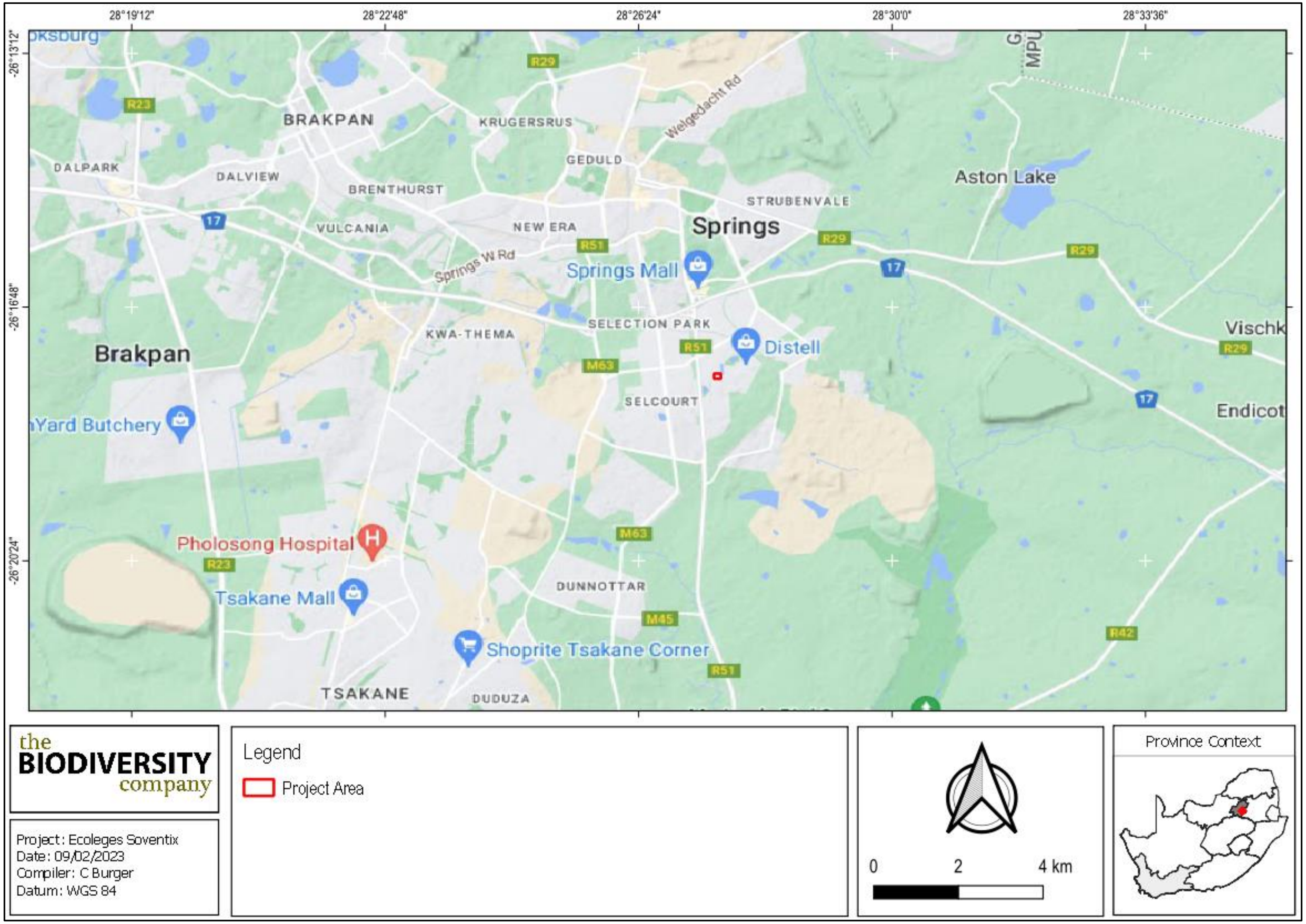

Figure 1-1 Regional overview of the project area

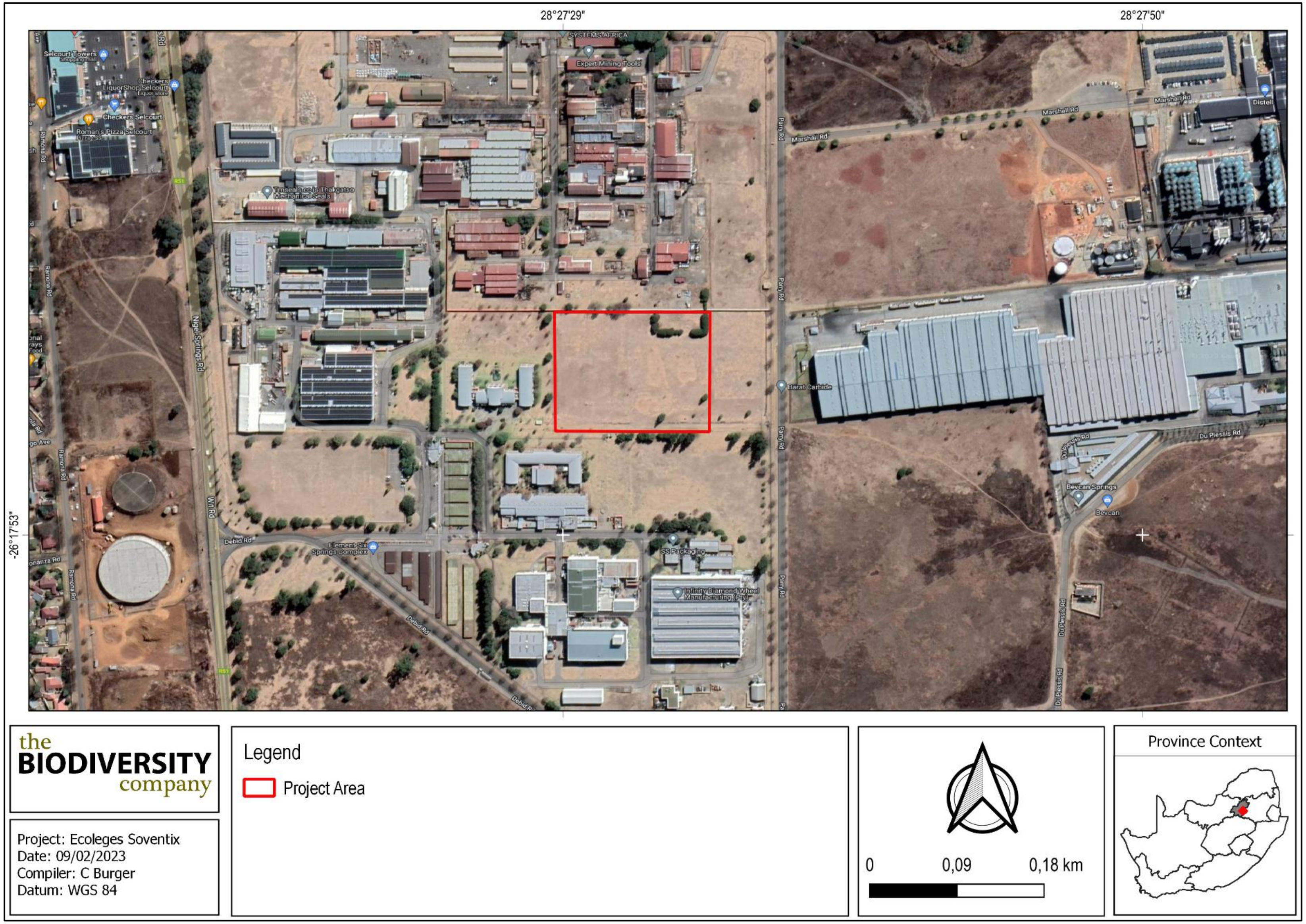

Figure 1-2 Project area

1.2 Specialist Details

Report Name	**Wetland Baseline & Risk Assessment for the Proposed Soventix Solar PV facility Project**	
Reference	**Soventix Solar PV**	
Submitted to	ecoleges Environmental Consultants	
Report Writer & Fieldwork	**Rian Pienaar**	
	Rian Pienaar is an aquatic ecologist (Cand. Sci. Nat. 135544) with experience in wetland identification and delineations. Rian completed his M.Sc. in environmental science at the North-West University Potchefstroom Campus. Rian has been part of wetland studies for road and culvert upgrades, power station and dam construction.	
Reviewer	**Andrew Husted**	
	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 13 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.	
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.	

1.3 Terms of Reference

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- The delineation, classification and assessment of wetlands within 500 m of the project area;
- Conduct risk assessments relevant to the proposed activity;
- Recommendations relevant to associated impacts; and
- Report compilation detailing the baseline findings.

