EcoFocus
Ecological Specialist Services
Leave a future behind

Aquatic Ecological Assessment Report

110 MW Khauta South Solar Photovoltaic (PV) Facility Development, Riebeeckstad, Free State Province

August 2022

Compiled for:

enviro works
Today's Impact | Tomorrow's Legacy

Compiled by:

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Leave a future behind

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Aquatic Biodiversity Protocol Compliance

- **Screening Report**
  - Aquatic Biodiversity Theme is rated as "very high sensitivity", solely due to the likely presence of a very small confined portion of a wetland within the south-western corner of the assessment area.
- **Protocol Heading 2: Site Sensitivity Verification and Minimum Report Content Requirements**
  - **Sub-Headings 2.1 & 2.2**
  - A desktop and on-site Site Verification Assessment was conducted of the original proposed development area and the surrounding 500 m 'zone of influence'.
  - **Sub-Heading 2.3**
  - A Site Verification Report was compiled to provide the outcomes and results of the on-site Site Verification Assessment. A number of ecologically/conservationally significant and sensitive aquatic features/habitats and -species were identified throughout this original proposed development area and the surrounding 500 m 'zone of influence'. Based on these findings and the subsequent initial recommendations of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were revised by the applicant. This was done proactively by the applicant, prior to the formal commencement of the Environmental Impact Assessment (EIA) process, in order to ensure that the proposed development area is adequately kept away from any of the identified ecologically/conservationally significant and sensitive aquatic features/habitats and -species. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area.
  - 'Ground truthing' and on-site wetland delineation during the Site Verification Assessment also confirmed that the very small confined south-western corner of the assessment area, which is indicated as a likely wetland in the Screening Report, is in fact not a wetland, but rather forms part of the surrounding terrestrial grassland landscape.
  - Therefore, based on the outcomes and results of the Site Verification Report, the specialist is not in agreement with the Screening Tool, but rather concludes that the Aquatic Biodiversity Theme of the final proposed development area is rated as "low sensitivity".

- **Protocol Heading 3: Specialist Assessment and Minimum Report Content Requirements**
  - **Sub-heading 1.1**
  - An applicant intending to undertake an activity identified in the scope of this Protocol on a site identified on the screening tool as being of:
  - 1.1.2. "low sensitivity" for aquatic biodiversity, must submit an Aquatic Biodiversity Compliance Statement.
  - **Sub-heading 3**
  - The specialist however rather compiled a more extensive Aquatic Ecological Assessment Report, which complies with- and exceeds the minimum Protocol requirements of a required Aquatic Biodiversity Compliance Statement, as per Sub-heading 3.

- **Bookmarks to Aquatic Biodiversity Protocol Requirements**

Sub-heading 3.1 Specialist Qualifications

Sub-heading 3.2.1 Assessment Area

Sub-heading 3.2.2 Site Low Sensitivity Confirmation

Sub-heading 3.2.3 Aquatic Ecological Impact Assessment

Sub-heading 3.3.1 Specialist Contact Details, Qualifications and Curriculum Vitae

Sub-heading 3.3.2 Specialist Declaration of Independence

Sub-heading 3.3.3 Site Assessment Details

Sub-heading 3.3.4 Biodiversity and Ecosystem Description

Sub-heading 3.3.5 Methodology

Sub-heading 3.3.6 Not applicable

Sub-heading 3.3.7 Aquatic Ecological Impact Mitigation Measures

Sub-heading 3.3.8 Assumptions, Uncertainties and Gaps in Knowledge

Sub-heading 3.3.9 Specialist Opinion and Conditions

- **The Aquatic Ecological Assessment Report also complies with the following minimum Protocol requirements of an Aquatic Biodiversity Specialist Assessment Report (which is not required for the proposed development), as per Sub-heading 2.7.**

Sub-heading 2.7.1 Specialist Contact Details, Qualifications and Curriculum Vitae

