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Ecological Specialist Services
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Aquatic Ecological Assessment Report

Proposed Expansion of Chicken Houses from approximately 30 000 to 60 000 Chickens, Bulhoek Farm, near Swartruggens, North West Province

October 2021

Compiled for:

enviro works
Today's Impact | Tomorrow's Legacy

Compiled by:

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Leave a future behind

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Executive Summary

The project applicant, Quantum Foods, currently operates twelve (12) chicken layer houses at their existing poultry farm, located between the town of Swartruggens and the city of Rustenburg, North West Province. The applicant now proposes the expansion of the poultry farm from approximately 30 000 to 60 000 chickens (rounded up), by developing eight (8) additional new layer houses and twenty (20) evaporation ponds. Six (6) of these proposed new layer houses will be constructed directly adjacent to the existing houses, while merely two (2) will be located at a separate location, at the existing facility.

The layer houses are deemed to mainly operate as isolated units from their surrounding undeveloped environments and therefore do not result in any significant or continued ecological impacts. In accordance with the information received from the farm manager during the site assessment, the layer houses only get washed out twice annually. This process constitutes the following main two steps:

- Manure and other undesired waste products are manually, thoroughly cleaned out of the layer houses and then adequately and safely removed from site, by a contracted third party (farmer). The manure is used by the external farmer for agricultural fertiliser.
- The floors of the layer houses are then additionally sprayed clean with chemically treated water, with the use of pressure hoses.
    - This is done in order to ensure complete removal and neutralisation of all undesired waste products from the layer houses.
    - In accordance with the information received from the Environmental Assessment Practitioner (EAP), only environmentally friendly biodegradable chemical products are used for this wash-out process.

In accordance with the information received from the EAP, all wash water emanating from these twice-annual layer house wash-out processes, are currently disposed of into the surrounding undeveloped environments. The wash water will however now be sufficiently isolated and channelled towards the proposed evaporation ponds. The purpose of the evaporation ponds will be to ensure adequate containment and subsequent evaporation of all wash water. This will prevent any significant wash water contact with- and potential contamination of the surrounding undeveloped environments.

The following additional information was also received from the EAP, for reporting purposes:

- Sewage and wastewater
    - Sewage generated on site, is kept in holding tanks until it is removed by a service provider.
- Waste removal
    - After the required quarantine period on the farm, chicken carcasses will be taken to the local zoo and the remaining general waste generated on site, will be disposed of at a registered landfill site.
- Water source
    - The water sources currently used on site, constitute three (3) boreholes that supply approximately 228 742.31 m^3/month. The three (3) water reservoirs currently present on site, have a capacity of approximately 100 000 litres.

Enviroworks was appointed by the applicant as the independent Environmental Assessment Practitioner (EAP), to conduct the legally required Basic Assessment (BA) process.

Due to the nature of potential ecological impacts posed by the proposed development to the local aquatic ecosystem and ecology, an aquatic ecological study is required. This is required in order to determine the potential presence of ecologically/conservationally significant or sensitive aquatic habitats, species and/or ecosystems, which may be adversely affected by the proposed development. Any potential aquatic ecological impacts associated with the proposed development, must be identified. Impact mitigation and management measures in accordance with the requirements of the National Environmental Management Act (Act 107 of 1998) Mitigation Hierarchy, must subsequently be recommended. This must be done in order to attempt to reduce/alleviate the adverse effects of identified potential aquatic ecological impacts.

EcoFocus Consulting was therefore subsequently appointed by the EAP as the independent ecological specialist, to conduct the required aquatic ecological study for the proposed development. This report constitutes the Aquatic Ecological Assessment.

A site assessment for the proposed development areas was conducted on 22 September 2021. This date forms part of the commencement of the new growing season. At the time of the site assessment, the area had however not received adequate initial rainfall yet. It must therefore be noted that the timing of the assessment was not necessarily favourable for successful identification of all plant species individuals.

Methodology

The proposed development area was assessed on foot with the use of a vehicle. Visual observations/identifications were made of aquatic habitat conditions, any aquatic ecologically sensitive/conservationally significant areas as well as relevant species present. Identified species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 as well as the Provincially Protected species of the North West Biodiversity Management Act (Act 4 of 2016): Schedule 2. Significant watercourses/wetlands found to be present within the assessment area, were identified, delineated and discussed. Georeferenced photographs were taken of any aquatic ecologically sensitive/conservationally significant areas, significant watercourses/wetlands as well as any Red Data Species Listed-, nationally- or provincially protected species if encountered, in order to indicate their specific locations in a Geographic Information System (GIS) mapping format.

Potential aquatic ecological impacts of the proposed development on the surrounding environment were identified, evaluated, rated and discussed. The Present Ecological State (PES) as well as the Ecological Importance and Sensitivity (EIS) of the identified watercourses/wetlands were also determined and discussed.

Assessment Area

The assessment area for the proposed development, constitutes the footprint areas of the eight (8) additional new chicken layer houses and the twenty (20) evaporation ponds to be constructed at the applicant's existing poultry farm, as well as surrounding areas in close/influential proximity to these footprint areas. In accordance with the information received from the EAP, the design specifications and size parameters of the proposed layer houses and evaporation ponds vary depending on their locations. The design specifications and size parameters of the most northerly situated layer house and two evaporation ponds, to be located directly to the south of the Dwarsspruit and which are most relevant to this report, are as follows. They will henceforth be discussed as chicken layer house site no 8 and evaporation ponds site no 8:

- Chicken layer house site no 8
  - 60 m long x 13.5 m wide
  - Direct surface footprint size of approximately 780 m²
- Evaporation ponds site no 8
  - 5 m long x 5 m wide and 1.2 m deep (each)
  - Direct surface footprint size of approximately 25 m² (each)

The assessment area is situated on the Farm Bulhoek No 389, which is located between the town of Swartruggens and the city of Rustenburg. The assessment area forms part of the Kgetlengrivier Local Municipality which in turn, forms part of the Bojanala Platinum District Municipality, North West Province. Access to the assessment area is obtained by way of the N 4 national highway and a subsequent dirt road from the south.

Results and Conclusion

The assessment area for the proposed development, constitutes the footprint areas of the eight (8) additional new chicken layer houses and the twenty (20) evaporation ponds to be constructed at the applicant's existing poultry farm, as well as surrounding areas in close/influential proximity to these footprint areas.

The assessment area falls within the A22D quaternary surface water catchment- and drainage area. The Dwarsspruit flows past directly adjacent north of the assessment area and continues in a north-easterly direction. No other significant watercourses, preferential water flow paths/drainage lines or wetlands were however found to be present within or in close/influential proximity to the assessment area.

The majority of the proposed additional new chicken layer houses and evaporation ponds should therefore not pose significant risk to any watercourses. Only the most northerly situated layer house site no 8 and evaporation ponds site no 8 to be located directly to the south of the Dwarsspruit, could however potentially impact on the Spruit.

The locations of the proposed additional new chicken layer houses and evaporation ponds do not fall within any provincially demarcated aquatic biodiversity/conservation priority areas, in accordance with the North West Biodiversity Spatial Plan 2015 (NWBSP), which sets out biodiversity priority areas in the province. The area directly adjacent to the north of the most northerly situated layer house site no 8 and evaporation ponds site no 8, is however categorised as a combination of mainly aquatic Critical Biodiversity Area's one and two (CBA 1 & 2) and to a lesser extent, Ecological Support Area's one and two (ESA 1 & 2). This is in accordance with the NWBSP. This relevant combination of CBA and ESA to the north of the layer house and evaporation pond, is mainly associated with the important Dwarsspruit, which flows past directly adjacent north of the assessment area as well as the accompanying ecological corridor, that runs along the Spruit.

The specific portion of the Dwarsspruit which flows past the assessment area, currently possesses a relatively narrow main active streamflow channel, but also houses a broader surrounding floodplain and riparian zone. Merely limited water flow was evident and confined to the main active streamflow channel, at the time of the site assessment. It is however expected that the usual broad, free-flowing perennial flow regime and aquatic system will return, once adequate rainfall has been received in the area.

The instream vegetation of the Spruit mainly constitutes semi-aquatic and aquatic habitat, which is mostly dominated by hydrophytic grass species. The vegetation associated with the surrounding floodplain and riparian zone, mainly constitutes a moderate-density woodland landscape, with a well-represented grass layer in more open areas, but merely sparse grasses in denser woodland areas.

In accordance with the Southern African Bird Atlas Project (SABAP) information, no Red Data Listed avifaunal species or any avifaunal species of conservational significance, are necessarily expected to be present throughout the assessment area. The combined aquatic and semi-aquatic habitat of the Dwarsspruit and its associated floodplain and riparian zone, is however highly likely utilised by various common and habitat-specific bird-, small antelope and other mammalian species, for refuge as well as breeding, foraging and/or persistence purposes. This reiterates the conservational importance/significance of the relevant combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit as well as the accompanying ecological corridor, that runs along the Spruit.

The specific portion of the Dwarsspruit which flows past the assessment area, scored a moderate Ecological Importance and Sensitivity (EIS) value and is viewed as being of moderately-high conversational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Critical Biodiversity Area (CBA) and Ecological Support Area (ESA) as well as the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

It is therefore evident from a hydrological and ecological perspective, that the Dwarsspruit forms an important part of the local and broader quaternary surface water catchment- and drainage area, towards the north-east.

It is therefore recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone.

It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.

It is presumed and reasonably expected that the design specifications and size parameters of the proposed evaporation ponds will ensure adequate containment and subsequent evaporation of the required maximum potential volumes of wash water twice annually, even during significant rainfall events. Under no circumstances may overflow or spillage of wash water and subsequent potential contamination of the surrounding undeveloped environment and Dwarsspruit, take place.

It is however recommended that only environmentally friendly biodegradable chemical products may be used for the twice-annual evaporation pond wash-out process, as far as practicably possible.

The proposed evaporation ponds must also be sufficiently lined, in accordance with the relevant minimum norms and standards, in order to prevent undesired seepages or leaks into the groundwater.

Conclusion

Transformation of an aquatic Critical Biodiversity Area (CBA) and Ecological Support Area (ESA); Disturbance of-/damage to aquatic and semi-aquatic faunal habitats, associated with the Dwarsspruit as well as Contamination/eutrophication of groundwater, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the proposed development.

These potential long-term aquatic ecological impacts identified for the proposed development, could therefore potentially add moderate to moderately-high cumulative impact to existing negative impacts caused by the sporadic presence of existing agricultural developments, along the localised length of the Dwarsspruit.

It is however the opinion of the specialist, by application of the NEMA Mitigation Hierarchy, that all the identified potential aquatic ecological impacts associated with the proposed development, can be suitably reduced and mitigated to within acceptable residual levels, by implementation of the recommended mitigation measures. It is therefore not anticipated that the proposed development will necessarily add any significant residual aquatic ecological impacts to the surrounding environment or Dwarsspruit, if all the recommended mitigation measures as per this aquatic ecological report are adequately implemented and managed, for both the construction and operational phases of the proposed development.

It is the opinion of the specialist that the proposed development of the eight (8) additional new layer houses and twenty (20) evaporation ponds, should be considered by the competent authority for Environmental Authorisation and approval. All recommended mitigation measures as per this aquatic ecological report must however be adequately implemented and managed for both the construction and operational phases of the proposed development. All necessary authorisations, permits and licenses must also be obtained prior to the commencement of any construction.

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Abbreviations

BA	Basic Assessment
CBA	Critical Biodiversity Area
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
MAP	Mean Annual Precipitation
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEMA	National Environmental Management Act (Act 107 of 1998)
NFA	National Forests Act (Act 84 of 1998)
NWA	National Water Act (Act 36 of 1998)
NWBSP	North West Biodiversity Spatial Plan 2015
PES	Present Ecological State

Declaration of Independence

I, Adriaan Johannes Hendrikus Lamprecht, ID 870727 5043 083, declare that I:

- am the Director and Ecological Specialist of EcoFocus Consulting (Pty) Ltd
- act as an independent specialist consultant in the field of botany and ecology
- am assigned as the Ecological Specialist consultant by the Environmental Assessment Practitioner (EAP), Enviroworks, for the proposed development
- do not have or will not have any financial interest in the undertaking of the proposed project activity other than remuneration for work as stipulated in the Purchase Order terms of reference
- confirm that remuneration for my services relating to the proposed development is not linked to approval or rejection of the project by the competent authority
- have no interest in secondary or subsequent developments as a result of the authorisation of the proposed project
- have no and will not engage in any conflicting interests in the undertaking of the activity
- undertake to disclose to the applicant and the competent authority any information that has or may have the potential to influence the decision of the competent authority
- will provide the applicant and competent authority with access to all relevant project information in my possession whether favourable or not

AJH Lamprecht

Signature

1. Introduction

The project applicant, Quantum Foods, currently operates twelve (12) chicken layer houses at their existing poultry farm, located between the town of Swartruggens and the city of Rustenburg, North West Province. The applicant now proposes the expansion of the poultry farm from approximately 30 000 to 60 000 chickens (rounded up), by developing eight (8) additional new layer houses and twenty (20) evaporation ponds. Six (6) of these proposed new layer houses will be constructed directly adjacent to the existing houses, while merely two (2) will be located at a separate location, at the existing facility.