1.4 Key Legislative Requirements

1.4.1 National Water Act (NWA, 1998)

The DWS is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means;

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

1.4.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

2 Methods

A single wetland site visit was conducted on the 13th of February 2023, this would constitute a wet season survey.

2.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2-1. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
    - The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

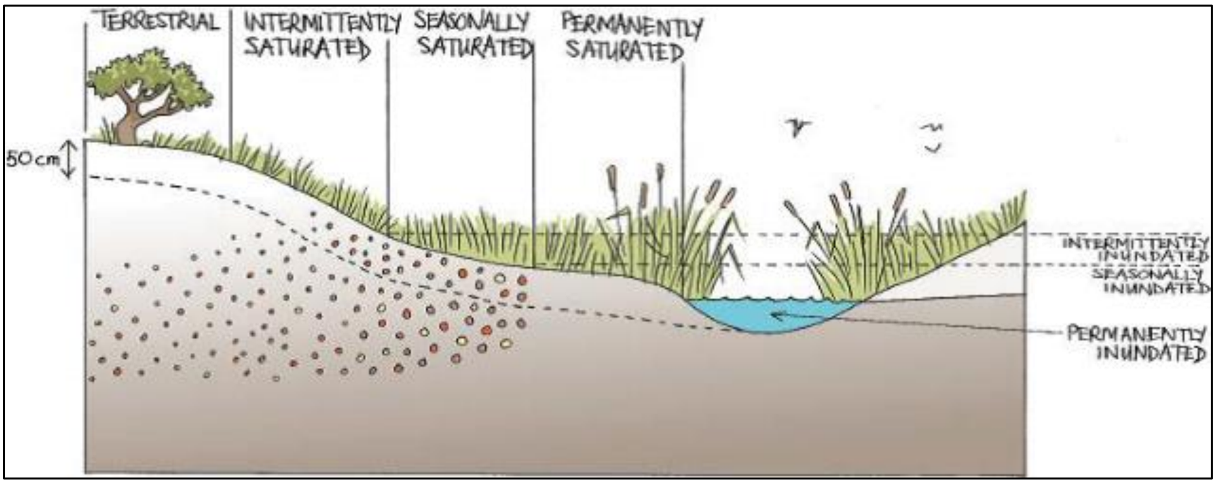

Figure 2-1 Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)

2.2 Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the project area. These delineations are then illustrated by means of maps accompanied by descriptions.

2.3 Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Eco Services serves as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al*. 2008). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 2-1).

Table 2-1 Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

2.4 Present Ecological Status

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 Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences 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. The Present State categories are provided in Table 2-2.

Table 2-2 The Present Ecological Status categories (Macfarlane, et al., 2008)

Impact Category	Description	Impact Score Range	PES
None	Unmodified, natural	0 to 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.	1.0 to 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.	2.0 to 3.9	C
Large	Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	D
Serious	Seriously Modified. The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	6.0 to 7.9	E
Critical	Critical Modification. The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.0 to 10	F

2.5 Importance and Sensitivity

The importance and sensitivity of water resources are determined to establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants is used to assign the Importance and Sensitivity (IS) category as listed in Table 2-3.

Table 2-3 Description of Importance and Sensitivity categories

IS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

2.6 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

2.7 Buffer Requirements

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity.

2.8 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The focus area was based on the spatial files provided by the client and any alterations to the area and/or missing GIS information would have affected the area surveyed;
- Only the outline area of the proposed site was provided to the specialist;
- Some areas within the 500 m project area of influence were fenced and no access was granted to groundtruth; and
- The GPS used for the survey has a 5 m accuracy and therefore any spatial features may be offset by 5 m.

3 Results and Discussion

3.1 Desktop Baseline

3.1.1 Vegetation Type

The project area is situated within the Grassland biome. On a fine-scale vegetation type, the project area overlaps with the Tsakane Clay Grassland (Figure 3-1).

The Tsakane Clay Grassland is characterised by flat to slightly undulating plains and low hills. Vegetation is short, dense grassland dominated by a mixture of common highveld grasses such as *Themeda triandra, Heteropogon contortus, Elionurus muticus* and a number of *Eragrostis* species (Mucina & Rutherford, 2006). Most prominent forbs are of the families Asteraceae, Rubiaceae, Malvaceae, Lamiaceae and Fabaceae. Disturbance often leads to an increase in the abundance of the grasses *Hyparrhenia hirta* and *Eragrostis chloromelas* (Mucina & Rutherford, 2006).

Conservation Status

This vegetation is classified as EN, with a conservation target of 24% (Mucina & Rutherford, 2006). Only 1.5% conserved in statutory reserves (Suikerbosrand, Olifantsvlei, Klipriviersberg, Marievale) and a small portion also in private nature reserves (Mucina & Rutherford, 2006).

Figure 3-1 Map illustrating the vegetation type associated with the project area.

3.1.2 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Bb 3 land type. This Bb land type consists of plinthic catena. Upland duplex and margalitic soils are rare and dystrophic and/or mesotrophic red soils are not widespread.

This region is characterised by basaltic igneous rocks from the Ventersdorp Supergroup's Klipriviersberg Group. Additionally, the Karoo Supergroup's Madzaringwe Formation's sedimentary rocks. Land types that typically would occur in this region includes Bb and Ba land types(Mucina and Rutherford, 2006).

3.1.3 Climate

This region is characterised by strongly seasonal summer rainfall and dry winters, see Figure 3-2. The mean annual precipitation for this region ranges from 630 to 720 mm with an overall mean annual temperature of 15 ℃. Frost frequently occurs within this region and occurs more frequently in the southern parts of the Gm 9 vegetation type (Mucina & Rutherford, 2006).

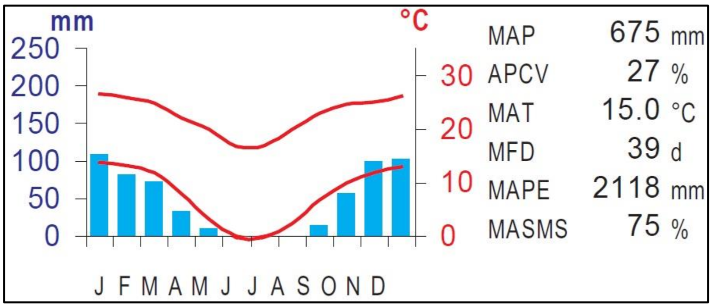

Figure 3-2 Climate for the region Mucina & Rutherford (2006).

3.1.4 South African Inventory of Inland Aquatic Ecosystems

This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the National Biodiversity Assessment (NBA 2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other datasets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE, 2018).

Two wetland types were identified by means of this dataset. The wetlands were classified as being two depression wetlands as well as two hillslope seep wetlands (see Figure 3-3). The conditions of these wetlands ranged from moderately modified (C) to critically modified (D/E/F).

3.1.5 NFEPA Wetlands

Two wetland types have been identified within the PAOI for the proposed solar power project, namely five wetland flats, and one depression wetland (see Figure 3-4). Two of the wetland flats were rated as being artificial and two as being natural, the depression wetland was rated natural.

3.1.6 Topographical Inland Water and River Lines

The topographical inland and river line data for “2628” quarter degree was used to identify potential wetland areas within the PAOI. This dataset indicates four inland water areas of which were classified as being one dam, one large reservoir and two non-perennial pans with no topographical river lines being present within the project area of influence (see Figure 3-5).