Sub-heading 2.7.2 Specialist Declaration of Independence

Sub-heading 2.7.3 Site Assessment Details

Sub-heading 2.7.4 Methodology

Sub-heading 2.7.5 Assumptions, Uncertainties and Gaps in Knowledge

Sub-heading 2.7.6 Suitable and Unsuitable Development Areas

Sub-heading 2.7.7 Aquatic Ecological Impact Assessment

Sub-heading 2.7.8 Cumulative Impacts

Sub-heading 2.7.9 Aquatic Ecological Impact Mitigation Measures

Sub-heading 2.7.10 Aquatic Ecological Impact Mitigation Measures

Sub-heading 2.7.11 Aquatic Ecological Impact Mitigation Measures

Sub-heading 2.7.12 Buffer zones

Sub-heading 2.7.13 Aquatic Ecological Impact Mitigation Measures

Sub-heading 2.7.14 Not applicable

Sub-heading 2.7.15 Conclusion

Sub-heading 2.7.16 Specialist Opinion and Conditions

Executive Summary

The project applicant, WKN Windcurrent SA, proposes to formally develop a vacant portion of agricultural farm land for a 110 MW Photovoltaic (PV) solar power generation facility, outside the town of Riebeeckstad, Free State Province. The proposed development will entail the construction of the following main infrastructure:

- 110 MW Photovoltaic (PV) solar power generation facility
- Electrical substation
- Office block and parking
- Construction yard

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size.

Enviroworks was appointed by the applicant as the independent Environmental Assessment Practitioner (EAP), to conduct the legally required Environmental Impact Assessment (EIA) 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 features/habitats, -species 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 No. 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 consequently 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 area was conducted on 17 & 18 January 2022. These dates form part of the growing season and most plant species present, could therefore be successfully identified.

Due to the inaccessibility of various portions of the proposed development area as a result of the abnormally high rainfall received during that time period, a follow-up site assessment was conducted on 27 January 2022. This was done in order to attempt to adequately assess all portions of the proposed development area.

Another follow-up site assessment was conducted on 11 February 2022. This was done in order to finalise the delineations of all aquatic features and all soil type classifications

Assessment Area

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size and is situated on the Remaining Extent of the Farm Taffel Baai No. 413 (SG 21 Digit Code: F02400000000041300000), Portion 9 of the Farm Commandants Pan No. 382 (SG 21 Digit Code: F02400000000038200009) and Portion 12 of the Farm Nooitgedacht No. 74 (SG 21 Digit Code: F03900000000007400012). The proposed development area is located approximately 2.7 km north-east of the town of Riebeeckstad. The town forms part of the Matjhabeng Local Municipality which in turn, forms part of the Lejweleputswa District Municipality, Free State Province. Access to the assessment area is obtained by way of the R 34 provincial road and a subsequent dirt road, from the north.

Methodology

The proposed development area and the approximate 500 m 'zone of influence' surrounding the proposed development area, were assessed on foot and with the use of a vehicle. An ATV/quad motorcycle had to be used to gain access to most areas, due to the inaccessibility of the broader area as a result of the abnormally high rainfall received during that time period.

Visual observations/identifications were made of any significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats and their conditions, as well as relevant aquatic species present.

Identified aquatic species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act No. 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Alien and Invasive Species Regulations, 2014 as well as the Provincially Protected species of the Free State's Nature Conservation Ordinance (No 8 of 1969).

Any significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats which were found to be present within the proposed development area and the approximate 500 m 'zone of influence' surrounding the proposed development area, were identified, delineated and discussed.

Georeferenced photographs were taken of any significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats, as well as any Red Data Species Listed-, nationally- or provincially protected aquatic species if encountered. This was done 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 aquatic environment were identified, evaluated, rated and discussed. The Present Ecological State (PES) as well as the Ecological Importance and Sensitivity (EIS) of the identified aquatic features were also determined and discussed.