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Due to the nature of potential ecological impacts posed by the proposed development to the local aquatic ecosystem and ecology, an aquatic ecological study is required. This is required in order to determine the potential presence of ecologically/conservationally significant or sensitive aquatic habitats, species and/or ecosystems, which may be adversely affected by the proposed development. Any potential aquatic ecological impacts associated with the proposed development, must be identified. Impact mitigation and management measures in accordance with the requirements of the National Environmental Management Act (Act 107 of 1998) Mitigation Hierarchy, must subsequently be recommended. This must be done in order to attempt to reduce/alleviate the adverse effects of identified potential aquatic ecological impacts.

EcoFocus Consulting was therefore subsequently appointed by the EAP as the independent ecological specialist, to conduct the required aquatic ecological study for the proposed development. This report constitutes the Aquatic Ecological Assessment.

Preliminary preparations conducted prior to the aquatic ecological site assessment, were as follows:

- Georeferenced spatial information was obtained of the proposed development areas, in order to determine the direct impact footprint areas.
- A desktop study was conducted of the most up-to-date information/data available on the relevant vegetation types, national/provincial conservation significance status as well as surface water catchment- and drainage, associated with the proposed development areas.

2. Date and Season of Aquatic Ecological Site Assessment

A site assessment for the proposed development areas was conducted on 22 September 2021. This date forms part of the commencement of the new growing season. At the time of the site assessment, the area had however not received adequate initial rainfall yet. It must therefore be noted that the timing of the assessment was not necessarily favourable for successful identification of all plant species individuals.

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3. Assessment Rational

South Africa is a country rich in natural resources and splendour and is rated as having some of the highest biodiversity in the world. South Africa is however also a semi-arid and very water scares country. Any potentially significant negative impacts on the ecological integrity, -functionality and/or -services provided by our important water resources, which could pose a potential threat to national, provincial or even local water security, should therefore be prevented, as far as practicably possible.

Other than the pure aesthetic value which our biodiversity and natural resources provides, it also plays a significant positive role in our national economy. While continuous economic development and progress is a key national focus area, which forms a cornerstone in the socio-economic improvement of society and the livelihoods of communities and individuals, the preservation and management of the integrity and sustainability of our natural resources is also essential in achieving this objective.

Socio-economic development and progress can therefore not be completely inhibited for the sake of ensuring environmental conservation, therefore solutions and compromises rather need to be explored in order to achieve the need for socio-economic development without unreasonably jeopardising the needs of environmental conservation. A sustainable and responsible balance needs to be maintained in order to accommodate the requirements of both.

Adequate, sustainable and responsible utilisation and management of our natural resources is crucial. Finding the required balance between socio-economic development and environmental conservation, should therefore always be a priority focus point during any proposed development process.

Various environmental legislation in South Africa makes provision for the protection of our natural resources and the functionality of ecological systems in order to ensure sustainability. Such acts include the National Environmental Management: Biodiversity Act (Act 10 of 2004), National Forests Act (Act 84 of 1998), Conservation of Agricultural Resources Act (Act 43 of 1983), National Water Act (Act 36 of 1998) and framework legislation such as the National Environmental Management Act (Act 10 of 2004).

An Aquatic Ecological Assessment of the proposed development areas was therefore conducted in order to identify and quantify any potential aquatic ecological impacts, associated with the proposed development.

4. Objectives of the Assessment

- Identify, delineate and discuss any significant watercourses/wetlands and/or aquatic ecologically sensitive/conservationally significant areas, if found to be present within or in close/influential proximity to the assessment area.
    - The delineations will not include formal 1:100-year floodline calculations, as this is deemed to be an engineering function.
- Assess and discuss the Present Ecological State (PES) of the identified watercourses/wetlands, in order to provide an indication of the current ecological condition as well as the extent and severity of degradation and/or transformation of the watercourses/wetlands, if applicable.
- Assess and discuss the Ecological Importance and Sensitivity (EIS) of the identified watercourses/wetlands, in order to provide an indication of the ecological sensitivity/conservational significance of the identified watercourses/wetlands.
- Identify, evaluate, rate and discuss any potential aquatic ecological impacts, associated with the proposed development.
    - Provide recommendations on impact mitigation and management measures in accordance with the requirements of the NEMA (Act 107 of 1998) Mitigation Hierarchy, in order to attempt to reduce/alleviate the adverse effects of identified potential aquatic ecological impacts.
- Provide recommendations on the aquatic ecological suitability/acceptability of the assessment area, for the proposed development.
- A digital report (this document) as well as digital .KML files will be provided to the EAP, of any significant watercourses/wetlands and/or aquatic ecologically sensitive/conservationally significant areas, if found to be present within or in close/influential proximity to the assessment area.

5. Methodology

- The proposed development areas were assessed on foot and with the use of a vehicle.
- Visual observations/identifications were made of aquatic habitat conditions, any aquatic ecologically sensitive/conservationally significant areas as well as relevant species present.
- Identified species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 as well as the Provincially Protected species of the North West Biodiversity Management Act (Act 4 of 2016): Schedule 2.
- Significant watercourses/wetlands found to be present within the assessment area, were identified, delineated and discussed as per the methodology described below:
    - For the purposes of this investigation a wetland was defined according to the definition in the National Water Act (Act 36 of 1998) as: "land which is transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which in normal circumstances, supports or would support vegetation typically adapted to life in saturated soil."
    - In 2005 DWAF published a wetland delineation procedure in a guideline document titled "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas". Guidelines for the undertaking of biodiversity assessments exist. These guidelines contain a number of stipulations relating to the protection of wetlands and the undertaking of wetland assessments.
    - The wetland delineation procedure identifies the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas. This constitutes the part of the wetland that might remain flooded or saturated close to the soil surface for only a few weeks in the year, but long enough to develop anaerobic conditions and determine the nature of the plants growing in the soil.
    - The guidelines also state that the locating of the outer edge of the temporary zone must make use of four specific indicators namely:
        - terrain unit indicator
        - soil form indicator
        - soil wetness indicator
        - vegetation indicator

- In addition, the wetland/watercourse and a protective buffer zone beginning from the outer edge of the wetland temporary zone, was designated as sensitive in a sensitivity map. The guidelines stipulate buffers to be delineated around the boundary of a wetland. An adequate protective buffer zone, beginning from the outer edge of the wetland temporary zone, was implemented and designated as sensitive within which no development must be allowed to occur.

- Georeferenced photographs were taken of any aquatic ecologically sensitive/conservationally significant areas, significant watercourses/wetlands as well as any Red Data Species Listed-, nationally- or provincially protected species if encountered, in order to indicate their specific locations in a Geographic Information System (GIS) mapping format.

The **Present Ecological State (PES)** of the identified watercourses/wetlands was assessed and discussed as per the table below.

- The Present Ecological State (PES) refers to the current state or condition of an area in terms of all its characteristics and reflects the change to the area from its reference condition. The value gives an indication of the alterations that have occurred in the ecosystem.

Table 1: Criteria for PES calculations

Ecological Category	Score	Description
A	> 90-100%	**Unmodified**, natural and pristine.
B	> 80-90%	**Largely natural**. A small change in natural habitats and biota may have taken place but the ecosystem functionality has remained essentially unchanged.
C	> 60-80%	**Moderately modified**. Moderate loss and transformation of natural habitat and biota have occurred, but the basic ecosystem functionality has still remained predominantly unchanged.
D	> 40-60%	**Largely modified**. A significant loss of natural habitat, biota and subsequent basic ecosystem functionality has occurred.
E	> 20-40%	**Seriously modified**. The loss of natural habitat, biota and basic ecosystem functionality is extensive.
F	0-20%	**Critically/Extremely modified**. Transformation has reached a critical level and the ecosystem has been modified completely with a virtually complete loss of natural habitat and biota. The basic ecosystem functionality has virtually been destroyed and the transformation is irreversible.

The **Ecological Importance and Sensitivity (EIS)** of the identified watercourses/wetlands was assessed and discussed as per the table below.

- The Ecological Importance and Sensitivity (EIS) of an area is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Both abiotic and biotic components of the system are taken into consideration. Sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance, once it has occurred.

Table 2: Criteria for EIS calculations

EIS Categories	Score	Description
Low/Marginal	**D**	Not ecologically important and/or sensitive on any scale. Biodiversity is ubiquitous and not unique or sensitive to habitat modifications.
Moderate	**C**	Ecologically important and sensitive on local or possibly provincial scale. Biodiversity is still relatively ubiquitous and not usually sensitive to habitat modifications.
High	**B**	Ecologically important and sensitive on provincial or possibly national scale. Biodiversity is relatively unique and may be sensitive to habitat modifications.
Very High	**A**	Ecologically important and sensitive on national and possibly international scale. Biodiversity is very unique and sensitive to habitat modifications.

Potential aquatic ecological impacts posed by the proposed development to the local aquatic ecosystem and ecology, were identified, evaluated, rated and discussed as per the methodology described below. The tables below indicate and explain the methodology and criteria used for the evaluation of the Environmental Risk Ratings as well as the calculation of the final Environmental Significance Ratings of the identified potential aquatic ecological impacts. Each identified potential aquatic ecological impact is scored for each of the Evaluation Components, as per the table below.

Table 3: Scale utilised for the evaluation of the Environmental Risk Ratings

Evaluation Component	Rating Scale and Description/Criteria
Magnitude of Negative or Positive Impact	**10 - Very high**: Bio-physical features and/or ecological functionality/processes may be severely impacted upon. **8 - High**: Bio-physical features and/or ecological functionality/processes may be significantly impacted upon. **6 - Medium**: Bio-physical features and/or ecological functionality/processes may be moderately impacted upon. **4 - Low**: Bio-physical features and/or ecological functionality/processes may be slightly impacted upon. **2 - Very Low**: Bio-physical features and/or ecological functionality/processes may be slightly impacted upon. **0 - Zero**: Bio-physical features and/or ecological functionality/processes will not be impacted upon.
Duration of Negative or Positive Impact	**5 – Permanent**: Impact will continue on a permanent basis. **4 - Long term**: Impact should cease a period (> 40 years) after the operational phase/project life of the activity. **3 - Medium term**: Impact may occur for the period of the operational phase/project life of the activity. **2 - Short term**: Impact may only occur during the construction phase of the activity after which it will cease. **1 - Immediate**: Impact may only occur as a once off during the construction phase of the activity.
Extent of Positive or Negative Impact	**5 - International**: Impact will extend beyond National boundaries. **4 - National**: Impact will extend beyond Provincial boundaries but remain within National boundaries. **3 - Regional**: Impact will extend beyond 5 km of the development footprint but remain within Provincial boundaries. **2 - Local**: Impact will not extend beyond 5 km of the development footprint. **1 - Site-specific**: Impact will only occur on or within 200 m of the development footprint. **0 –** No impact.
Irreplaceability of Natural Resources being impacted upon	**5 – Definite** loss of irreplaceable natural resources. **4 – High** potential for loss of irreplaceable natural resources. **3 – Moderate** potential for loss of irreplaceable natural resources. **2 – Low** potential for loss of irreplaceable natural resources. **1 – Very low** potential for loss of irreplaceable natural resources. **0 –** No impact.

Reversibility of Impact	**5 –** Impact **cannot** be reversed. **4 – Low** potential that impact may be reversed. **3 – Moderate** potential that impact may be reversed. **2 – High** potential that impact may be reversed. **1 –** Impact **will be** reversible. **0 –** No impact.
Probability of Impact Occurrence	**5 - Definite**: Probability of impact occurring is > 95 %. **4 - High**: Probability of impact occurring is > 75 %. **3 - Medium**: Probability of impact occurring is between 25 % - 75 %. **2 - Low**: Probability of impact occurring is between 5 % - 25 %. **1 - Improbable**: Probability of impact occurring is < 5 %.
Cumulative Impact	**High**: Numerous similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts. **Medium**: Few similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts. **Low**: Virtually no similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts. The development is anticipated to be an isolated occurrence and should therefore have a negligible cumulative impact. **None**: No cumulative impact.

Once the Environmental Risk Ratings have been evaluated for each identified potential aquatic ecological impact, the Significance Score of each impact is calculated by using the following formula:

- **SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**
- **The maximum Significance Score value is 150.**

The Significance Score is then used to rate the Environmental Significance of each identified potential aquatic ecological impact, as per Table 4 below. The Environmental Significance rating process is completed for all identified potential aquatic ecological impacts for the construction- and subsequent operational phases of the proposed development, both before and after implementation of the recommended mitigation measures.

Table 4: Scale used for the evaluation of the Environmental Significance Ratings

Environmental Significance Score	Environmental Significance Rating	Description/Criteria
125 – 150	Very High	An impact of very high significance after mitigation will mean that the development may not take place. The impact cannot be suitably reduced and mitigated to within acceptable levels.
100 – 124	High	An impact of high significance after mitigation should influence a decision about whether or not to proceed with the development. Additional, impact-specific mitigation measures must be implemented if the continuation of the development is to be considered.
75 – 99	Medium-High	Additional, impact-specific mitigation measures must be implemented for an impact of medium-high significance if the continuation of the development is to be considered.
50 – 74	Medium	An impact of medium significance after mitigation must be adequately managed in accordance with the mitigation measures provided by the specialist.
< 50	Low	If any mitigation measures are provided by the specialist for an impact of low significance after mitigation, the impact must be adequately managed in accordance with these measures.
+	Positive impact	A positive impact is likely to result in a beneficial consequence/effect and should therefore be viewed as a motivation for the development to proceed.