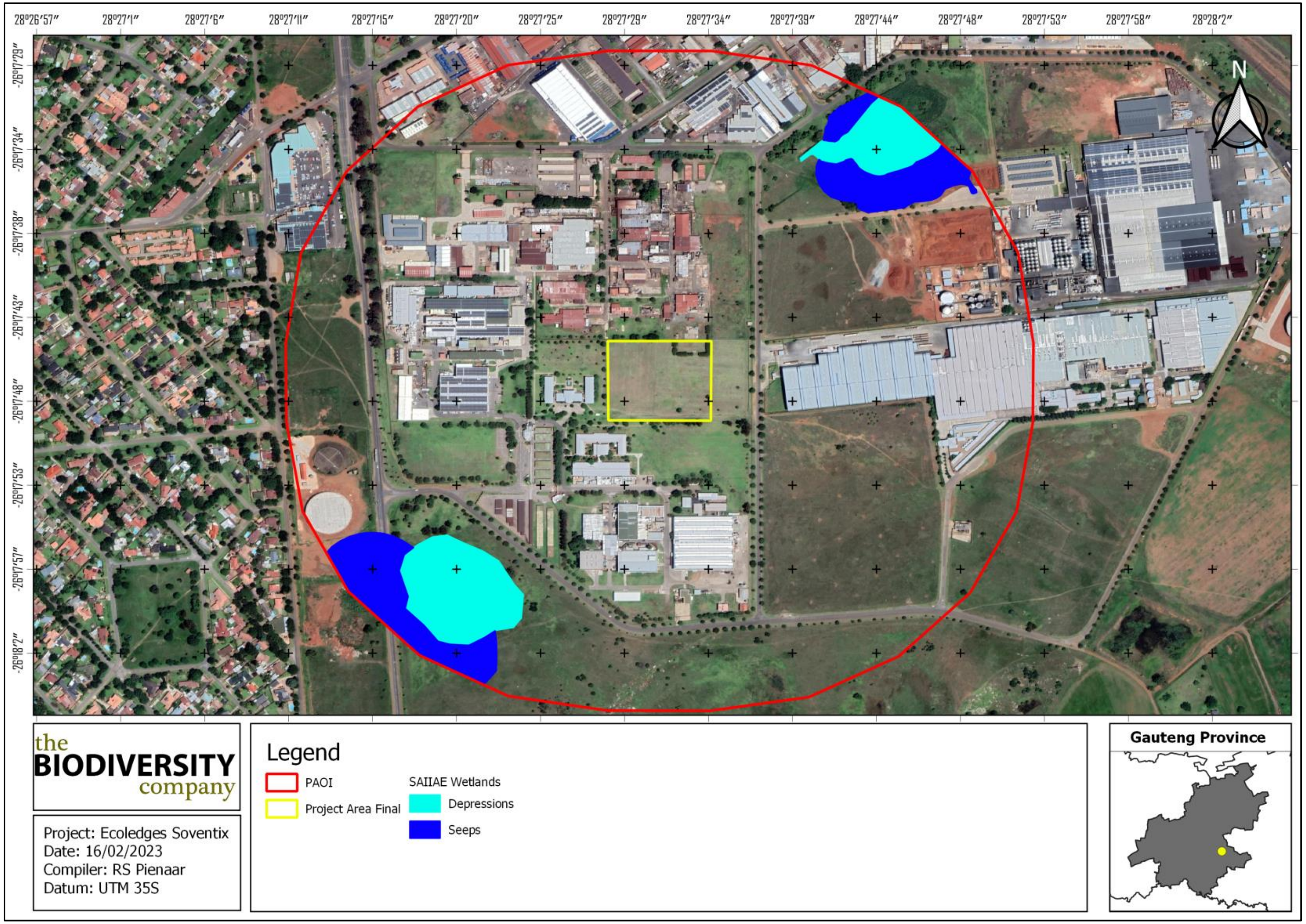

Figure 3-3 SAIIAE wetlands located within PAOI

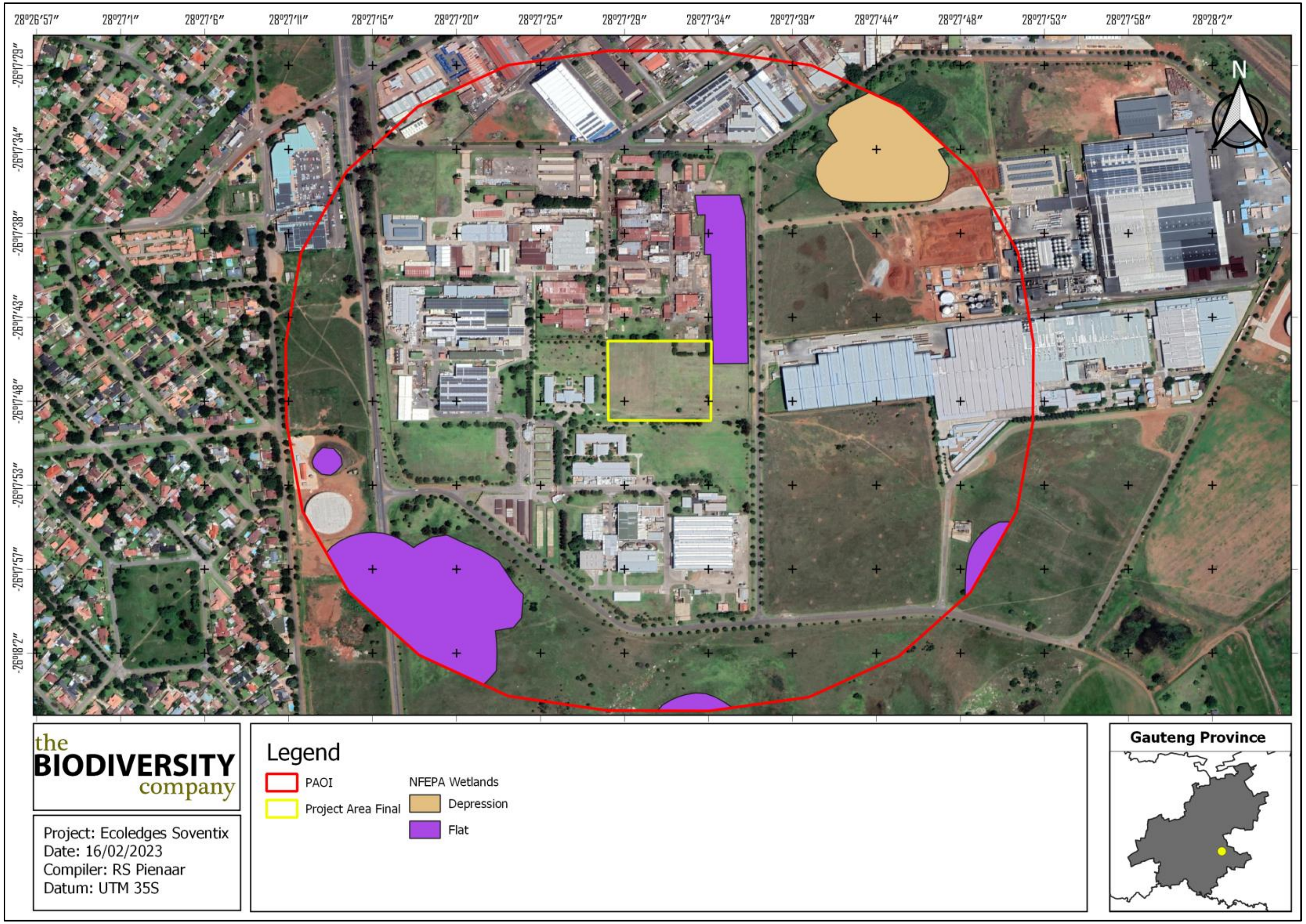

Figure 3-4 NFEPA wetlands located within PAOI

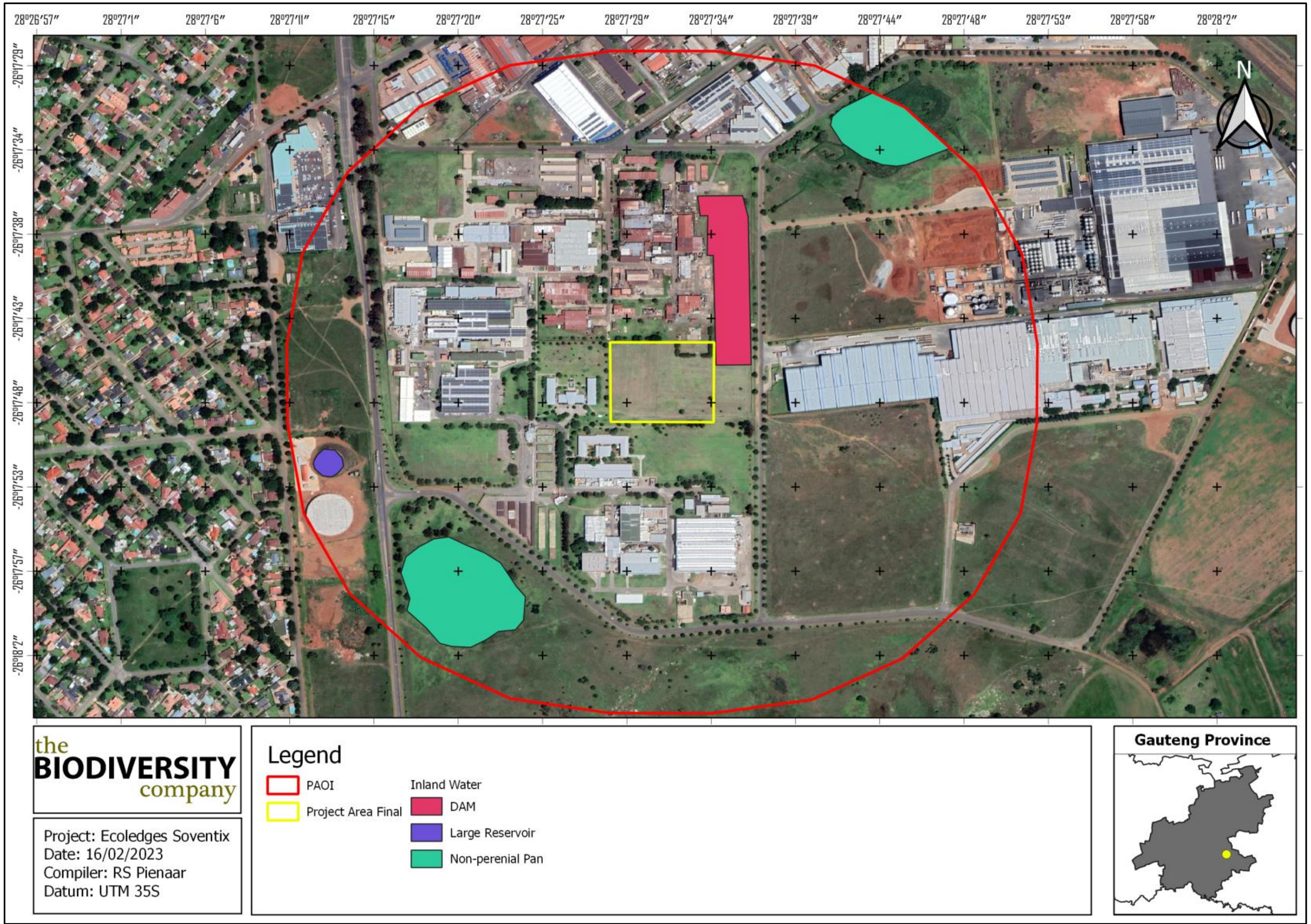

Figure 3-5 Topographical inland water areas located within the PAOI

3.1.7 Terrain

The terrain of the 500 m regulated area has been analysed to determine potential areas where wetlands are more likely to accumulate (due to convex topographical features, preferential pathways, or more gentle slopes).

3.1.7.1 Digital Elevation Model (DEM)

A Digital Elevation Model (DEM) has been created to identify lower laying regions as well as potential convex topographical features which could point towards preferential flow paths. The 500 m regulated area ranges from 1 609 to 1 632 metres above sea level (MASL). The lower laying areas (generally represented in dark blue) represent the area that will have the highest potential to be characterised as wetlands (see Figure 3-6).

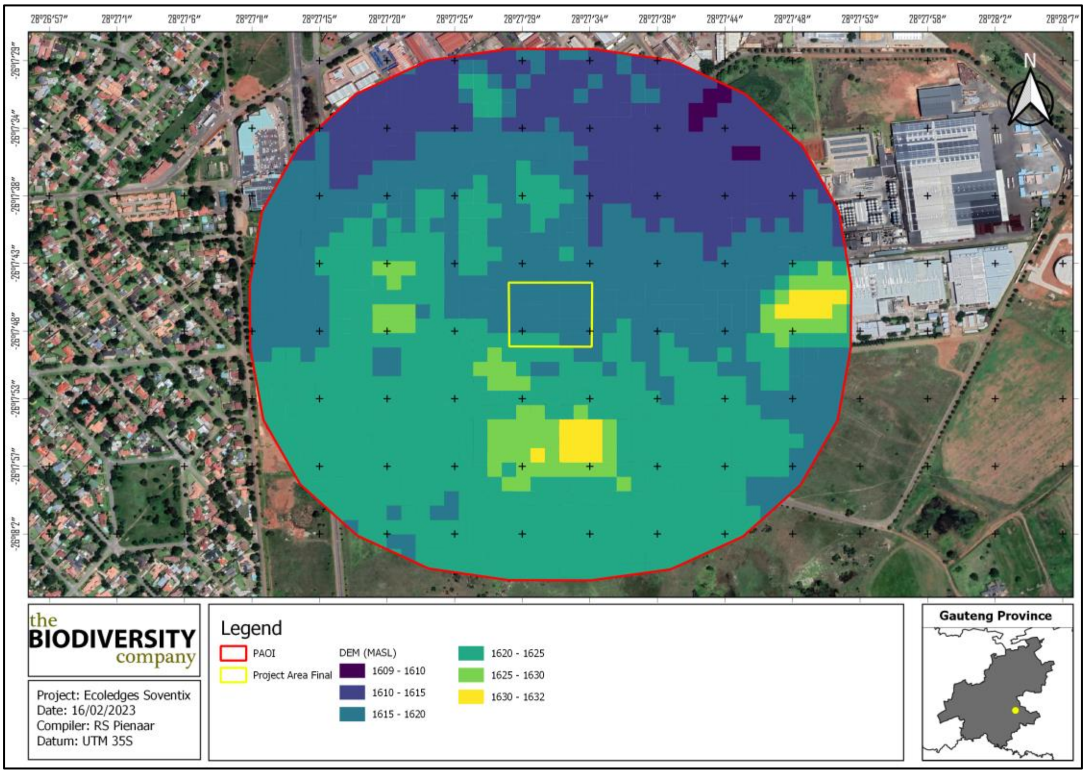

Figure 3-6 Digital Elevation Model of the 500 m regulated area

4 Field Assessment

4.1 Delineation and Description