Results and Conclusion

A number of ecologically/conservationally significant and sensitive aquatic features/habitats and -species were identified throughout the original assessment area and the surrounding 500 m 'zone of influence'. Based on these findings and the subsequent initial recommendations of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were revised by the applicant. This was done proactively by the applicant, prior to the formal commencement of the Environmental Impact Assessment (EIA) process, in order to ensure that the proposed development area is adequately kept away from any of the identified ecologically/conservationally significant and sensitive aquatic features/habitats and -species. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area.

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size. The proposed development area and surrounding 500 m 'zone of influence' consist of a mosaic of mainly natural undisturbed terrestrial grassland and to a lesser extent, old historically cultivated agricultural lands.

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints. The proposed development area could therefore likely be prone to significant potential surface soil erosion, due to the sloping landscape mainly towards the south-west but also towards the east, together with the loosening of surface materials and clearance of vegetation caused by construction activities, which usually binds the soil surface. Such soil erosion could potentially lead to a gradual, continual increase in sediment inputs into- and substantial contamination of the identified aquatic features to the south-west and east of the proposed development area as well as subsequent downstream waterbodies, over time.

It is therefore recommended that vegetation clearance should be avoided or at least minimised as far as practicably/reasonably possible and should only occur within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints, if required. Existing vegetation situated in- between these main physical footprint areas, should not be cleared or damaged in any way and should be left intact and adequately preserved, as far as practicably/reasonably possible. This must be done in order to sufficiently manage and prevent any significant soil erosion from occurring within and around the proposed development area, which could potentially lead to an increase in sediment inputs into- and contamination of the identified aquatic features to the south-west and east of the proposed development area as well as subsequent downstream waterbodies, over time.

Water Catchment and Drainage Information

The proposed development area and surrounding 500 m 'zone of influence' fall within the Middle Vaal Water Management Area (WMA 9). A local but extensive linear topographic highpoint/ridge apex traverses the proposed development area, which roughly lies in a south-west to north-east direction. This highpoint/ridge apex acts as the main natural linear surface water runoff- and drainage separator, between the C25B quaternary surface water catchment- and drainage area situated north of- and the C42J quaternary surface water catchment- and drainage area situated south of the highpoint/ridge apex, respectively. Surface water runoff from the local area consequently mainly drains either in a south-westerly- or easterly direction, depending on which side of the highpoint/ridge apex the area is situated. The majority of the proposed development area drains towards the south-west, while the substantial eastern portion drains towards the east.

Watercourse Baseline Information

No significant watercourses were found to be present throughout the proposed development area or surrounding 500 m 'zone of influence'.

Depression Pans

The Commandants Pan constitutes a well-known significantly sized naturally occurring depression pan, which is situated approximately 270 m east of the proposed development area. The pan is seasonally/temporarily inundated and its main inflow originates from a significantly sized unchanneled valley-bottom wetland, situated approximately 2.3 km north-east of the proposed development area as well as an associated watercourse. A broad surface water outflow is also evident on the southern side of the pan. This outflow constitutes a watercourse and water drainage plain/valley-bottom wetland, which gradually flows in a south-westerly direction and eventually flows into a second smaller depression pan, located approximately 200 m south-west of the proposed development area. A number of artificially constructed earth dams are present within this watercourse and water drainage plain/valley-bottom wetland, situated between the Commandants Pan and second pan. This second pan in turn, discharges into an artificially constructed earth dam, located approximately 230 m west of the proposed development area, which finally discharges into a significantly sized depression pan, located approximately 900 m west of the proposed development area.

The Commandants Pan also collects rainwater as well as general surface water runoff from a limited upstream area to its north, but which is still situated to the south of the highpoint/ridge apex as well as from the substantial eastern portion of the proposed development area, situated to its west.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

The pans house locally distinct and important semi-aquatic habitats within their basins and around their edges, which are mainly dominated by hydrophytic grass- and -graminoid species.