6. Assessment Area

The assessment area for the proposed development, constitutes the footprint areas of the eight (8) additional new chicken layer houses and the twenty (20) evaporation ponds to be constructed at the applicant's existing poultry farm, as well as surrounding areas in close/influential proximity to these footprint areas. In accordance with the information received from the EAP, the design specifications and size parameters of the proposed layer houses and evaporation ponds vary depending on their locations. The design specifications and size parameters of the most northerly situated layer house and two evaporation ponds, to be located directly to the south of the Dwarsspruit and which are most relevant to this report, are as follows. They will henceforth be discussed as chicken layer house site no 8 and evaporation ponds site no 8:

- Chicken layer house site no 8
    - 60 m long x 13.5 m wide
    - Direct surface footprint size of approximately 780 m²
- Evaporation ponds site no 8
    - 5 m long x 5 m wide and 1.2 m deep (each)
    - Direct surface footprint size of approximately 25 m² (each)

The assessment area is situated on the Farm Bulhoek No 389, which is located between the town of Swartruggens and the city of Rustenburg. The assessment area forms part of the Kgetlengrivier Local Municipality which in turn, forms part of the Bojanala Platinum District Municipality, North West Province. Access to the assessment area is obtained by way of the N 4 national highway and a subsequent dirt road from the south.

See locality map below (see A3 sized map in the Appendices).

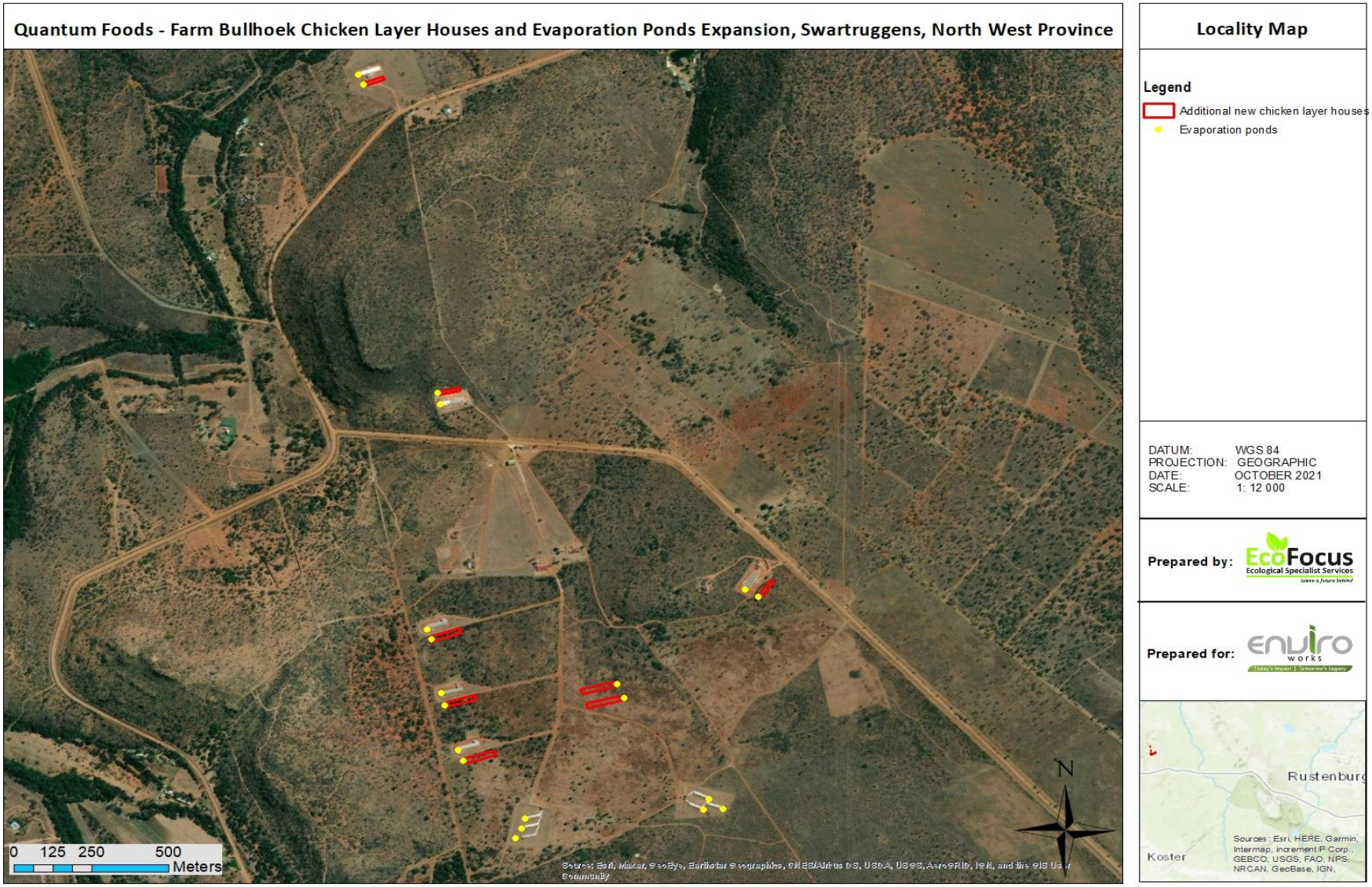

Figure 1: Locality map illustrating the assessment area

6.1. Climate

The rainfall of the region peaks during the summer months and the Mean Annual Precipitation (MAP) of the area is approximately 663 mm (www.climate-data.org). The maximum average monthly temperature is approximately 23.7°C in the summer months while the minimum average monthly temperature is approximately 11.5°C during the winter. Maximum daily temperatures can reach up to 30.5°C in the summer months and dip to as low as 2.3°C during the winter.

6.2. Geology and Soils

According to Mucina & Rutherford (2006) the main geology of the landscape and associated vegetation type can be described as the following:

The assessment area is mainly covered by shales, quartzites and andesites of the Pretoria Group (Transvaal Supergroup). Stoney shallow soils of the Glenrosa and Mispah soil forms are mostly present, while land types mainly include Fb, Ib and Ae.

6.3. Vegetation Type and Aquatic Conservation Status

Vegetation Type

According to SANBI (2006-2019), the entire assessment area and broader surrounding landscape fall within the Dwarsberg-Swartruggens Mountain Bushveld vegetation type (SVcb 4). This vegetation type mainly consists of rocky low to medium height hills and ridges, with steep faces in certain areas. Variable vegetation structure is evident depending on slope, exposure, aspect and local habitat. Various combinations of tree and shrub layers and species, often also housing dense grass layers. Bush clumps also occur frequently. This vegetation type is classified as Least Concerned (SANBI, 2006-2019).

Aquatic Conservation Status

The locations of the proposed eight (8) additional new chicken layer houses and twenty (20) evaporation ponds do not fall within any provincially demarcated aquatic biodiversity/conservation priority areas, in accordance with the North West Biodiversity Spatial Plan 2015 (NWBSP), which sets out biodiversity priority areas in the province.

The area directly adjacent to the north of the most northerly situated layer house site no 8 and evaporation ponds site no 8, is however categorised as a combination of mainly aquatic Critical Biodiversity Area's one and two (CBA 1 & 2) and to a lesser extent, Ecological Support Area's one and two (ESA 1 & 2). This is in accordance with the NWBSP. CBA 1 are areas that are deemed irreplaceable or near-irreplaceable for meeting biodiversity targets. There are no or very few other options for meeting biodiversity targets for the features associated with the site (Collins, 2018). CBA 2 are areas that have been selected as the best option for meeting biodiversity targets based on complementarity, efficiency and/or avoidance of conflict with other land or resource uses (Collins, 2018). ESA are areas that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area, or to generate or deliver ecosystem services, or to meet remaining biodiversity targets for ecosystem types or species, when it is not possible or not necessary to meet them in natural or near-natural areas (Collins, 2018).

This relevant combination of CBA and ESA to the north of the layer house and two evaporation ponds, is mainly associated with the important Dwarsspruit, which flows past directly adjacent north of the assessment area as well as the accompanying ecological corridor, that runs along the Spruit.

See vegetation- and aquatic conservation status maps below (see A3 sized maps in the Appendices).

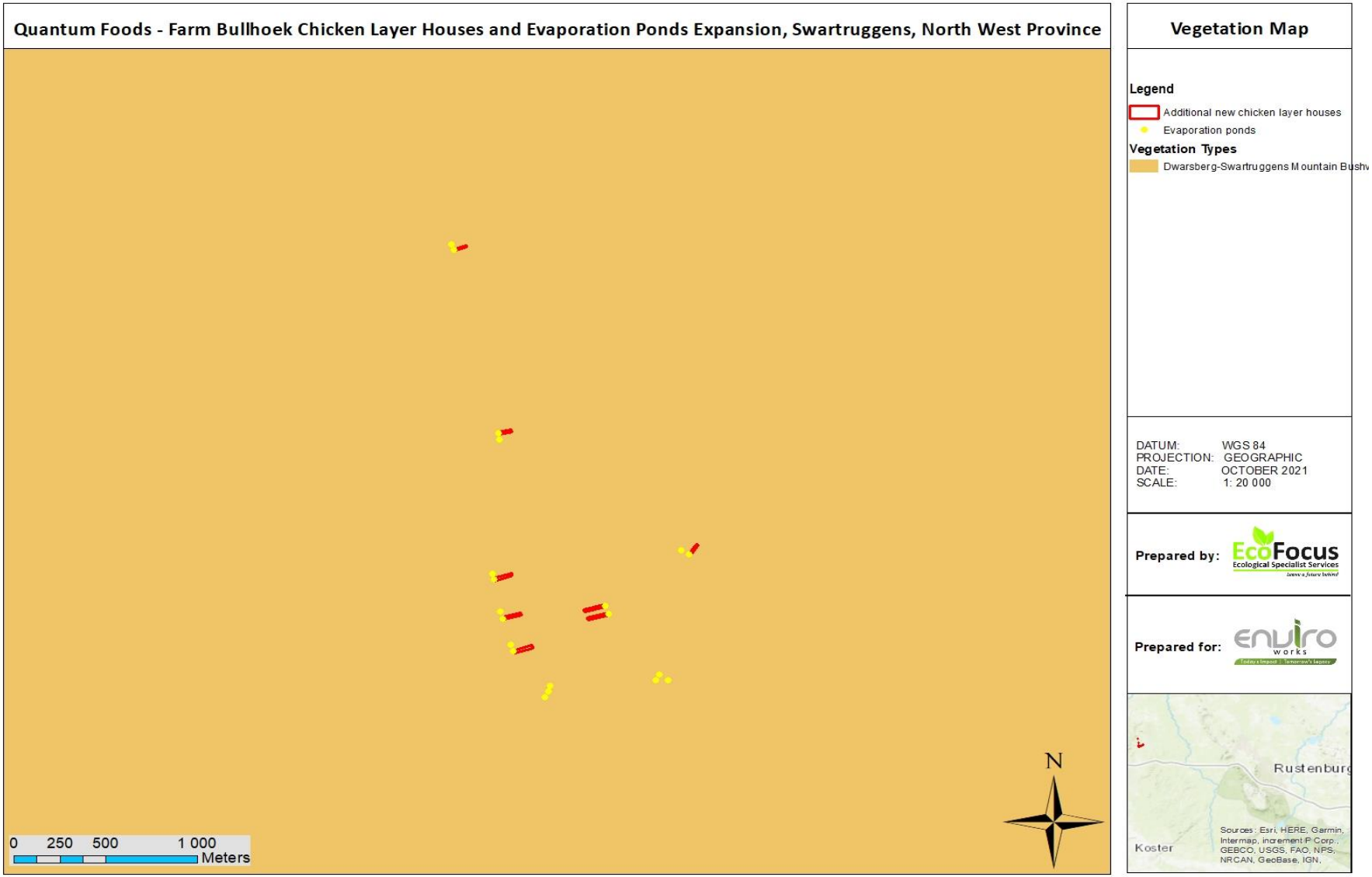

Figure 2: Vegetation map illustrating the vegetation type associated with the assessment area