During the site visit, four HGM units were identified within the PAOI (see Figure 4-2). The wetland areas were delineated in accordance with the DWAF (2005) guidelines (see Figure 4-1 and Figure 4-2). Both HGM 1 and HGM 2 have been identified as depression wetlands with HGM 3 classified as a seep and HGM 4 was classified as an unchannelled valley bottom wetland. Along with the four HGM units artificial drainage features were also identified. These artificial systems do not classify as a wetland system and provide no ecological function. For this assessment it was deemed that none of the HGM units will be directly impacted by the development and with the correct mitigation measures, no risks to the systems are expected for the proposed development.

Drainage features (or lines) were also identified for the eastern catchment for the PAOI. These features are referred to as 'A' Section channels that convey surface runoff immediately after a storm event and are not associated with a baseflow (DWAF, 2005).

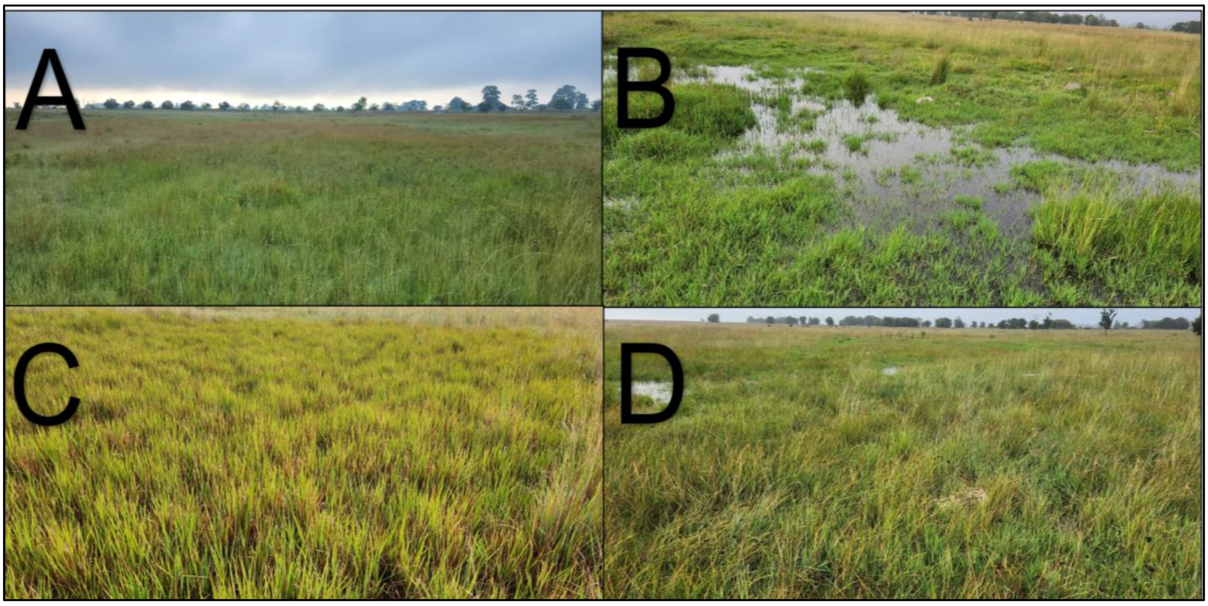

Figure 4-1 Photographical evidence of the different HGM units located within the PAOI, A) HGM 2- Depression., B) HGM 1- Depression, C) HGM 3 – Seep, D) HGM 4 Unchannelled valley bottom.