The locally distinct and important semi-aquatic habitats of the Commandants Pan and to a lesser extent, the second pan are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Unchanneled Valley-bottom Wetlands

A significantly sized, broad naturally occurring unchanneled valley-bottom wetland is present, approximately 80 m west of the proposed development area. This wetland is situated to the south of a local but extensive linear topographic highpoint/ridge apex, which roughly lies in a south-west to north-east direction (not the same ridge as discussed earlier above). This highpoint/ridge apex acts as a natural linear surface water runoff- and drainage separator, between the areas situated south and north of the highpoint/ridge apex, respectively.

Surface water runoff from a substantial portion of the landscape to the south of the highpoint/ridge apex, consequently mainly channels and drains through this wetland, towards the lower lying south-west. The substantial central-western- and north-western portions of the proposed development area drain towards this wetland. Surface water flow from the east towards this wetland, will therefore be directly impacted by the proposed development.

The wetland gradually flows into a subsequent significantly sized naturally occurring unchanneled valley-bottom wetland, located approximately 300 m west of the proposed development area. The local topography flattens-out slightly in the vicinity of the subsequent wetland, which results in this subsequent wetland being seasonally/temporarily inundated. The outflow of this subsequent wetland further flows into an artificially constructed earth dam, located approximately 230 m west of the proposed development area (the same dam as mentioned earlier above), which finally discharges into a significantly sized depression pan, located approximately 900 m west of the proposed development area (the same pan as mentioned earlier above).

Another naturally occurring water drainage plain/unchanneled valley-bottom wetland is present, approximately 100 m south-west of the proposed development area. As discussed earlier above, this wetland forms part of the downstream outflow of the Commandants Pan and subsequent inflow into the second smaller pan. This wetland therefore channels and drains significant volumes of surface water runoff towards the west, into the pan. As discussed earlier above, a number of artificially constructed earth dams are present within this wetland, directly upstream of the portion that is adjacent to the proposed development area.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

Due to the sloping topography of the area along with a lack of continuous water flow through the local area, the two wetlands do not possess any ecologically/conservationally significant semi-aquatic habitat. They rather house similar terrestrial grassland vegetation compositions and -structures, relative to the surrounding landscape, with merely slight variations in species representation. The wetlands are therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

As discussed earlier above, the subsequent wetland into which the first broad wetland gradually flows, is seasonally/temporarily inundated due to its local slightly flattened-out topography. It therefore houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species.

This locally distinct and important semi-aquatic habitat is also likely utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

During the site assessment, a number of Marsh owl (*Asio capensis*) individuals were in fact found to be utilising the semi-aquatic habitat of the wetland as well as the surrounding terrestrial grassland landscape. Although not specifically observed during the site assessment as the focus of the assessment was not on avifauna, the wetland and local surrounding terrestrial grassland landscape also provide very suitable habitat for Grass owls (*Tyto capensis*). It is therefore likely that the semi-aquatic habitat of the identified wetland and local surrounding terrestrial grassland landscape are also utilised by individuals and/or pairs of this species as refuge and for breeding, foraging and/or persistence purposes. Both of these owl species are considered to be very habitat-specific and therefore range-limited. The latter species is nationally classified as a Vulnerable Red Data Listed bird species, due to extensive habitat degradation and loss.

Artificially Constructed Earth Dam

An artificially constructed earth dam is present, approximately 230 m west of the proposed development area (the same dam as mentioned earlier above). The inflow of this dam mainly constitutes the second depression pan as well as the unchanneled valley-bottom wetlands. Also as mentioned earlier above, the outflow of this dam discharges into a subsequent significantly sized depression pan, located approximately 900 m west of the proposed development area.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

The dam constitutes the main convergence point where virtually all surface water flow from the local and broader landscape to the north-east, east and south-east of the dam, comes together. Significant anthropogenic impeding and modification of the original flow regime of the local and broader landscape has therefore taken place.