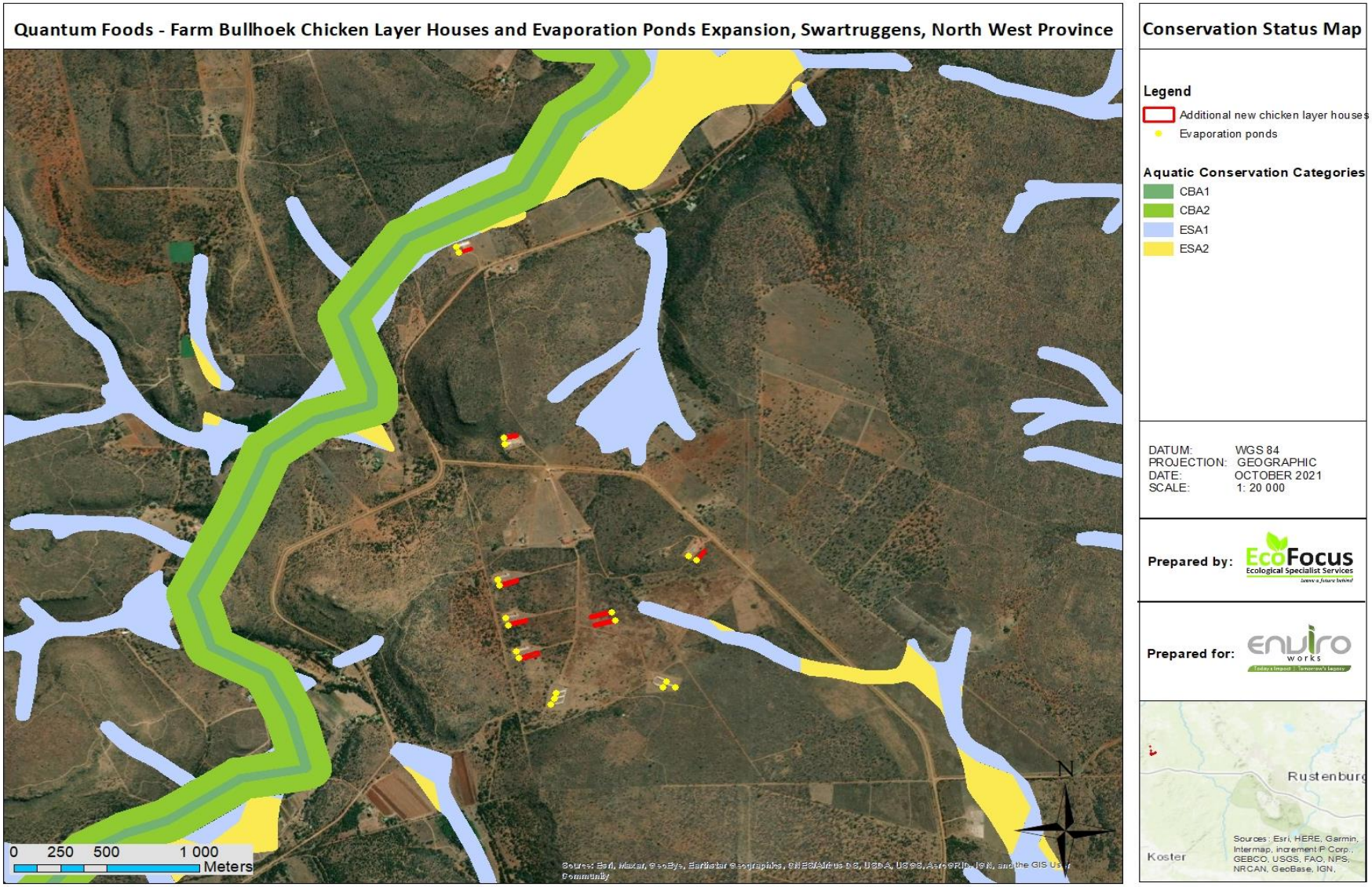

Figure 3: Aquatic conservation status map illustrating the aquatic conservation categories associated with the assessment area

7. Assumptions, Uncertainties and Gaps in Knowledge

Various assumptions need to be made during the assessment process, at the hand of the relevant specialist. It is therefore assumed that:

- all relevant project information provided to the ecological specialist by the EAP, was correct and valid at the time that it was provided.
- the proposed development areas as provided by the EAP, are correct and will not be significantly deviated from, as these were the only areas assessed.
- strategic level investigations undertaken by the applicant prior to the commencement of the Basic Assessment process, determined that the proposed development areas represent potentially suitable and technically acceptable locations.
- the public, local communities, relevant organs of state and surrounding landowners will receive a sufficient reoccurring opportunity to participate and comment on the proposed development during the Basic Assessment process, through the provision of adequately facilitated public participation interventions and timeframes as stipulated in the NEMA: EIA Regulations, 2014.
- the need and desirability of the proposed development is based on strategic national, provincial and local plans and policies, which reflect the interests of both statutory and public viewpoints.
- the BA process is a project-level framework and the specialists are limited to assessing the anticipated environmental impacts, associated with the construction and operational phases of the proposed development.
- it is assumed that strategic level decision making by the relevant authorities will be conducted through cooperative governance principles, with the consideration of environmentally sustainable and responsible development principles underpinning all decision making.
- in accordance with the information received from the farm manager during the site assessment, the layer houses only get washed out twice annually.
- in accordance with the information received from the Environmental Assessment Practitioner (EAP), only environmentally friendly biodegradable chemical products are used for this wash-out process.
- it is presumed and reasonably expected that the design specifications and size parameters of the proposed evaporation ponds will ensure adequate containment and subsequent evaporation of the required maximum potential volumes of wash water twice annually, even during significant rainfall events.

Given that an BA involves prediction, the uncertainty factor forms part of the assessment process. Two types of uncertainty are associated with the BA process, namely process-related and prediction-related.

- Uncertainty of prediction is critical at the data collection phase as observations, recommendations and conclusions are made, solely based on professional specialist opinion. Final certainty will only be obtained upon actual implementation of the proposed development. Adequate research, specialist experience and expertise should however minimise this uncertainty.
- Uncertainty of relevant decision making relates to the interpretation of provided information by relevant authorities during the BA process. Continual two-way communication and coordination between EAP's and relevant authorities should however decrease the uncertainty of subjective interpretation. The importance of widespread/comprehensive consultation towards minimising the risk/possibility of omitting significant information and impacts is further stressed. The use of quantitative impact significance rating formulas (as utilised in this document) can further standardise the objective interpretation of results and limit the occurrence and scale of uncertainty and subjectivity.
- The principle of human nature provides for uncertainties and unpredictability with regards to the socio-economic impacts of the proposed development and the subsequent public reaction/opinion, which will be received during the Public Participation Process (PPP)

Gaps in knowledge can be attributed to:

- The aquatic ecological assessment process was undertaken prior to the availing of certain information, which would only be derived from the final development design and layout. The design layout for the proposed development, had not been finalised yet at the time of the ecological assessment.
- It must be noted that the timing of the assessments was not necessarily favourable for successful identification of all plant species individuals.
- The broader region surrounding the assessment area constitutes a vast, continuous undeveloped natural landscape.

EcoFocus Consulting is an independent ecological specialist company. All information and recommendations as per this report are therefore provided in a fair and unbiased/objective manner and are based on the qualitative data gathered and professional specialist opinion.

8. Results and Discussion

8.1. Catchment and Watercourse Baseline Information

The assessment area falls within the A22D quaternary surface water catchment- and drainage area. The Dwarsspruit flows past directly adjacent north of the assessment area and continues in a north-easterly direction. No other significant watercourses, preferential water flow paths/drainage lines or wetlands were however found to be present within or in close/influential proximity to the assessment area.

The majority of the proposed additional new chicken layer houses and evaporation ponds should therefore not pose significant risk to any watercourses. Only the most northerly situated layer house site no 8 and evaporation ponds site no 8 to be located directly to the south of the Dwarsspruit, could however potentially impact on the Spruit.

The Dwarsspruit will therefore be discussed as the only significant watercourse, which could potentially be impacted upon by the construction- and operational phases of the proposed development. The following baseline watercourse information and categorisation is applicable to the specific portion of the Dwarsspruit, which flows past the assessment area, in accordance with the latest South African National Biodiversity Assessment of 2018 (Van Deventer *et al*., 2019):

- River order = First-order river; fourth-order watercourse
- Flow = Permanent or seasonal (merely limited water flow was evident and confined to the narrow main active streamflow channel of the spruit, at the time of the site assessment)
- Geomorphic zone = Upper foothills
- River condition = A combination of unmodified, natural and largely natural with few modifications
- Present Ecological State (PES), 2018 = Class C (Moderately Modified)
- Ecosystem Threat Status (ETS), 2018 = Critically Endangered (CR)
- Ecosystem Protection Level (EPL), 2018 = Poorly Protected (PP)

It is therefore evident from a hydrological perspective, that the Dwarsspruit forms an important part of the local and broader quaternary surface water catchment- and drainage area, towards the north-east.

8.2. Current Existing Vegetation and Site Description

8.2.1. Proposed Development Area

The proposed development area of the additional new layer house site no 8 and evaporation ponds site no 8 constitutes a slightly sloping landscape to the north, towards the Dwarsspruit. Due to the presence of the existing chicken layer house directly to the south of the Dwarsspruit, the proposed locations of layer house site no 8 and evaporation ponds site no 8 as well as the localised surrounding area, have been mechanically cleared of virtually all naturally occurring indigenous vegetation. This cleared area is also continually manually maintained as such and is therefore virtually devoid of any naturally occurring indigenous vegetation, on a permanent basis. The mechanical clearance associated with the proposed development of the layer house site no 8 and evaporation ponds site no 8, will therefore not result in any further transformation of naturally occurring indigenous vegetation.

It must be noted that a portion of this cleared area falls within the relevant combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit as well as the accompanying ecological corridor, that runs along the Spruit.

See photograph below:

Figure 4: Image illustrating the locations of the proposed additional new layer house site no 8 and evaporation ponds site no 8 to the south of the Dwarsspruit as well as the localised surrounding area, which have been mechanically cleared of virtually all naturally occurring indigenous vegetation; this cleared area is also continually manually maintained as such

8.2.2. Dwarsspruit

The specific portion of the Dwarsspruit which flows past the assessment area, currently possesses a relatively narrow main active streamflow channel, but also houses a broader surrounding floodplain and riparian zone. Merely limited water flow was evident and confined to the main active streamflow channel, at the time of the site assessment. It is however expected that the usual broad, free-flowing perennial flow regime and aquatic system will return, once adequate rainfall has been received in the area.

The instream vegetation of the Spruit mainly constitutes semi-aquatic and aquatic habitat, which is mostly dominated by hydrophytic grass species such as *Typha capensis, Cyperus spp.* and *Paspalum dilatatum.* Other hydrophytic grass species also found to be well-represented along the main active streamflow channel include *Phragmites australis, Panicum maximum, Cynodon dactylon* and *Eragrostis spp.*

The vegetation associated with the surrounding floodplain and riparian zone, mainly constitutes a moderate-density woodland landscape, with a well-represented grass layer in more open areas, but merely sparse grasses in denser woodland areas. The grass layer mainly consists of the species *Eragrostis spp., Cynodon dactylon* and *Panicum maximum.* The sparseness of the grass layer in the denser woodland areas, is mainly attributed to the lack of adequate sunlight penetration and exposure.

The woodland landscape mainly houses medium-height to large tree individuals of the species *Searsia lancea, S leptodictya, Salix mucronata, Combretum erythrophyllum, C zeyheri, C molle, Vachellia robusta, V karroo, Ziziphus mucronata, Englerophytum magalismontanum, Kiggelaria africana, Ozoroa paniculosa, Pappea capensis, Spirostachys africana*.

The succulent species *Aloe grandidentata* was found to be well-represented, while the species *Aloe marlothii* and the legally declared invasive species *Opuntia ficus-indica* (Category 1b) were merely found to be very sparsely present. It is recommended that all individuals of the identified alien invasive species must be actively eradicated from the Dwarsspruit, in accordance with the National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014. Removed materials must also be adequately disposed of.

See photographs below.

Figure 5: Image illustrating an example of the current relatively narrow main active streamflow channel of the Dwarsspruit, where merely limited water flow was evident, at the time of the site assessment; the instream vegetation mainly constitutes semi-aquatic and aquatic habitat

Figure 6: Two images illustrating examples of the broader floodplain and riparian zone surrounding the Dwarsspruit; the moderate-density woodland landscape is also evident

In accordance with the Southern African Bird Atlas Project (SABAP) information, no Red Data Listed avifaunal species or any avifaunal species of conservational significance, are necessarily expected to be present throughout the assessment area. The combined aquatic and semi-aquatic habitat of the Dwarsspruit and its associated floodplain and riparian zone, is however highly likely utilised by various common and habitat-specific bird-, small antelope and other mammalian species, for refuge as well as breeding, foraging and/or persistence purposes. This reiterates the conservational importance/significance of the relevant combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit as well as the accompanying ecological corridor, that runs along the Spruit.

The chicken layer houses are deemed to mainly operate as isolated units from their surrounding undeveloped environments and therefore do not result in any significant or continued ecological impacts. The mechanical air conditioning and ventilation system of the existing layer house situated directly to the south of the Dwarsspruit, however emits continuous low frequency sound/noise. If layer house site no 8 is to be developed within close proximity to the Dwarsspruit and its associated floodplain and riparian zone, the temporary noise emitted by the construction processes as well as the subsequent continued additional noise emissions of the ventilation system during the operational phase, could potentially cause undesired disturbance and have a negative impact on the habitat-specific faunal species, which utilise the floodplain and riparian zone.