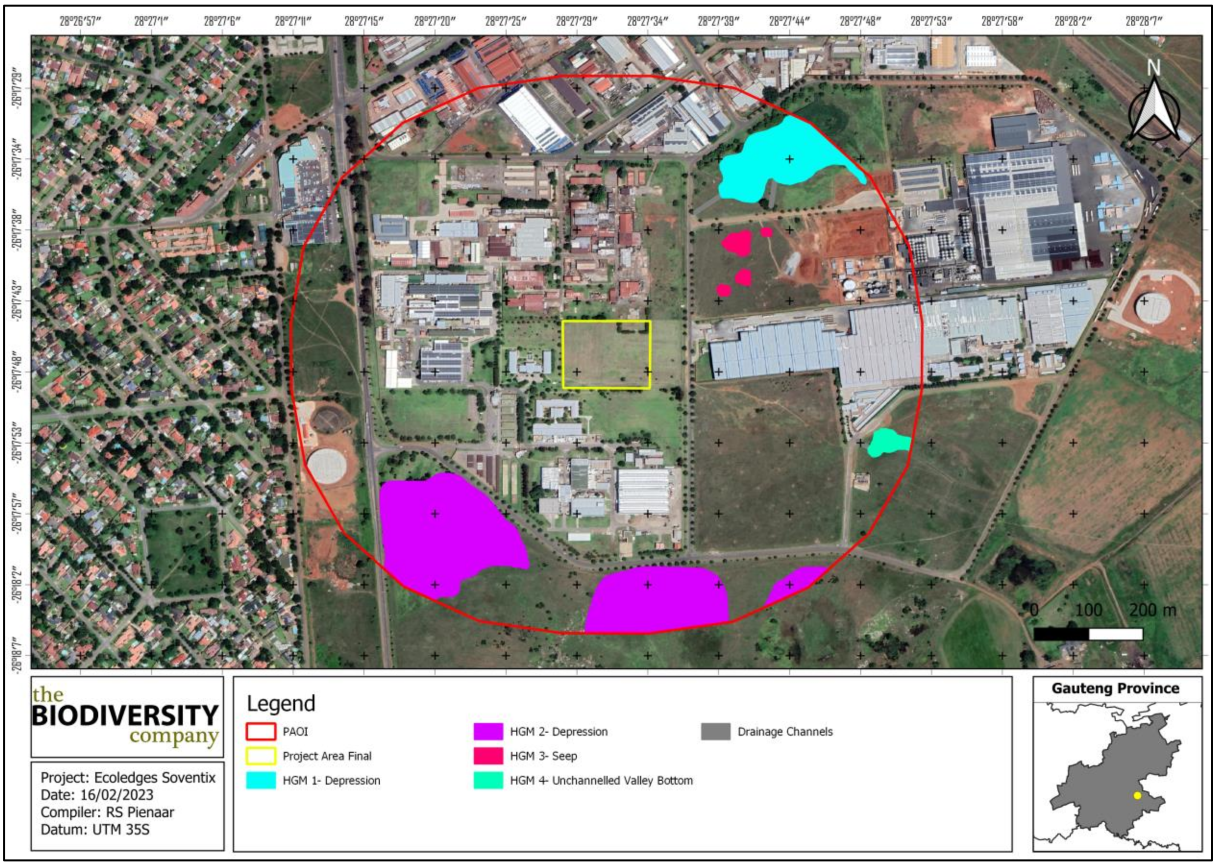

Figure 4-2 Delineation and location of the different HGM units as well as the artificial wetland identified within the PAOI

4.2 Unit Setting

Depression wetlands are located on the "slope" landscape unit. Depressions are inward draining basins with an enclosing topography which allows for water to accumulate within the system. Depressions, in some cases, are also fed by lateral sub-surface flows in cases where the dominant geology allows for these types of flows. Figure 4-3 presents a diagram of a typical depression wetland, showing the dominant movement of water into, through and out of the system.

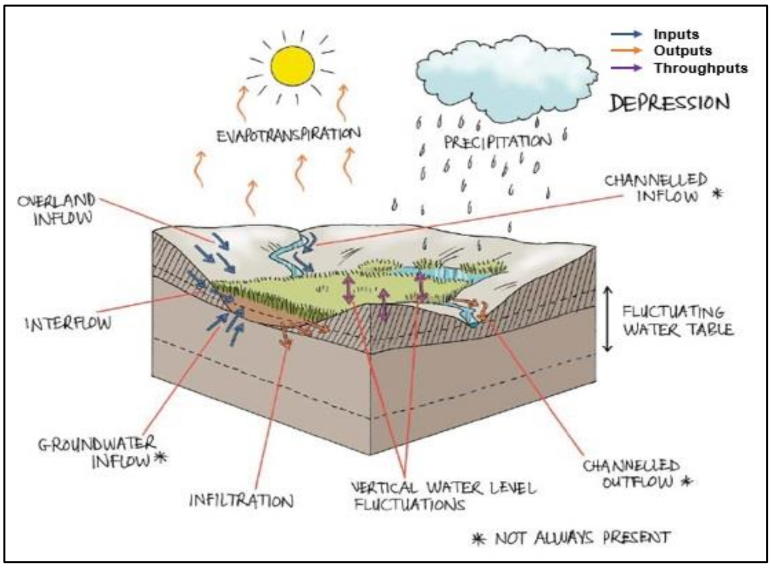

Figure 4-3 Amalgamated diagram of a typical depression wetland, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

A typical hillslope seep is located within slopes, as mentioned in Figure 4-4. Isolated hillslope seeps are characterised by colluvial movement of material. These systems are fed by very diffuse sub-surface flows which seep out at very slow rates, ultimately ensuring that no direct surface water connects this wetland with other water courses within the valleys. Figure 4-4 illustrates a diagram of the hillslope seeps, showing the dominant movement of water into, through and out of the system.

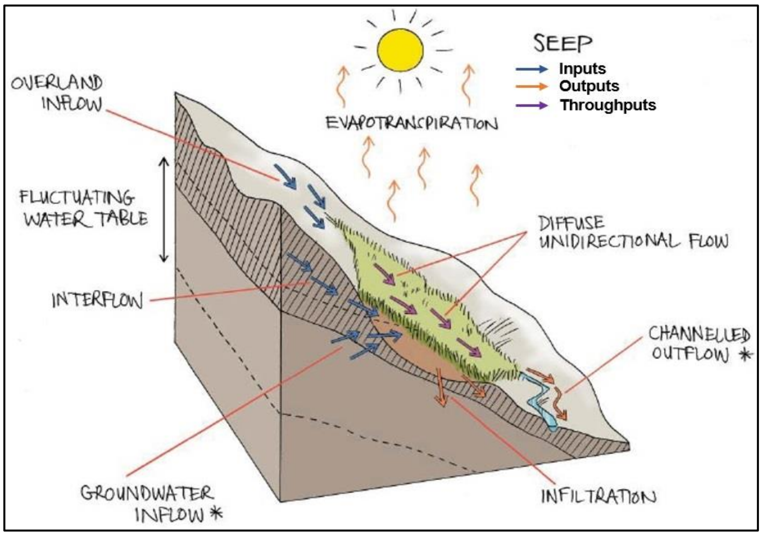

Figure 4-4 Amalgamated diagram of a typical hillslope seep, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

Unchannelled valley bottom wetlands are typically found on valley floors where the landscape does not allow high energy flows. **Error! Reference source not found.** presents a diagram of a typical unchannelled valley bottom wetland, showing the dominant movement of water into, through and out of the system.

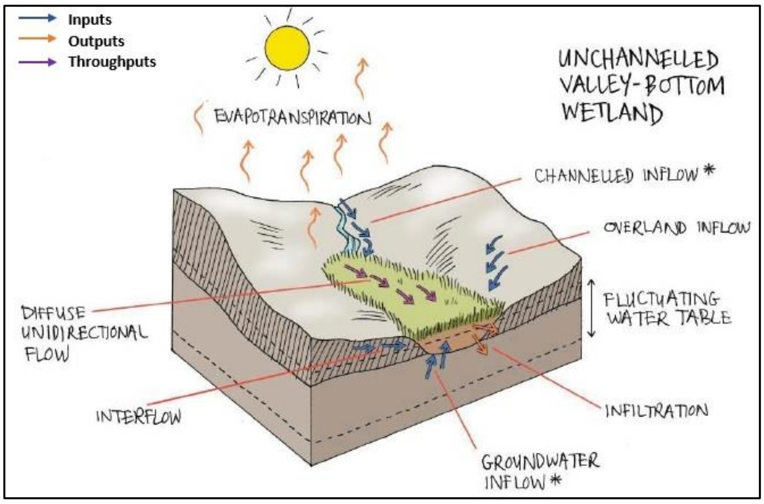

Figure 4-5 Amalgamated diagram of a typical unchannelled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

The DWAF (2005) manual separates the classification of watercourses into three (3) separate types of channels or sections defined by their position relative to the zone of saturation in the riparian area. The classification system separates channels into:

- those that do not have baseflow ('A' Sections);
- those that sometimes have baseflow ('B' Sections) or non-perennial; or
- those that always have baseflow ('C' Sections) or perennial.