Although the earth dam has been artificially constructed, the dam still houses locally distinct and important aquatic and semi-aquatic habitats within its basin and around its edges, which are mainly dominated by hydrophytic grass- and -graminoid species

These locally distinct and important aquatic and semi-aquatic habitats are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Buffer Zone- and Other Recommendations

It is recommended that the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.

By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam.

By implementing the relevant Department of Water and Sanitation (DWS) Wetland buffer calculation tool, a minimum Water Quality- and Biodiversity Buffer distance of approximately 60 m from the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), was determined. Due to the extensive vegetation clearance and associated significantly increased sediment input into the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality- and Biodiversity Buffer distance is therefore recommended to be implemented around the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west).

The significant noise generated by the construction activities, will likely cause substantial disturbance and subsequently impact negatively on the ecological integrity and -functionality of the aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland into which the first one gradually flows (300 m west), dam and the local surrounding terrestrial grassland landscapes. The erection of permanent permitter fencing and associated night-time illumination infrastructure around the proposed solar power generation facility footprint area, furthermore poses a significant collision and mortality risk to the relevant owl and other nocturnal avifaunal species that utilise the area. The operations of the established solar power generation facility infrastructure will also result in continual emissions of significantly bright glare/shine into the surrounding landscape.

From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second depression pan and artificially constructed earth dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.

After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the unchanneled valley-bottom wetland (300 m west). It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.

It is further recommended that no bright light from any spotlights or perimeter lights should be emitted into the surrounding landscape towards the two depression pans, unchanneled valley-bottom wetland (300 m west) or artificially constructed earth dam, during the night-time. As little light emissions as practicably/reasonably possible from the proposed development area, should occur during night time as this could lure owl and other nocturnal avifaunal species individuals towards the permitter fences and potentially result in collisions and mortality.

These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam and their associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans, wetlands and dam and in so doing, ensure the persistence/livelihood of aquatic and semi-aquatic fauna and flora in the local and broader area.

As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.

Conclusion

The various aquatic features identified within the 500 m 'zone of influence' surrounding the proposed development area, all scored moderate Ecological Importance and Sensitivity (EIS) values and are viewed as being of moderate to high conservational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding aquatic ecosystem and the associated habitat-specific waterbirds, amphibian species and aquatic invertebrates along with the actual confirmed presence of ecologically important, habitat-specific and range-limited bird species.

Disturbance of-/damage to semi-aquatic faunal habitats, associated with the identified two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam as well as impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the construction phase of the proposed development.

Continued impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area as well as over-extraction of operational water from a borehole, were furthermore identified and addressed as significant potential long-term aquatic ecological impacts, associated with the operational phase of the proposed development.

The proposed development merely forms a small part of a significantly sized and extensive combined solar power generation facility cluster, which is envisaged and consequently being applied for throughout the local and broader landscape surrounding the proposed development area. This extensive combined cluster development and subsequent transformation in the same geographical area, which will highly likely take place, will therefore lead to substantial cumulative aquatic ecological impacts.

The significant potential long-term aquatic ecological impacts identified for the proposed development, could therefore potentially add moderate to moderately-high cumulative impact to the existing and anticipated future negative impacts, associated with the envisaged significantly sized and extensive combined solar power generation facility cluster.

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 add any significant residual cumulative aquatic ecological impacts to the surrounding environment, if all 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 from an aquatic ecological and hydrological perspective, that the proposed development area is of low sensitivity and 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

CBA	Critical Biodiversity Area
DWS	Department of Water and Sanitation
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)
NWA	National Water Act (Act 36 of 1998)
ONA	Other Natural Area
PES	Present Ecological State
WULA	Water Use License Application

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

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1. Introduction

The project applicant, WKN Windcurrent SA, proposes to formally develop a vacant portion of agricultural farm land for a 110 MW Photovoltaic (PV) solar power generation facility, outside the town of Riebeeckstad, Free State Province. The proposed development will entail the construction of the following main infrastructure:

- 110 MW Photovoltaic (PV) solar power generation facility
- Electrical substation
- Office block and parking
- Construction yard

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size.