8.3. Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

Table 5: PES table for the Dwarsspruit (0-5 indicates decrease in significance)

Criteria & Attributes	Relevance	Score	Reasoning
Flow Modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime, volumes, velocity which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota.	3	Agricultural developments are sporadically present along the localised length of the Dwarsspruit. Such developments tend to cause moderate contamination of watercourse systems through organic and inorganic eutrophication, chemical herbicide and pesticide washaway and erosion runoff. The development of the proposed additional new chicken layer house site no 8 and evaporation ponds site no 8, must however take place outside the recommended minimum buffer zone, from the main active streamflow channel of the Dwarsspruit. It is the opinion of the specialist that this recommended buffer zone should be sufficient in preventing any potential significant future disturbance of- or ecological interaction between the aquatic and semi-aquatic habit and system of the Dwarsspruit and the daily operations of the proposed development.
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	5	The development of the proposed additional new chicken layer house site no 8 and evaporation ponds site no 8, must take place outside the recommended minimum buffer zone, from the main active streamflow channel of the Dwarsspruit. It is the opinion of the specialist that this recommended buffer zone should be sufficient in preventing any potential significant future disturbance

			of- or ecological interaction between the aquatic and semi-aquatic habit and system of the Dwarsspruit and the daily operations of the proposed development.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduce or changes wetland habitat directly or through changes in inundation patterns.	5	The development of the proposed additional new chicken layer house site no 8 and evaporation ponds site no 8, must take place outside the recommended minimum buffer zone, from the main active streamflow channel of the Dwarsspruit. It is the opinion of the specialist that this recommended buffer zone should be sufficient in preventing any potential significant future disturbance of- or ecological interaction between the aquatic and semi-aquatic habit and system of the Dwarsspruit and the daily operations of the proposed development.
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.	4	The specific portion of the Dwarsspruit which flows past the assessment area, currently possesses a relatively narrow main active streamflow channel, but also houses a broader surrounding floodplain and riparian zone. The instream vegetation of the Spruit mainly constitutes semi-aquatic and aquatic habitat. The vegetation associated with the surrounding floodplain and riparian zone, mainly constitutes a moderate-density woodland landscape, with a well-represented grass layer in more open areas, but merely sparse grasses in denser woodland areas.

			The development of the proposed additional new chicken layer house site no 8 and evaporation ponds site no 8, must however take place outside the recommended minimum buffer zone, from the main active streamflow channel of the Dwarsspruit. It is the opinion of the specialist that this recommended buffer zone should be sufficient in preventing any potential significant future disturbance of- or ecological interaction between the aquatic and semi-aquatic habit and system of the Dwarsspruit and the daily operations of the proposed development.
Indigenous Vegetation Removal	Direct destruction of habitat through any human activities affecting wildlife habitat and flow attenuation functions, organic matter inputs and increase potential for erosion.	3	Agricultural developments are sporadically present along the localised length of the Dwarsspruit. Such developments tend to cause moderate contamination of watercourse systems through organic and inorganic eutrophication, chemical herbicide and pesticide washaway and erosion runoff. Significant clearance of indigenous vegetation is also required and conducted for such agricultural developments. Due to the presence of the existing chicken layer house directly to the south of the Dwarsspruit, the locations of the proposed additional new layer house site no 8 and evaporation ponds site no 8 as well as the localised surrounding area, have been mechanically cleared of virtually all naturally occurring indigenous vegetation.

			This cleared area is also continually manually maintained as such and is therefore virtually devoid of any naturally occurring indigenous vegetation, on a permanent basis. The mechanical clearance associated with the proposed development of the layer house site no 8 and evaporation ponds site no 8, will therefore not result in any further transformation of naturally occurring indigenous vegetation.
Alien Fauna	Presence of alien fauna affecting faunal community structure.	4	At the time of the site assessment, no significant legally declared alien invasive species establishments were found to be present throughout the specific portion of the Dwarsspruit, which flows past the assessment area or within the cleared area surrounding the layer house site no 8 and evaporation ponds site no 8 locations. The legally declared invasive species *Opuntia ficus-indica* (Category 1b) was merely found to be very sparsely present throughout the surrounding floodplain and riparian zone of the Dwarsspruit.
Over utilisation of biota	Over gazing, over fishing etc.	4	The utilisation of fauna and flora is insignificant.
Total		**28/35**	
Class		**C or B**	

The Present Ecological State (PES) of the specific portion of the Dwarsspruit which flows past the assessment area, is classified as Class B although it borders on Class C, as a result of directly surrounding upstream transformation impacts. The portion is deemed largely natural, while small to moderate changes in the natural habitat and biota have taken place. The ecosystem functionality has however remained essentially unchanged.

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Table 6: EIS table for the Dwarsspruit (0-5 indicates increase in significance)

Determinant	Score
1. Rare and Endangered Species	1
2. Population of Unique Species	2
3. Species/taxon Richness	3
4. Diversity of Habitat Types or Features	2
5. Migration route/breeding and feeding site for wetland species.	3
6. Sensitivity to changes in Natural Hydrological Regime.	3
7. Sensitivity to water quality changes.	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	2
9. Protected Status	3
10. Ecological Integrity	3
Total	**25/50**
Overall Ecological Sensitivity and Importance	**C**

The Ecological Importance and Sensitivity (EIS) of the specific portion of the Dwarsspruit which flows past the assessment area, is classified as Class C (moderate) as it is viewed as being ecologically important and sensitive on provincial scale, mainly due to the area forming part of a combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA) as well as forming an important part of the local and broader quaternary surface water catchment- and drainage area, towards the north-east. Biodiversity is however still relatively ubiquitous.

The specific portion of the Dwarsspruit which flows past the assessment area, is viewed as being of moderately-high conversational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Critical Biodiversity Area (CBA) and Ecological Support Area (ESA) as well as the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

It is therefore recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area.

8.4. Buffer Zone Calculation

By using the relevant Department of Water and Sanitation River buffer calculation tool, a minimum buffer distance of approximately 55 m from the main active streamflow channel of the Dwarsspruit, was determined.

This calculation is however done purely done from a hydrological perspective. From an ecological perspective, when taking the presence and conservational importance/significance of the relevant combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA) into account, it is highly recommended that the proposed buffer distance should be significantly increased, by a further approximate 95 m. **A minimum approximately 150 m aquatic ecological buffer distance is therefore recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone.**

It is the opinion of the specialist that this recommended buffer zone should be sufficient in preventing any potential significant future disturbance of- or ecological interaction between the aquatic and semi-aquatic habit and system of the Dwarsspruit and the daily operations of the proposed development. This should ensure the continued ecological functionality and -integrity of the CBA and ESA associated with the Dwarsspruit as well as the accompanying ecological corridor, that runs along the Spruit.

It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.

8.5. Aquatic Ecological Site Sensitivity Map

The site sensitivity map below (see A3 sized map in the Appendices) illustrates the approximate delineation of the main active streamflow channel boundary as well as the floodplain and riparian zone boundary of the Dwarsspruit. It also illustrates the recommended buffer zone to be implemented around the main active streamflow channel of the Spruit.

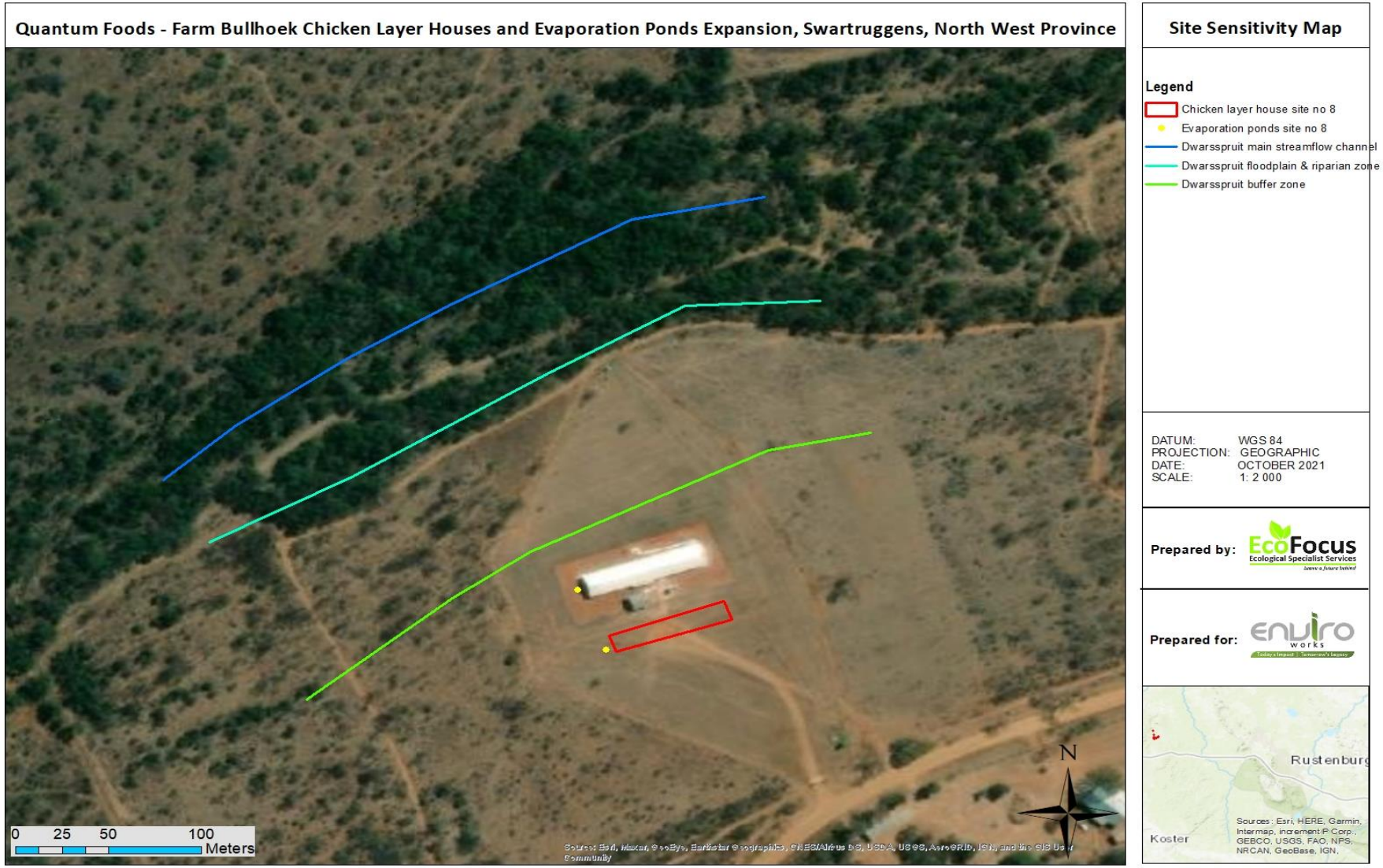

Figure 7: Site sensitivity map illustrating the approximate delineation of the main active streamflow channel boundary as well as the floodplain and riparian zone boundary of the Dwarsspruit; the recommended buffer zone to be implemented around the main active streamflow channel of the Spruit, is also illustrated

9. Aquatic Ecological Impact Assessment

The following section identifies the potential aquatic ecological impacts (both positive and negative), which the proposed development will have on the surrounding environment.

Once the potential aquatic ecological impacts are identified, they are assessed by rating their Environmental Risk after which the final Environmental Significance is calculated and rated for each identified aquatic ecological impact.

The same Environmental Risk rating process is then followed for each aquatic ecological impact to determine the Environmental Significance, if the recommended mitigation measures were to be implemented.

The objective of this section is therefore firstly to identify all the potential aquatic ecological impacts associated with the proposed development and secondly to determine the significance of the impacts and how effective the recommended mitigation measures will be able to reduce their significance. The potential aquatic ecological impacts which are still rated as highly significant, even after implementation of mitigations, can then be identified in order to specifically focus on implementation of effective management strategies for them.

9.1. Construction Phase

The assessment area falls within the A22D quaternary surface water catchment- and drainage area. The Dwarsspruit flows past directly adjacent north of the assessment area and continues in a north-easterly direction. No other significant watercourses, preferential water flow paths/drainage lines or wetlands were however found to be present within or in close/influential proximity to the assessment area.

The majority of the proposed additional new chicken layer houses and evaporation ponds should therefore not pose significant risk to any watercourses. Only the most northerly situated layer house site no 8 and evaporation ponds site no 8 to be located directly to the south of the Dwarsspruit, could however potentially impact on the Spruit.

Transformation of an aquatic Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit

The locations of the proposed eight (8) additional new chicken layer houses and twenty (20) evaporation ponds do not fall within any provincially demarcated aquatic biodiversity/conservation priority areas, in accordance with the North West Biodiversity Spatial Plan 2015 (NWBSP), which sets out biodiversity priority areas in the province.

The area directly adjacent to the north of the most northerly situated layer house site no 8 and evaporation ponds site no 8, is however categorised as a combination of mainly aquatic Critical Biodiversity Area's one and two (CBA 1 & 2) and to a lesser extent, Ecological Support Area's one and two (ESA 1 & 2). This is in accordance with the NWBSP.

This relevant combination of CBA and ESA to the north of the layer house and evaporation pond, is mainly associated with the important Dwarsspruit, which flows past directly adjacent north of the assessment area as well as the accompanying ecological corridor, that runs along the Spruit.

Due to the presence of the existing chicken layer house directly to the south of the Dwarsspruit, the locations of the proposed additional new layer house site no 8 and evaporation ponds site no 8 as well as the localised surrounding area, have been mechanically cleared of virtually all naturally occurring indigenous vegetation. This cleared area is also continually manually maintained as such and is therefore virtually devoid of any naturally occurring indigenous vegetation, on a permanent basis. The mechanical clearance associated with the proposed development of the layer house site no 8 and evaporation ponds site no 8, will therefore not result in any further transformation of naturally occurring indigenous vegetation.

It must be noted that a portion of this cleared area falls within the relevant combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit as well as the accompanying ecological corridor, that runs along the Spruit.

The significance of this impact has been medium-high.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Disturbance of-/damage to aquatic and semi-aquatic faunal habitats, associated with the Dwarsspruit

In accordance with the Southern African Bird Atlas Project (SABAP) information, no Red Data Listed avifaunal species or any avifaunal species of conservational significance, are necessarily expected to be present throughout the assessment area. The combined aquatic and semi-aquatic habitat of the Dwarsspruit and its associated floodplain and riparian zone, is however highly likely utilised by various common and habitat-specific bird-, small antelope and other mammalian species, for refuge as well as breeding, foraging and/or persistence purposes. This reiterates the conservational importance/significance of the relevant combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit as well as the accompanying ecological corridor, that runs along the Spruit.