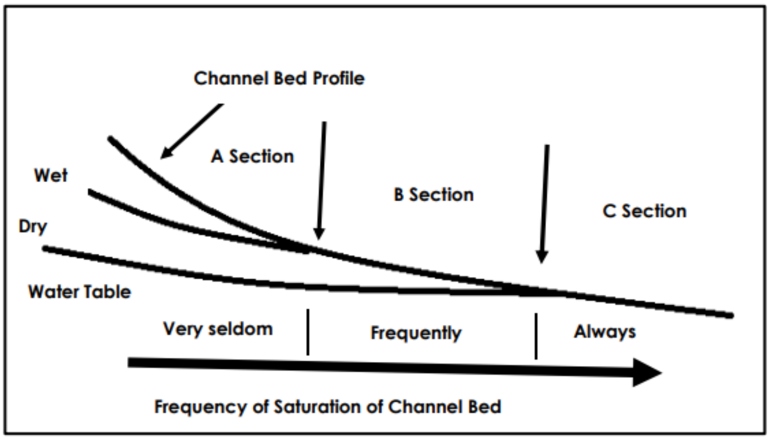

Figure 4-6 The watercourse classifications (DWAF, 2005)

4.3 General Functional Description

The generally impermeable nature of depressions and their inward draining features are the main reasons why the streamflow regulation ability of these systems is mediocre. Regardless of the nature of depressions in regard to trapping all sediments entering the system, sediment trapping is another Eco Service that is not deemed as one of the essential services provided by depressions, even though some systems might contribute to a lesser extent. The reason for this phenomenon is due to winds picking up sediments within pans during dry seasons which ultimately leads to the removal of these sediments and the deposition thereof elsewhere. The assimilation of nitrates, toxicants and sulphates are some of the higher rated Eco Services for depressions. This latter statement can be explained as the precipitation as well as continues precipitation and dissolving of minerals and other contaminants during dry and wet seasons respectively, (Kotze et al., 2009).

Hillslope seeps are well documented by (Kotze et al., 2009) to be associated with sub-surface ground water flows. These systems tend to contribute to flood attenuation given their diffuse nature. This attenuation only occurs while the soil within the wetland is not yet fully saturated. The accumulation of organic material and sediment contributes to prolonged levels of saturation due to this deposition slowing down the sub-surface movement of water. Water typically accumulates in the upper slope (above the seep). The accumulation of organic matter additionally is essential in the denitrification process involved with nitrate assimilation. Seeps generally also improve the quality of water by removing excess nutrient and inorganic pollutants originating from agriculture, industrial or mine activities. The diffuse nature of flows ensures the assimilation of nitrates, toxicants and phosphates with erosion control being one of the Eco Services provided very little by the wetland given the nature of a typical seep's position on slopes.

Unchanneled valley-bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley-bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes. The shallow depths of surface water within this system adds to the degradation of toxic contaminants by means of sunlight penetration.

It is however important to note that the descriptions of the above-mentioned functions are merely typical expectations. All wetland systems are unique and therefore, the ecosystem services rated high for these systems on site might differ slightly to those expectations.

4.4 Ecological Functional Assessment

The ecosystem services provided by the wetland units identified on site were assessed and rated using the WET-EcoServices method (Kotze *et al.,* 2008). The average ecosystem service scores for the delineated systems are illustrated in Table 4-1 and Figure 4-7. The ecosystem service scores of the delineated wetlands ranges from moderately low to moderately high. Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation, erosion control, and provision of cultivated foods.

Table 4-1 Average ecosystem service scores for delineated wetlands

Moderately High	Intermediate	Moderately Low
HGM 1	HGM 2	HGM 3
	HGM 4	

HGM 1 has the highest ecological services scores due to the density of hydrophyte vegetation. The wetland was classified as a depression that plays an important role in habitat and resource provisioning as well as the accumulation of toxicants from the surroundings. The vegetation helps with the accumulation of toxicants from the environment and also provides resources.

HGM units 2 and 4 scored intermediate for ecological services. These HGM units were classified as being a depression and a unchannelled valley bottom wetlands The unchannelled valley bottom is where water will runoff to after heavy rains and plays an important role in flood attenuation and streamflow regulation. Although these wetlands have the same ability to regulate streamflow as HGM 4 they do not have the same amounts of hydrophyte vegetation and will thus have lower ecosystem services scores.

HGM 3 scored the lowest ecological services due to the lack of hydrophyte vegetation. The wetlands will still provide limited habitat and resources during the dry season to help the environment.

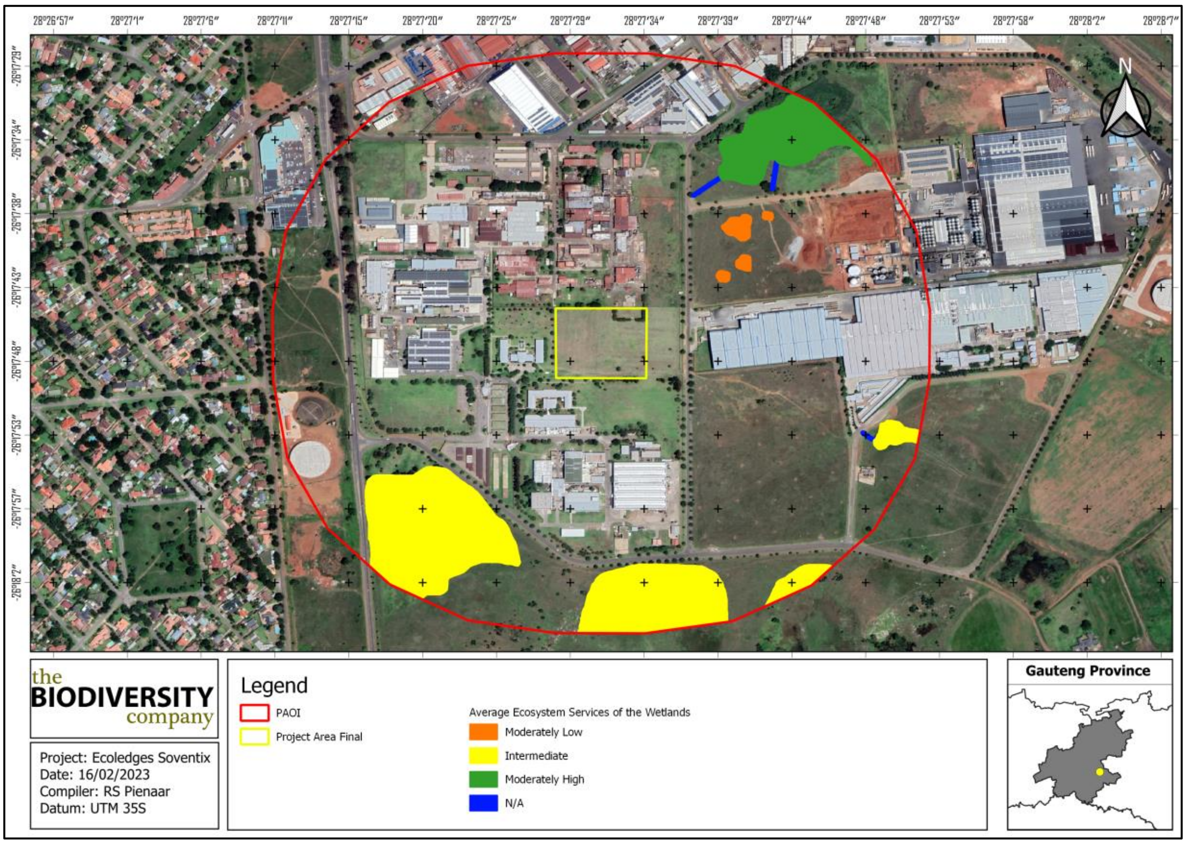

Figure 4-7 Average ecosystem services scores for the delineated wetlands

4.5 Ecological Health Assessment

The PES for the assessed HGM units is presented in Figure 4-8 and Table 4-2. The delineated wetland systems have been scored overall PES ratings ranging from largely modified (class D) to seriously modified (class E), depending on the level of modification.