The chicken layer houses are deemed to mainly operate as isolated units from their surrounding undeveloped environments and therefore do not result in any significant or continued ecological impacts. The mechanical air conditioning and ventilation system of the existing layer house situated directly to the south of the Dwarsspruit, however emits continuous low frequency sound/noise. If layer house site no 8 is to be developed within close proximity to the Dwarsspruit and its associated floodplain and riparian zone, the temporary noise emitted by the construction processes as well as the subsequent continued additional noise emissions of the ventilation system during the operational phase, could potentially cause undesired disturbance and have a negative impact on the habitat-specific faunal species, which utilise the floodplain and riparian zone.

The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Terrestrial and aquatic alien invasive species establishment within the Dwarsspruit

At the time of the site assessment, no significant legally declared alien invasive species establishments were found to be present throughout the specific portion of the Dwarsspruit, which flows past the assessment area or within the cleared area surrounding the layer house site no 8 and evaporation ponds site no 8 locations.

The legally declared invasive species *Opuntia ficus-indica* (Category 1b) was merely found to be very sparsely present throughout the surrounding floodplain and riparian zone of the Dwarsspruit.

The proposed development area could however potentially be prone to slight alien invasive species establishment, due to surface disturbance and vegetation clearance caused by construction activities. The presence of the Dwarsspruit directly adjacent north of the assessment area, could further also potentially act as a significant transport/distribution vector for numerous terrestrial and aquatic alien invasive species into the broader region.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Contamination of the Dwarsspruit by surface material erosion

The proposed development area of the additional new layer house site no 8 and evaporation ponds site no 8 constitutes a slightly sloping landscape to the north, towards the Dwarsspruit. The area could therefore potentially be prone to slight surface soil erosion, due to the loosening of materials and clearance of vegetation caused by construction activities, which usually binds surface material.

If layer house site no 8 and evaporation ponds site no 8 are to be developed within close proximity to the Dwarsspruit and its associated floodplain and riparian zone, the potential surface soil erosion could result in contamination of the Spruit, due to dirty erosion water runoff during rainfall events.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Contamination of the Dwarsspruit by dust generation and emissions

The construction activities associated with the proposed development, could potentially result in slight fugitive dust emissions, due to vegetation clearance and movement of machinery and equipment. Generated dust could potentially spread into the surrounding undeveloped landscape and contaminate the Dwarsspruit.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Impeding and contamination of the flow regime of the Dwarsspruit, within the associated local and broader quaternary surface water catchment- and drainage area

The assessment area falls within the A22D quaternary surface water catchment- and drainage area. It is evident from a hydrological and ecological perspective, that the Dwarsspruit forms an important part of the local and broader quaternary surface water catchment- and drainage area, towards the north-east.

The activities associated with the construction phase could potentially result in slight impeding of natural surface water flow towards the Dwarsspruit, within the associated local and broader quaternary surface water catchment- and drainage area, due to artificial obstruction of flow during rainfall events. The construction phase could potentially also result in contamination of natural surface water flow within the associated local and broader quaternary surface water catchment- and drainage area, due to hydrocarbon and/or other chemical spills by construction machinery and equipment.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.2. Operational Phase

Transformation of an aquatic Critical Biodiversity Area (CBA) and Ecological Support Area (ESA) as well as disturbance of-/damage to aquatic and semi-aquatic faunal habitats, associated with the Dwarsspruit, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the construction phase of the proposed development.

A number of additional significant potential aquatic ecological impacts, could however likely occur during the operational phase of the proposed development. The following additional significant potential aquatic ecological impacts are associated with the proposed operational phase:

Contamination/eutrophication of the Dwarsspruit by wash water from the layer house site no 8 wash-out process, within the associated local and broader quaternary surface water catchment- and drainage area

In accordance with the information received from the farm manager during the site assessment, the layer houses only get washed out twice annually. In accordance with the information received from the EAP, all wash water emanating from these twice-annual layer house wash-out processes, are currently disposed of into the surrounding undeveloped environments. The wash water will however now be sufficiently isolated and channelled towards the proposed evaporation ponds. The purpose of the evaporation ponds will be to ensure adequate containment and subsequent evaporation of all wash water. This will prevent any significant wash water contact with- and potential contamination of the surrounding undeveloped environments.

It is presumed and reasonably expected that the design specifications and size parameters of the proposed evaporation ponds will ensure adequate containment and subsequent evaporation of the required maximum potential volumes of wash water twice annually, even during significant rainfall events. Under no circumstances may overflow or spillage of wash water and subsequent potential contamination of the surrounding undeveloped environment and Dwarsspruit, take place.

The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Contamination/eutrophication of groundwater by wash water from the twenty (20) chicken layer houses wash-out processes

Continued containment and subsequent evaporation of wash water within the evaporation ponds during the twice-annual layer house wash-out processes, will likely result in significant long-term leaching and infiltration of salts, chemicals and other inorganic elements into the soil and groundwater. This will potentially alter and negatively affect the quality/characteristics of groundwater over time. This will constitute a long-term effect, which will gradually commence during the operational phase and will continue for the entire duration of the proposed developments' lifespan and significantly beyond.

The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Over-extraction of groundwater from the three boreholes

The water sources currently used on site, constitute three (3) boreholes that supply approximately 228 742.31 m^3/month. The three (3) water reservoirs currently present on site, have a capacity of approximately 100 000 litres. The quantities of water which will be required on site and subsequently extracted from the boreholes, will increase significantly as a result of the development of the proposed eight (8) additional new chicken layer houses. This could potentially lead to over-extraction from the boreholes, if not adequately managed.

In accordance with the information received from the EAP, the sustainable yields of the boreholes will be able to adequately and sustainably supply the required volumes of water on site.

The significance of this potential impact will be zero.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.3. Cumulative Impacts

The assessment area for the proposed development, constitutes the footprint areas of the eight (8) additional new chicken layer houses and the twenty (20) evaporation ponds to be constructed at the applicant's existing poultry farm, as well as surrounding areas in close/influential proximity to these footprint areas.

The assessment area falls within the A22D quaternary surface water catchment- and drainage area. The Dwarsspruit flows past directly adjacent north of the assessment area and continues in a north-easterly direction. No other significant watercourses, preferential water flow paths/drainage lines or wetlands were however found to be present within or in close/influential proximity to the assessment area.

The majority of the proposed additional new chicken layer houses and evaporation ponds should therefore not pose significant risk to any watercourses. Only the most northerly situated layer house site no 8 and evaporation ponds site no 8 to be located directly to the south of the Dwarsspruit, could however potentially impact on the Spruit.

The specific portion of the Dwarsspruit which flows past the assessment area, scored a moderate Ecological Importance and Sensitivity (EIS) value and is viewed as being of moderately-high conversational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Critical Biodiversity Area (CBA) and Ecological Support Area (ESA) as well as the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

Transformation of an aquatic Critical Biodiversity Area (CBA) and Ecological Support Area (ESA); Disturbance of-/damage to aquatic and semi-aquatic faunal habitats, associated with the Dwarsspruit as well as Contamination/eutrophication of groundwater, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the proposed development.

These potential long-term aquatic ecological impacts identified for the proposed development, could therefore potentially add moderate to moderately-high cumulative impact to existing negative impacts caused by the sporadic presence of existing agricultural developments, along the localised length of the Dwarsspruit.

It is however the opinion of the specialist, by application of the NEMA Mitigation Hierarchy, that all the identified potential cumulative aquatic ecological impacts associated with the proposed development, can be suitably reduced and mitigated to within acceptable residual levels, by implementation of the recommended mitigation measures. It is therefore not anticipated that the proposed development will necessarily add any significant residual cumulative aquatic ecological impacts to the surrounding environment or Dwarsspruit, if all recommended mitigation measures as per this ecological report are adequately implemented and managed, for both the construction and operational phases of the proposed development.

9.4. Risk Ratings of Potential Aquatic Ecological Impacts

The following section provides the Environmental Risk as well as the Environmental Significance Ratings for the potential aquatic ecological impacts associated with the proposed development, both before and after implementation of the recommended mitigation measures.

9.4.1. Construction Phase

Table 7: Environmental Risk and Significance Ratings

	Chicken Layer House no 8 and Evaporation Ponds no 8	No-Go Alternative
Identified Environmental Impact	**Transformation of an aquatic Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit**	
Magnitude of Negative or Positive Impact	Very low (2)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	Definite (5)	-
Cumulative Impact Rating prior to mitigation	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium-High (75)	-

Mitigation Measures to be implemented	It is recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone. It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist. The proposed development construction footprint must be kept as small as practicably possible to reduce the surface impact on surrounding vegetation and no unnecessary/unauthorised footprint expansion into the broader undeveloped landscape surrounding the proposed development footprint, may take place. No site construction basecamps may be established within the broader undeveloped landscape surrounding the proposed development footprint. Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, -machinery or -equipment operate or impact within the broader undeveloped landscape outside the cordoned off area. Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern and restrict movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities. Disturbed areas within and immediately surrounding the proposed development footprint area, must be adequately rehabilitated as soon as practicably possible after construction.

Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (24)	-
	Chicken Layer House no 8 and Evaporation Ponds no 8	**No-Go Alternative**
Identified Environmental Impact	**Disturbance of-/damage to aquatic and semi-aquatic faunal habitats, associated with the Dwarsspruit**	
Magnitude of Negative or Positive Impact	Very low (2)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Moderate (3)	-
Probability of Impact Occurrence	High (4)	-

Cumulative Impact Rating prior to mitigation	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium (56)	-
Mitigation Measures to be implemented	It is recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone. It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist. The proposed development construction footprint must be kept as small as practicably possible to reduce the surface impact on surrounding vegetation and no unnecessary/unauthorised footprint expansion into the broader undeveloped landscape surrounding the proposed development footprint, may take place. No site construction basecamps may be established within the broader undeveloped landscape surrounding the proposed development footprint. Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, -machinery or -equipment operate or impact within the broader undeveloped landscape outside the cordoned off area.	

	Adequate operational procedures for construction machinery and equipment must be developed in order to strictly govern and restrict movement of machinery only within the proposed development construction footprint area and to ensure environmentally responsible construction practices and activities. Disturbed areas within and immediately surrounding the proposed development footprint area, must be adequately rehabilitated as soon as practicably possible after construction.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (11)	-
	Chicken Layer House no 8 and Evaporation Ponds no 8	**No-Go Alternative**
Identified Environmental Impact	**Terrestrial and aquatic alien invasive species establishment within the Dwarsspruit**	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Regional (3)	-

Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	High (2)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (48)	-
Mitigation Measures to be implemented	It is recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone. It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist. It is recommended that all individuals of the identified alien invasive species must be actively eradicated from the Dwarsspruit, in accordance with the National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014. Removed materials must also be adequately disposed of.	

	Implement an adequate Alien Invasive Species Management Plan during the construction and operational phases. Such a Management Plan must be compiled by a suitably qualified and experienced ecologist. Disturbed areas within and immediately surrounding the proposed development footprint area, must be adequately rehabilitated as soon as practicably possible after construction.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (10)	-
	Chicken Layer House no 8 and Evaporation Ponds no 8	**No-Go Alternative**
Identified Environmental Impact	**Contamination of the Dwarsspruit by surface material erosion**	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Short term (2)	-
Extent of Positive or Negative Impact	Regional (3)	-

Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Moderate (3)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (45)	-
Mitigation Measures to be implemented	Implement an adequate Stormwater and Erosion Management Plan during the construction phase of the proposed development, to sufficiently manage storm water runoff and clean/dirty water separation on site. This must be done in order to prevent any significant soil erosion in and around the assessment area and subsequently prevent any significant contamination of the Dwarsspruit. It is further recommended that small temporary stormwater cut-off berms/trenches be constructed directly adjacent around the upstream sides of the proposed layer house site no 8 and evaporation ponds site no 8 construction footprints. These cut-off berms/trenches must assist with clean/dirty water separation during the construction phase, by diverting and channelling clean surface water runoff from the south, around the construction footprints, towards the Dwarsspruit. It is recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone.	

	It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist. Disturbed areas within and immediately surrounding the proposed development footprint area, must be adequately rehabilitated as soon as practicably possible after construction.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (11)	-
	Chicken Layer House no 8 and Evaporation Ponds no 8	**No-Go Alternative**
Identified Environmental Impact	**Contamination of the Dwarsspruit by dust generation and emissions**	
Magnitude of Negative or Positive Impact	Very low (2)	-
Duration of Negative or Positive Impact	Short term (2)	-

Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Moderate (3)	-
Probability of Impact Occurrence	Low (2)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (26)	-
Mitigation Measures to be implemented	Implement suitable dust management and prevention measures during the construction phase of the proposed development. Construction areas and –roads to be sufficiently wetted down during the construction phase, in order to prevent significant fugitive dust emissions. Adequate operational procedures for machinery and equipment must be developed to strictly govern and restrict movement of machinery, in order to avoid unnecessary fugitive dust emissions and ensure environmentally responsible construction practices and activities.	