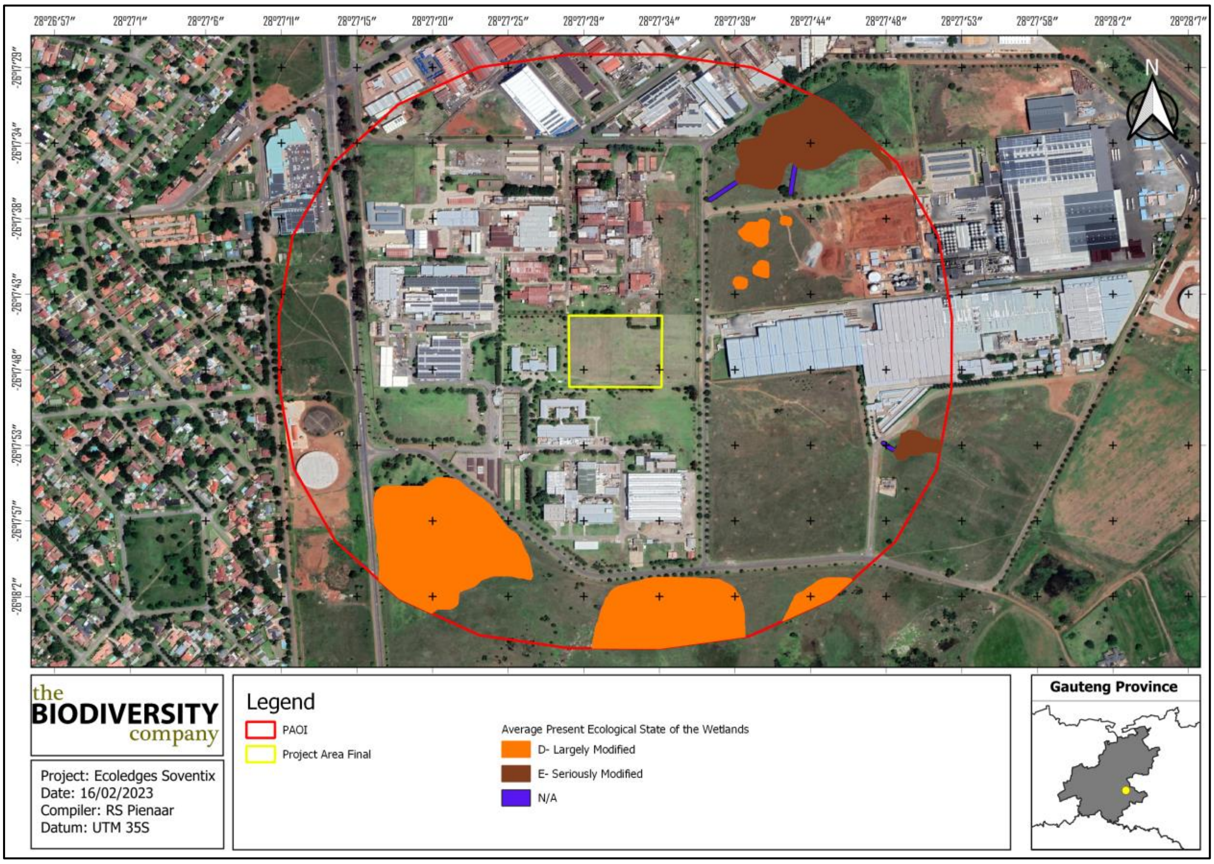

Figure 4-8 Overall present ecological state of delineated wetlands

Table 4-2 Summary of the scores for the wetland PES

Largely Modified (D)	Seriously Modified (E)
HGM 2	HGM 1
HGM 4	HGM 3

4.6 Importance & Sensitivity Assessment

The results of the ecological IS assessment are shown in Table 4-3. Various components pertaining to the protection status of a wetland are considered for the IS, including Strategic Water Source Areas (SWSA), the NFEPA wetland vegetation (wet veg) threat status and the protection status of the wetland. The IS for all the wetlands have been calculated to be "Moderate", which combines the relatively High threat status and the low protection levels of the wetland.

Table 4-3 The IS results for the delineated HGM units

HGM Type	NFEPA Wet Veg			NBA Wetlands			SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level		
Seep	Mesic Highveld Grassland Group 2	Least Concern	Poorly Protected	Class D	Critical	Not Protected	N	**Moderate**
Unchannelled Valley Bottoms	Mesic Highveld Grassland Group 2	N/A	Poorly Protected	Class E	Critical	Not Protected	N	**Moderate**

Depression	Mesic Highveld Grassland Group 2	Critical	Poorly Protected	Class D	Critical	Not Protected	N	**Moderate**

4.7 Buffer Requirements

It is worth noting that the scientific buffer calculation (Macfarlane *et al*., 2014) was used to determine the size of the buffer zones relevant to the proposed project. A pre-mitigation buffer zone for the PV development of 30 m is recommended for the identified wetlands, which can be decreased to 15 m with the addition of all prescribed mitigation measures (see Table 4-4).

Table 4-4 Pre- and post-mitigation buffer requirements

Aspect	Pre-Mitigation Buffer Size (m)	Post Mitigation Buffer Size (m)
PV development	30	15

5 Risk Assessment

5.1 Potential Impacts

The impact assessment considered both direct and indirect impacts, if any, to the wetland systems. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the assessment (Figure 5-1). In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in the project location, sitting, scale, layout, technology and phasing to avoid impacts. The wetlands are all located well outside the proposed site area and thus avoidance will be achieved for this project (see Figure 5-2).

Due to the fact that direct impacts to the wetlands (and buffers) can be avoided, the risk assessment will consider only indirect risks posed to the systems as a result of the project. Table 5-2 & Table 5-3 illustrates various aspects that are expected to impact upon the delineated wetlands during the respective project phases.

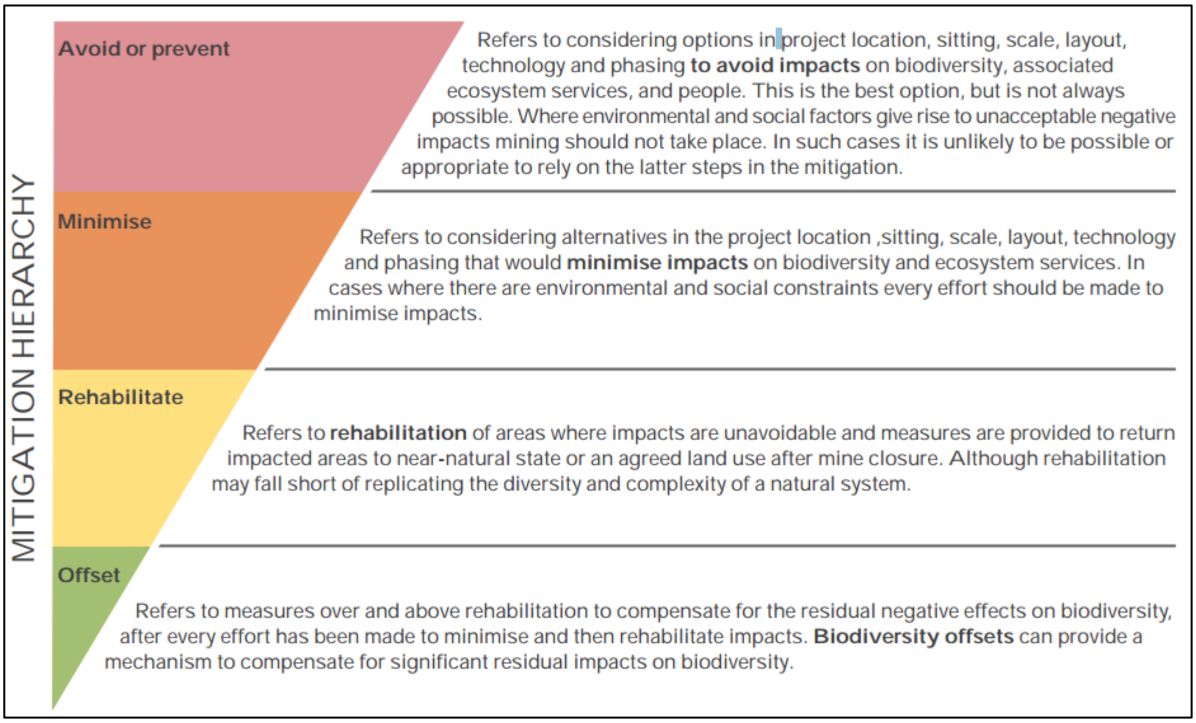

Figure 5-1 The mitigation hierarchy as described by the DEA (2013)

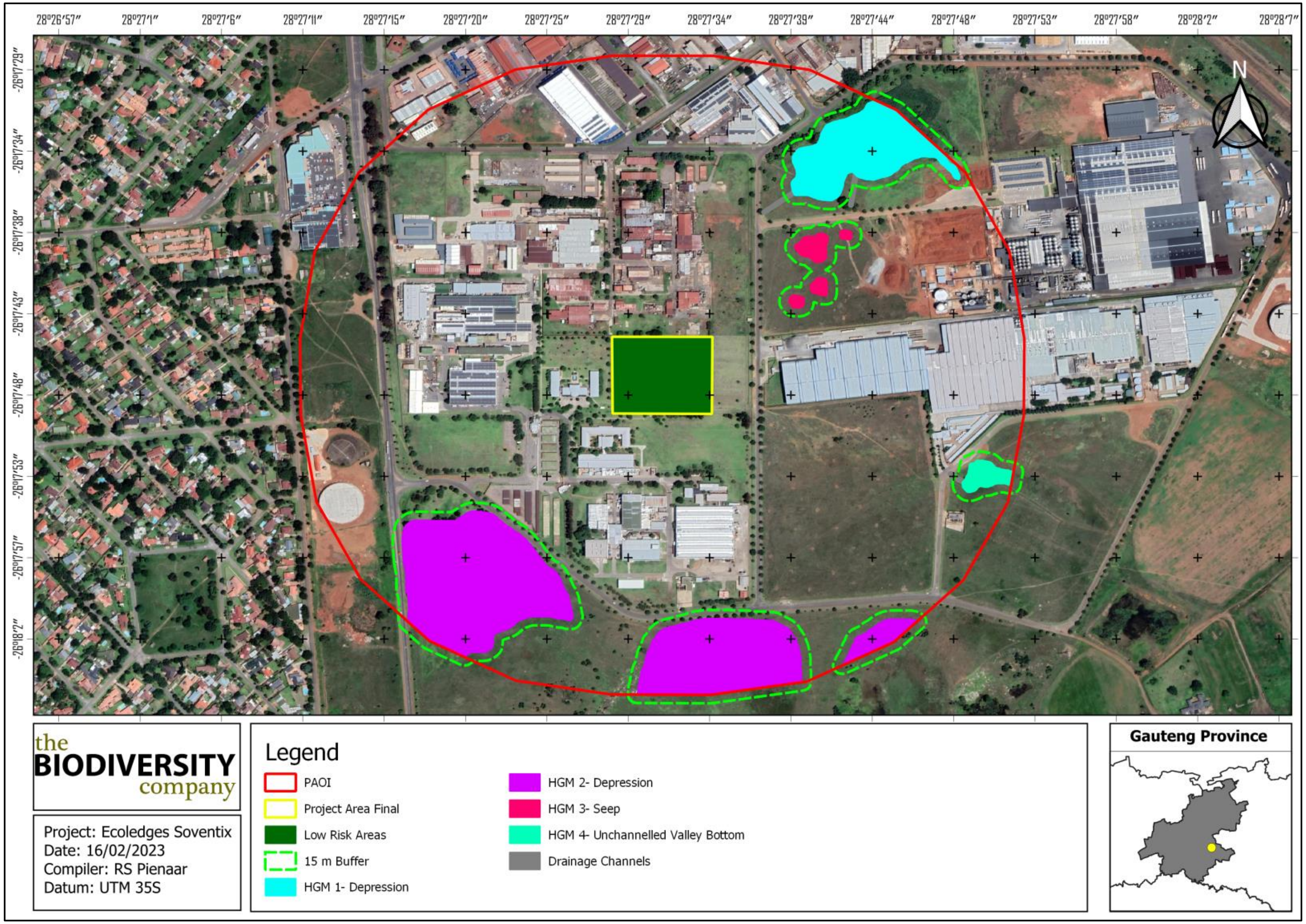

Figure 5-2 The identified risk areas

Table 5-1 Impacts assessed for the proposed project

Activity	Aspect	Impact
Construction Phase	Clearing of vegetation	• Altered surface flow dynamics; • Erosion; • Alteration of sub-surface flow dynamics; • Sedimentation of the water resource; • Indirect loss of wetland areas; • Water quality impairment; • Compaction; • Decrease in vegetation; • Change of drainage patterns; and • Altering hydromorphic properties
	Stripping and stockpiling of topsoil	
	Establish working area	
	Minor Excavations	
	Vehicle access	
	Leaks and spillages from machinery, equipment & vehicles	
	Solid waste disposal	
	Human sanitation& ablutions	
	Re-fuelling of machinery and vehicles	
	Laying of core samples	
	Backfill of material	
Operational Phase	Traffic	
	Waste Disposal	
	Altered Overflow Dynamics	
Decommissioning Phase	Removal of structures, machinery and equipment	
	Rehabilitation of site to agreed land use	

Table 5-2 DWS Risk Impact Matrix for the proposed project

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase								
Clearing of vegetation	3	1	3	3	2.5	1	4	7.5
Stripping and stockpiling of topsoil	3	1	3	3	2.5	1	4	7.5
Establish working area	1	1	1	1	1	1	1	3
Minor Excavations	1	1	1	1	1	2	2	5
Vehicle access	1	2	1	1	1.25	2	1	4.25
Leaks and spillages from machinery, equipment & vehicles	1	3	1	1	1.5	2	1	4.5
Solid waste disposal	1	2	1	1	1.25	2	1	4.25
Human sanitation& ablutions	1	3	1	1	1.5	2	1	4.5
Re-fuelling of machinery and vehicles	1	3	1	1	1.5	2	1	4.5
Laying of core samples	1	1	1	1	1	2	2	5
Backfill of material	1	1	1	1	1	2	2	5
Operational Phase								
Traffic	1	2	1	3	1,75	2	5	8,75
Waste Disposal	1	2	2	2	1,75	1	4	6,75
Altered Overflow Dynamics	1	2	2	2	1,75	1	4	6,75
Decommissioning Phase								
Removal of structures, machinery and equipment	1	2	1	2	1,5	2	1	4,5
Rehabilitation of site to agreed land use	1	2	1	2	1,5	2	1	4,5

Table 5-3 DWS Risk Impact Matrix for the proposed project continued

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase								
Clearing of vegetation	1	3	5	2	11	82.5	Moderate	Low
Stripping and stockpiling of topsoil	1	3	5	2	11	82.5	Moderate	Low
Establish working area	1	2	1	2	6	18	Low	Low
Minor Excavations	3	2	1	4	10	50	Low	Low
Vehicle access	2	2	1	2	7	29.75	Low	Low
Leaks and spillages from machinery, equipment & vehicles	2	2	1	3	8	36	Low	Low
Solid waste disposal	2	2	1	2	8	34	Low	Low
Human sanitation& ablutions	2	2	1	2	7	31.5	Low	Low
Re-fuelling of machinery and vehicles	2	2	1	2	7	31.5	Low	Low
Laying of core samples	2	2	1	2	7	35	Low	Low
Backfill of material	1	2	1	2	6	30	Low	Low
Operational Phase								
Traffic	2	1	1	1	5	43,75	Low	Low
Waste Disposal	5	1	1	1	8	54	Low	Low
Altered Overflow Dynamics	3	1	1	1	6	40,5	Low	Low
Decommissioning Phase								
Removal of structures, machinery and equipment	2	2	1	3	8	36	Low	Low
Rehabilitation of site to agreed land use	2	2	1	3	8	36	Low	Low

5.1.1 Mitigation Measures

The following general mitigation measures are provided in view of the expected Low levels of risk posed to the wetland areas:

- The wetlands and buffer areas must be avoided;
- A stormwater management plan must be compiled and implemented for the project, facilitating the diversion of clean water to the delineated resources;
- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- Laydown yards, camps and storage areas must be within project area;
- The contractors used for the project must have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces;
- All chemicals and toxicants to be used for the construction must be stored within the construction site and in a bunded area;
- All machinery and equipment must be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees must undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- Any exposed earth must be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- No dumping of material on-site may take place; and
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials must be supported.

6 Conclusion and Recommendation

6.1 Baseline Ecology

During the site assessment, four HGM units were identified and assessed within the project area of influence, it was determined that none of the HGM units can be impacted by the proposed development. Multiple drainage features flowing towards the HGM units were identified within the PAOI. These artificial wetlands do not provide any ecological function. The wetlands scored overall PES score ranging from D – “Largely Modified” to E – “Seriously Modified due to the modification to both the hydrology and vegetation of the wetlands through anthropogenic activities. The wetlands scored “Moderate” importance and sensitivity scores, predominantly attributed to the threat status of ‘Critical’. The average ecosystem service score was determined to range from “Moderately Low” to “Moderately High”. After using the wetland buffer tool, a 15 m post mitigation buffer was assigned to the wetland systems.

6.2 Risk Assessment

The risk assessment considered only the indirect impacts on the different HGM units. Since the proposed development will take place well outside the wetland buffers it is expected that the development will pose low residual risks to the systems.

6.3 Specialist Recommendation

Based on the results and conclusions presented in this report, it is expected that the proposed activities will not directly impact any wetlands.

Thus, the project was deemed to pose low residual risks on the wetland and thus no fatal flaws were identified for the project. Due to these low risks posed on the wetland a General Authorisation (GN 509 of 2016) is required for the water use authorisation for the proposed development.

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