	It is recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone. It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist. Disturbed areas within and immediately surrounding the proposed development footprint area, must be adequately rehabilitated as soon as practicably possible after construction.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (11)	-

	Chicken Layer House no 8 and Evaporation Ponds no 8	No-Go Alternative
Identified Environmental Impact	**Impeding and contamination of the flow regime of the Dwarsspruit, within the associated local and broader quaternary surface water catchment- and drainage area**	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Short term (2)	-
Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (48)	-

Mitigation Measures to be implemented	Implement an adequate Stormwater and Erosion Management Plan during the construction phase of the proposed development, to sufficiently manage storm water runoff and clean/dirty water separation on site. This must be done in order to prevent any significant soil erosion in and around the assessment area and subsequently prevent any significant contamination of the Dwarsspruit. It is further recommended that small temporary stormwater cut-off berms/trenches be constructed directly adjacent around the upstream sides of the proposed layer house site no 8 and evaporation ponds site no 8 construction footprints. These cut-off berms/trenches must assist with clean/dirty water separation during the construction phase, by diverting and channelling clean surface water runoff from the south, around the construction footprints, towards the Dwarsspruit. It is recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone. It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist. Disturbed areas within and immediately surrounding the proposed development footprint area, must be adequately rehabilitated as soon as practicably possible after construction.

	If hydrocarbons or other chemicals are to be stored on site during the construction phase, the storage areas must be situated as far away as practicably possible from the Dwarsspruit. Hydrocarbon and other chemical storage areas must be adequately bunded in order to be able to contain a minimum of 150 % of the capacity of storage tanks/units. Adequate hydrocarbon and other chemical storage, handling, usage and spillage clean-up procedures must be developed and all relevant construction personnel must be sufficiently trained on- and apply these procedures during the entire construction phase. Spill kits must be readily available on the construction site. All employees must be adequately trained on the correct procedure and use of the spill kits.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (12)	-

9.4.2. Operational Phase

Table 8: Environmental Risk and Significance Ratings

	Chicken Layer House no 8 and Evaporation Ponds no 8	No-Go Alternative
Identified Environmental Impact	**Contamination/eutrophication of the Dwarsspruit by wash water from the layer house site no 8 wash-out process, within the associated local and broader quaternary surface water catchment- and drainage area**	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Medium term (3)	-
Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	-
Reversibility of Impact	Moderate (3)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (48)	-

Mitigation Measures to be implemented	It is presumed and reasonably expected that the design specifications and size parameters of the proposed evaporation ponds will ensure adequate containment and subsequent evaporation of the required maximum potential volumes of wash water twice annually, even during significant rainfall events. Under no circumstances may overflow or spillage of wash water and subsequent potential contamination of the surrounding undeveloped environment and Dwarsspruit, take place. It is however recommended that only environmentally friendly biodegradable chemical products may be used for the twice-annual evaporation pond wash-out process, as far as practicably possible. All the recommended mitigation measures for the construction phase must be adequately implemented and managed. The recommended buffer zone must be adequately maintained and no current or future development is allowed to encroach into the buffered zones over time.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (12)	-

	20 Chicken Layer Houses and 20 Evaporation Ponds	No-Go Alternative
Identified Environmental Impact	**Contamination/eutrophication of groundwater by wash water from the twenty (20) chicken layer houses wash-out processes**	
Magnitude of Negative or Positive Impact	Medium (6)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium-High	-
Environmental Significance Score and Rating prior to mitigation	Medium-High (84)	-

Mitigation Measures to be implemented	The proposed evaporation ponds must be sufficiently lined, in accordance with the relevant minimum norms and standards, in order to prevent undesired seepages or leaks into the groundwater. The integrity of the lining must be re-evaluated and maintained annually in order to ensure its continued functionality. Adequate leakage detection and prevention systems must be installed in order to detect any potential leakages and subsequent contamination of groundwater. It is presumed and reasonably expected that the design specifications and size parameters of the proposed evaporation ponds will ensure adequate containment and subsequent evaporation of the required maximum potential volumes of wash water twice annually, even during significant rainfall events. Under no circumstances may overflow or spillage of wash water and subsequent potential contamination of the surrounding undeveloped environment and Dwarsspruit, take place. It is however recommended that only environmentally friendly biodegradable chemical products may be used for the twice-annual evaporation pond wash-out process, as far as practicably possible.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (13)	-

	20 Chicken Layer Houses and 20 Evaporation Ponds	No-Go Alternative
Identified Environmental Impact	**Over-extraction of groundwater from the three boreholes**	
Mitigation Measures to be implemented	A Water Use License Application (WULA) must be submitted to the Department of Water and Sanitation, in accordance with the National Water Act (Act 36 of 1998). Only the allotted water quantities as per the approved Water Use License are to be extracted. Flow meters must be installed in order to enable monitoring and management of water consumption. Water consumption figures must be submitted to the Department of Water and Sanitation (DWS) on a regular basis in order to ensure compliance with the allotted water quantities, as per the approved Water Use License. Water saving initiatives must be implemented for the operations of the poultry farm. Environmentally responsible water use practices and activities must be adopted for the operations of the poultry farm. Provide training interventions for the operational staff of the poultry farm, on correct environmentally responsible water use practices and activities for the operations of the poultry farm.	

10. Summary and Conclusion

The assessment area for the proposed development, constitutes the footprint areas of the eight (8) additional new chicken layer houses and the twenty (20) evaporation ponds to be constructed at the applicant's existing poultry farm, as well as surrounding areas in close/influential proximity to these footprint areas.

The assessment area falls within the A22D quaternary surface water catchment- and drainage area. The Dwarsspruit flows past directly adjacent north of the assessment area and continues in a north-easterly direction. No other significant watercourses, preferential water flow paths/drainage lines or wetlands were however found to be present within or in close/influential proximity to the assessment area.

The majority of the proposed additional new chicken layer houses and evaporation ponds should therefore not pose significant risk to any watercourses. Only the most northerly situated layer house site no 8 and evaporation ponds site no 8 to be located directly to the south of the Dwarsspruit, could however potentially impact on the Spruit.

The locations of the proposed additional new chicken layer houses and evaporation ponds do not fall within any provincially demarcated aquatic biodiversity/conservation priority areas, in accordance with the North West Biodiversity Spatial Plan 2015 (NWBSP), which sets out biodiversity priority areas in the province. The area directly adjacent to the north of the most northerly situated layer house site no 8 and evaporation ponds site no 8, is however categorised as a combination of mainly aquatic Critical Biodiversity Area's one and two (CBA 1 & 2) and to a lesser extent, Ecological Support Area's one and two (ESA 1 & 2). This is in accordance with the NWBSP. This relevant combination of CBA and ESA to the north of the layer house and evaporation pond, is mainly associated with the important Dwarsspruit, which flows past directly adjacent north of the assessment area as well as the accompanying ecological corridor, that runs along the Spruit.

The specific portion of the Dwarsspruit which flows past the assessment area, currently possesses a relatively narrow main active streamflow channel, but also houses a broader surrounding floodplain and riparian zone. Merely limited water flow was evident and confined to the main active streamflow channel, at the time of the site assessment. It is however expected that the usual broad, free-flowing perennial flow regime and aquatic system will return, once adequate rainfall has been received in the area.

The instream vegetation of the Spruit mainly constitutes semi-aquatic and aquatic habitat, which is mostly dominated by hydrophytic grass species. The vegetation associated with the surrounding floodplain and riparian zone, mainly constitutes a moderate-density woodland landscape, with a well-represented grass layer in more open areas, but merely sparse grasses in denser woodland areas.

In accordance with the Southern African Bird Atlas Project (SABAP) information, no Red Data Listed avifaunal species or any avifaunal species of conservational significance, are necessarily expected to be present throughout the assessment area. The combined aquatic and semi-aquatic habitat of the Dwarsspruit and its associated floodplain and riparian zone, is however highly likely utilised by various common and habitat-specific bird-, small antelope and other mammalian species, for refuge as well as breeding, foraging and/or persistence purposes. This reiterates the conservational importance/significance of the relevant combination of Critical Biodiversity Area (CBA) and Ecological Support Area (ESA), associated with the Dwarsspruit as well as the accompanying ecological corridor, that runs along the Spruit.

The specific portion of the Dwarsspruit which flows past the assessment area, scored a moderate Ecological Importance and Sensitivity (EIS) value and is viewed as being of moderately-high conversational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, Critical Biodiversity Area (CBA) and Ecological Support Area (ESA) as well as the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area.

It is therefore evident from a hydrological and ecological perspective, that the Dwarsspruit forms an important part of the local and broader quaternary surface water catchment- and drainage area, towards the north-east.

It is therefore recommended that the Dwarsspruit and its associated floodplain and riparian zone be adequately buffered out of the proposed development footprint area. A minimum approximately 150 m aquatic ecological buffer distance is recommended to be implemented around the main active streamflow channel of the Dwarsspruit. No current or future development is allowed to take place within the buffered zone.

It is further recommended that the continued mechanical/manual vegetation clearance and maintenance of the area situated directly to the south of the Dwarsspruit and associated with the relevant Critical Biodiversity Area two (CBA 2), should be permanently ceased, with immediate effect. The area should be adequately re-vegetated and rehabilitated, as soon as practicably possible. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.

It is presumed and reasonably expected that the design specifications and size parameters of the proposed evaporation ponds will ensure adequate containment and subsequent evaporation of the required maximum potential volumes of wash water twice annually, even during significant rainfall events. Under no circumstances may overflow or spillage of wash water and subsequent potential contamination of the surrounding undeveloped environment and Dwarsspruit, take place.

It is however recommended that only environmentally friendly biodegradable chemical products may be used for the twice-annual evaporation pond wash-out process, as far as practicably possible.

The proposed evaporation ponds must also be sufficiently lined, in accordance with the relevant minimum norms and standards, in order to prevent undesired seepages or leaks into the groundwater.

Conclusion

Transformation of an aquatic Critical Biodiversity Area (CBA) and Ecological Support Area (ESA); Disturbance of-/damage to aquatic and semi-aquatic faunal habitats, associated with the Dwarsspruit as well as Contamination/eutrophication of groundwater, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the proposed development.

These potential long-term aquatic ecological impacts identified for the proposed development, could therefore potentially add moderate to moderately-high cumulative impact to existing negative impacts caused by the sporadic presence of existing agricultural developments, along the localised length of the Dwarsspruit.

It is however the opinion of the specialist, by application of the NEMA Mitigation Hierarchy, that all the identified potential aquatic ecological impacts associated with the proposed development, can be suitably reduced and mitigated to within acceptable residual levels, by implementation of the recommended mitigation measures. It is therefore not anticipated that the proposed development will necessarily add any significant residual aquatic ecological impacts to the surrounding environment or Dwarsspruit, if all the recommended mitigation measures as per this aquatic ecological report are adequately implemented and managed, for both the construction and operational phases of the proposed development.

It is the opinion of the specialist that the proposed development of the eight (8) additional new layer houses and twenty (20) evaporation ponds, should be considered by the competent authority for Environmental Authorisation and approval. All recommended mitigation measures as per this aquatic ecological report must however be adequately implemented and managed for both the construction and operational phases of the proposed development. All necessary authorisations, permits and licenses must also be obtained prior to the commencement of any construction.

11. References

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12. Details of the Specialist

Adriaan Johannes Hendrikus Lamprecht (Pr.Sci.Nat)

M.Env.Sci. Ecological remediation and sustainable utilisation (NWU: Potchefstroom)

South African Council for Natural Scientific Professions (SACNASP): Professional Ecological Scientist (No 815601)

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Abbreviated Curriculum Vitae

Qualifications

- M.Env.Sci Ecological Remediation and Sustainable Utilisation/Vegetation Ecology
  - 2010 - North West University Potchefstroom
- B.Sc Botany and Zoology (Cum Laude)
  - 2008 - North West University Potchefstroom

Accredited courses completed

- Implementing Environmental Management Systems ISO 14001
  - 2011 - North West University Potchefstroom
- Environmental Law for Environmental Managers
  - 2011 - North West University Potchefstroom
- SASS 5 Aquatic Biomonitoring Training Course
  - 2017 – GroundTruth Consulting

Professional registrations

- South African Council for Natural Scientific Professions **(SACNASP)**
  - Professional Ecological Scientist Registration number 115601
- International Association for Impact Assessment **(IAIA)**
  - Registration number 5232
- South African Green Industries Council (**SAGIC**) Invasive Species training
  - Registration number 2405/2459

Employment and Experience Background

Upon completion of his studies, Rikus started his career in 2011 as an **Environmental Professional in Training (PIT) at Anglo American Thermal Coal: Environmental Services.** He received environmental training and practical implementation experience in all environmental facets of the mining industry with the focus on: Environmental rehabilitation, land management (biodiversity and invasive species eradication), waste & water-, air quality-, game reserve-, environmental management and legislation, as well as corporate reporting. He was also appointed as the Biodiversity management custodian at Anglo American Thermal Coal collieries.

He was subsequently employed by **Fraser Alexander Tailings from October 2011 to the end of November 2015 as an Environmental Contracts Manager,** where he was responsible for the technical and operational management of all Fraser Alexander Tailings' mining environmental rehabilitation work. He was responsible for all facets of project management, as well as implementation of rehabilitation and environmental strategies, by planning activities, organising physical, financial and human resources, delegating task responsibilities, leading people, controlling risks and providing technical support.

He conducted a significant amount of quantitative and qualitative ecological vegetation monitoring during his employment period with the company. Such monitoring mainly included environmentally rehabilitated mining areas in the open-cast coal-, gold-, platinum- and chrome mining industries situated in the Free State, Gauteng, Mpumalanga, North West and Limpopo Provinces. He was involved with analysis, processing and interpretation of environmental monitoring data and compilation of high quality technical/scientific environmental monitoring reports for clients. He was subsequently further involved with providing adequate ecological management and maintenance recommendations for rehabilitated areas. He also provided technical/scientific environmental rehabilitation support to mining clients, with regards to sufficient soil preparation and amelioration, grassing processes, as well as grass species mixtures and ratios.

He was then employed by **Enviroworks Consulting from January 2016 to the end of May 2017 as a Senior Ecological Specialist** where he was responsible for virtually all Ecological, Aquatic and Wetland specialist assessments and reporting related to Environmental Impact Assessment (EIA) and Basic Assessment (BA) projects. He also completed numerous EIA and BA projects as the main project Environmental Assessment Practitioner (EAP).

Rikus then subsequently established the company EcoFocus Consulting (Pty) Ltd at the end of May 2017, which provides high quality professional environmental and ecological specialist services and solutions to the industrial development-, construction-, mining-, agricultural and other sectors.

He possesses significant qualifications, vast knowledge, skills and practical experience in the specialist field of ecological and environmental management. This, coupled with his disciplined, determined and goal-driven approach, as well as his high level of personal standards, ensure high quality, timely and outcomes-based outputs and service delivery relating to any project.

Ecological & Wetland Specialist Assessment & Report Completion for the last two years

2021

- Proposed 126.77 ha Orania Residential development project in Orania, Northern Cape Province.
- Grazing and Invasive Species Follow-up Assessment for the Farm Tweefontein no 3344, outside Newcastle, KwaZulu-Natal Province.
- Proposed 245.5 ha Kgatelopele Local Municipality Residential development project in Danielskuil, Northern Cape Province.
- Relocation of provincially protected plant species individuals for the proposed 30 ha Portion 30 of the Farm Lilyvale no 2313 Residential development project in Bloemfontein, Free State Province.
- Proposed 0.5 ha Mduwelanga Projects Agricultural development project outside Paul Roux, Free State Province.
- Proposed Moledi Gorge Watercourse Weir NEMA Section 24G development outside Derby, North West Province.
- Revision of a proposed 135 ha Farm Zulani no 867 agricultural development project outside Douglas, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farm Kuilenburg no 241, outside Reitz, Free State Province.

- Revision of the Biodiversity Offset Feasibility Report for a proposed 385 ha Idstone Farming agricultural development projects outside Douglas, Northern Cape Province.
- Erosion and Invasive Species Management Plan for the Farms Nebo A no 957, Tevrede no 8088, Sarona no 8089 & Uitkyk no 8119, outside Reitz, Free State Province.
- Proposed 267.2 ha Tswaing Local Municipality residential development project in Ottosdal, North West Province.
- Proposed 10.2 ha PepsiCo Inc residential development project in Marchand, Northern Cape Province.
- Proposed 3.5 ha Itau Milling NEMA Section 24G Solar Power Development project in Bloemfontein, Free State Province.
- Grazing and Invasive Species Assessment for the Farm Brakfontein no 244, outside Verkykerskop, Free State Province.
- Wetland/watercourse Assessment for the proposed 250 ha Subsolar Energy Serurubele Solar Development project near Bloemfontein, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 250 ha Subsolar Energy Serurubele Solar Development project near Bloemfontein, Free State Province.
- Wetland/watercourse Assessment for the proposed 171 ha Subsolar Energy Sonneblom Solar Development project near Bloemfontein, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 171 ha Subsolar Energy Sonneblom Solar Development project near Bloemfontein, Free State Province.
- Proposed 13.6 ha Haldon Estate development project in Bloemfontein, Free State Province.
- Wetland/watercourse Assessment for the proposed 200 ha Subsolar Energy Delta Solar Development project near Bloemhof, North West Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 200 ha Subsolar Energy Delta Solar Development project near Bloemhof, North West Province.
- Water Use License Application (WULA) Specialist Opinion and Recommendation Letter for the proposed three Subsolar Energy Solar Development projects.
- Grazing and Invasive Species Follow-up Assessment for the Farm Waterval West no 653, outside Steynsrus, Free State Province.
- Proposed 25 ha Letsemeng Local Municipality landfill site development project in Luckhof, Free State Province.
- *Vachellia erioloba* Counting Report for the proposed 286 ha Subsolar Energy Gamma Solar Development project near Vryburg, North West Province.

- *Vachellia erioloba* Counting Report for the proposed 243 ha Subsolar Energy Khubu Solar Development project near Vryburg, North West Province.
- *Vachellia erioloba* Counting Report for the proposed 224 ha Subsolar Energy Protea Solar Development project near Vryburg, North West Province.
- *Vachellia erioloba* Counting Report for the proposed 262 ha Subsolar Energy Impala Solar Development project near Vryburg, North West Province.
- *Vachellia erioloba* Counting Report for the proposed 265 ha Subsolar Energy Sonbesie Solar Development project near Vryburg, North West Province.
- Ecological site suitability assessments for three potential 583 ha, 300 ha and 227 ha Alt-e Developments Herbert Phase 2 Solar Power Facility development projects near Douglas, Northern Cape Province.
- Proposed 113 ha Danrika Boerdery Edms BPK Vineyard Development project near Prieska, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 120 ha Northern Cape Department Agriculture Agricultural Development outside Hopetown, Northern Cape Province.
- Ecological Rehabilitation and Alien Invasive Species Management Plan for a proposed 120 ha Northern Cape Department Agriculture Agricultural Development outside Hopetown, Northern Cape Province.
- Protected Plant Species Management Plan for a proposed 120 ha Northern Cape Department Agriculture Agricultural Development outside Hopetown, Northern Cape Province.
- Ecological Stormwater and Erosion Management Plan for a proposed 120 ha Northern Cape Department Agriculture Agricultural Development outside Hopetown, Northern Cape Province.
- GIS Master Layout Plan for a proposed 120 ha Northern Cape Department Agriculture Agricultural Development outside Hopetown, Northern Cape Province.
- Grazing and Invasive Species Follow-up Assessment for the Farm Klipfontein No 71, outside Lindley, Free State Province.
- Proposed 384.3 ha Prieska Power Reserve Solar Power Facility Development outside Prieska, Northern Cape Province.

2020

- Proposed 120 ha Northern Cape Department Agriculture Hopetown Agricultural Development outside Hopetown, Northern Cape Province.
- Proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Stormwater Management Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- GIS Master Layout Plan for a proposed 3.27 ha Lynette Brand Ritchie NEMA Section 24G river lodge development project in Ritchie, Northern Cape Province.
- Preliminary Ecological Specialist Findings and Opinion Letter for the proposed 294 ha Northern Cape Department Agriculture Bucklands Agricultural Development, Douglas Northern Cape Province.
- Proposed 1.58 km Dihlabeng Local Municipality Sewer Bridge and Pipeline Development, Paul Roux, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 1.58 km Dihlabeng Local Municipality Sewer Bridge and Pipeline Development, Paul Roux, Free State Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 1.58 km Dihlabeng Local Municipality Sewer Bridge and Pipeline Development, Paul Roux, Free State Province.
- Proposed 2064 ha Free State Strategic Solar Project Development outside Bethulie, Free State Province.
- Proposed 7.83 ha Carpe Diem Raisins NEMA Section 24G Evaporation Pond Development project outside Upington, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 7.83 ha Carpe Diem Raisins NEMA Section 24G Evaporation Pond Development project outside Upington, Northern Cape Province.

- Desktop Protected Species and Alien Invasive Species Management Plan for a proposed Northern Cape N 8 & N 10 highway maintenance project between Britstown, Prieska, Groblershoop and Upington, Northern Cape Province.
- Proposed 10.7 ha Dikgatlong Local Municipality NEMA Section 24G residential development in Barkly West, Northern Cape Province.
- Erosion and Rehabilitation Monitoring Report for the Farms Die Kranse no 8174 and De Rotsen no 52 outside Vrede, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Tweefontein no 3344, outside Newcastle, KwaZulu-Natal Province.
- Grazing and Invasive Species Management Plan for the Farm Malpha Noord no 8063, outside Senekal, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Mizpah no 706, outside Memel, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Welgelegen no 802, outside Clarens, Free State Province.
- Proposed 123 ha Slovo Park Residential development project in Brandfort, Free State Province.
- Proposed 2.43 ha Zeekoefontein Resort development project in Vaal Oewer, Gauteng Province.
- Grazing and Invasive Species Assessment for the Farm De Hoek no 8238, outside Bethlehem, Free State Province.
- Proposed 236 ha Northern Cape Department Agriculture Bucklands Agricultural Development outside Douglas, Northern Cape Province.
- Proposed 9.1 ha Motheo College Expansion NEMA Section 24G development in Bloemfontein, Free State Province.
- Proposed 84.7 ha Sol Plaatje Local Municipality Residential development project in Kimberley, Northern Cape Province.
- Proposed 201 ha Siyathemba Local Municipality Residential development project in Prieska, Northern Cape Province.
- Proposed 60.2 ha Siyancuma Local Municipality Residential development project in Douglas, Northern Cape Province.
- Proposed 58.9 ha Maremane Communal Property Association Residential development project in Maremane, Northern Cape Province.

- Proposed 15 ha Maketshemo Trading Filling Station and Truckstop development project in Winburg, Free State Province.
- Rehabilitation and Alien Invasive Species Management Plan for the Moledi Gorge Watercourse Weir decommissioning outside Derby, North West Province.
- GIS Master Layout Plan for a proposed 35 ha Gladiam Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Proposed 46.5 ha Siyathemba Local Municipality Residential development project in Niekerkshoop, Northern Cape Province.
- Proposed 475 m Setsoto Local Municipality Pipeline development and water treatment works upgrade project in Clocolan, Free State Province.

2019

- Water Use License Application (WULA) Risk Assessment for a proposed Kopanong Local Municipality Bridge Upgrading development project in Philippolis, Free State Province.
- Proposed 4.9 ha Royal Vision Developments Gravel Quarry development project outside Kroonstad, Free State Province.
- Proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Proposed 53 ha Arborlane Estates (Pty) Ltd agricultural development project outside Augrabies, Northern Cape Province.
- Proposed 42.7 ha Arborlane Estates (Pty) Ltd NEMA Section 24G agricultural development project outside Augrabies, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 53 ha Arborlane Estates (Pty) Ltd agricultural development project outside Augrabies, Northern Cape Province.
- Proposed 20.2 km Water Pipeline Development from Lindley to Arlington, Free State Province.
- Watercourse delineation and report for a proposed 5.36 ha Filling Station and Shopping Centre Development project in Thaba Nchu, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 20.2 km Water Pipeline Development from Lindley to Arlington, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Driefontein no 274, outside Ficksburg, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.

- Rehabilitation and Alien Invasive Species Management Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- GIS Master Layout Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Proposed 535 ha Farms Bultfontein & Folmink agricultural development project outside Prieska, Northern Cape Province.
- Proposed 6.42 ha Phokwane Local Municipality Residential development project in Jan Kempdorp, Northern Cape Province.
- Stormwater Management Plan for a proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.
- GIS Master Layout Plan for a proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.
- Proposed 13.8 ha Phokwane Local Municipality Cemetery expansion project in Jan Kempdorp, Northern Cape Province.
- Proposed 19.9 ha Vergenoeg NEMA Section 24G residential development project in Wesselsbron, Free State Province.
- Proposed 20.5 ha Khalinkomo NEMA Section 24G residential development project in Wesselsbron, Free State Province.
- Erosion and Rehabilitation Monitoring Report for the Farms Die Kranse no 8174 and De Rotsen no 52 outside Vrede, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Zaaihoek no 8251, outside Vrede, Free State Province.
- Grazing and Invasive Species Management Plan for Plot 19 of the Farm Ballyduff no 8594, in Bethlehem, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Mooiuitzicht no 205, outside Bethlehem, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Rietfontein no 8457, outside Bethlehem, Free State Province.
- Proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.

- Rehabilitation and Alien Invasive Species Management Plan for a proposed Kopanong Local Municipality Bridge Upgrading development project in Philippolis, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.
- Protected Species Relocation Management Plan for a proposed Gamagara Local Municipality Water Reticulation Development project in Olifantshoek, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farm Erfenis no 8014, outside Bethlehem, Free State Province.
- Proposed 35 ha Gladiam Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farms Liebenbergsvlei no 848 & Aasvogelkrans no 96, outside Bethlehem, Free State Province.
- Grazing and Invasive Species Management Plan for the Farm Dwarsberg no 350, outside Paul Roux, Free State Province.
- Proposed 50 ha Siyathemba Local Municipality residential development project in Prieska, Northern Cape Province.
- Rehabilitation and Alien Invasive Species Management Plan for a proposed 35 ha Gladiam Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 35 ha Gladiam Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Stormwater Management Plan for a proposed 35 ha Gladiam Boerdery Familietrust NEMA Section 24G agricultural development project outside Niekerkshoop, Northern Cape Province.
- Grazing and Invasive Species Management Plan for the Farm Waterval West no 653, outside Steynsrus, Free State Province.
- Proposed 7.6 ha Annie van den Hever NEMA Section 24G agricultural development project outside Hanover, Northern Cape Province.
- Revision of a proposed 535 ha Farms Bultfontein & Folmink agricultural development project outside Prieska, Northern Cape Province.