Enviroworks was appointed by the applicant as the independent Environmental Assessment Practitioner (EAP), to conduct the legally required Environmental Impact Assessment (EIA) 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 features/habitats, -species 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 No. 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 consequently 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 area, in order to determine the direct impact footprint area.
- A desktop study was conducted of the most up-to-date information/data available on the relevant vegetation types, national/provincial aquatic conservation significance statuses as well as the quaternary surface water catchment- and drainage area, associated with the proposed development area.

2. Date of Ecological Site Assessment

A site assessment for the proposed development area was conducted on 17 & 18 January 2022. These dates form part of the growing season and most plant species present, could therefore be successfully identified.

Due to the inaccessibility of various portions of the proposed development area as a result of the abnormally high rainfall received during that time period, a follow-up site assessment was conducted on 27 January 2022. This was done in order to attempt to adequately assess all portions of the proposed development area.

Another follow-up site assessment was conducted on 11 February 2022. This was done in order to finalise the delineations of all aquatic features and all soil type classifications.

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. 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; 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 area was therefore conducted in order to identify and quantify any potential aquatic ecological impacts, associated with the proposed development.

4. 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 area as provided by the EAP, is correct and will not be significantly deviated from, as this was the only area assessed.
- strategic level investigations undertaken by the applicant prior to the commencement of the Environmental Impact Assessment process, determined that the proposed development area represents a potentially suitable and technically acceptable location.
- 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 Environmental Impact 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 EIA 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

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Given that an EIA involves prediction, the uncertainty factor forms part of the assessment process. Two types of uncertainty are associated with the EIA 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 EIA 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:

- This report purely constitutes an Aquatic Ecological Assessment; no terrestrial ecological aspects were therefore assessed or taken into account during any discussions, conclusions and/or recommendations associated with this report.
- 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 aquatic ecological assessment.
- The proposed development merely forms a small part of a significantly sized and extensive combined solar power generation facility cluster, which is envisaged and consequently being applied for throughout the local and broader landscape surrounding the proposed development area.
    - This extensive combined cluster development and subsequent transformation in the same geographical area, which will highly likely take place, will therefore lead to substantial cumulative aquatic ecological impacts.

- The local and broader region surrounding the proposed development area forms a mosaic of undeveloped natural landscapes intertwined with extensive agricultural cultivation transformation.
- An approximate 500 m 'zone of influence' was also assessed surrounding the proposed development area.
- The boundary delineation of wetlands and other aquatic features on the significant size scale associated with the proposed development and the extensive combined cluster development, cannot be considered to be 100 % exact and accurate, as transitional zones between terrestrial and aquatic features are subjectively interpretable. A minimum 90 % confidence level can however be assigned to the boundary delineation process.

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 qualitative data gathered as well as professional specialist observation and opinion.

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5. Assessment Area

The proposed development will entail the formal construction of the following main infrastructure, on a vacant portion of agricultural farm land:

- 110 MW Photovoltaic (PV) solar power generation facility
- Electrical substation
- Office block and parking
- Construction yard

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size and is situated on the Remaining Extent of the Farm Taffel Baai No. 413 (SG 21 Digit Code: F02400000000041300000), Portion 9 of the Farm Commandants Pan No. 382 (SG 21 Digit Code: F02400000000038200009) and Portion 12 of the Farm Nooitgedacht No. 74 (SG 21 Digit Code: F03900000000007400012). The proposed development area is located approximately 2.7 km north-east of the town of Riebeeckstad. The town forms part of the Matjhabeng Local Municipality which in turn, forms part of the Lejweleputswa District Municipality, Free State Province. Access to the assessment area is obtained by way of the R 34 provincial road and a subsequent dirt road, from the north.

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

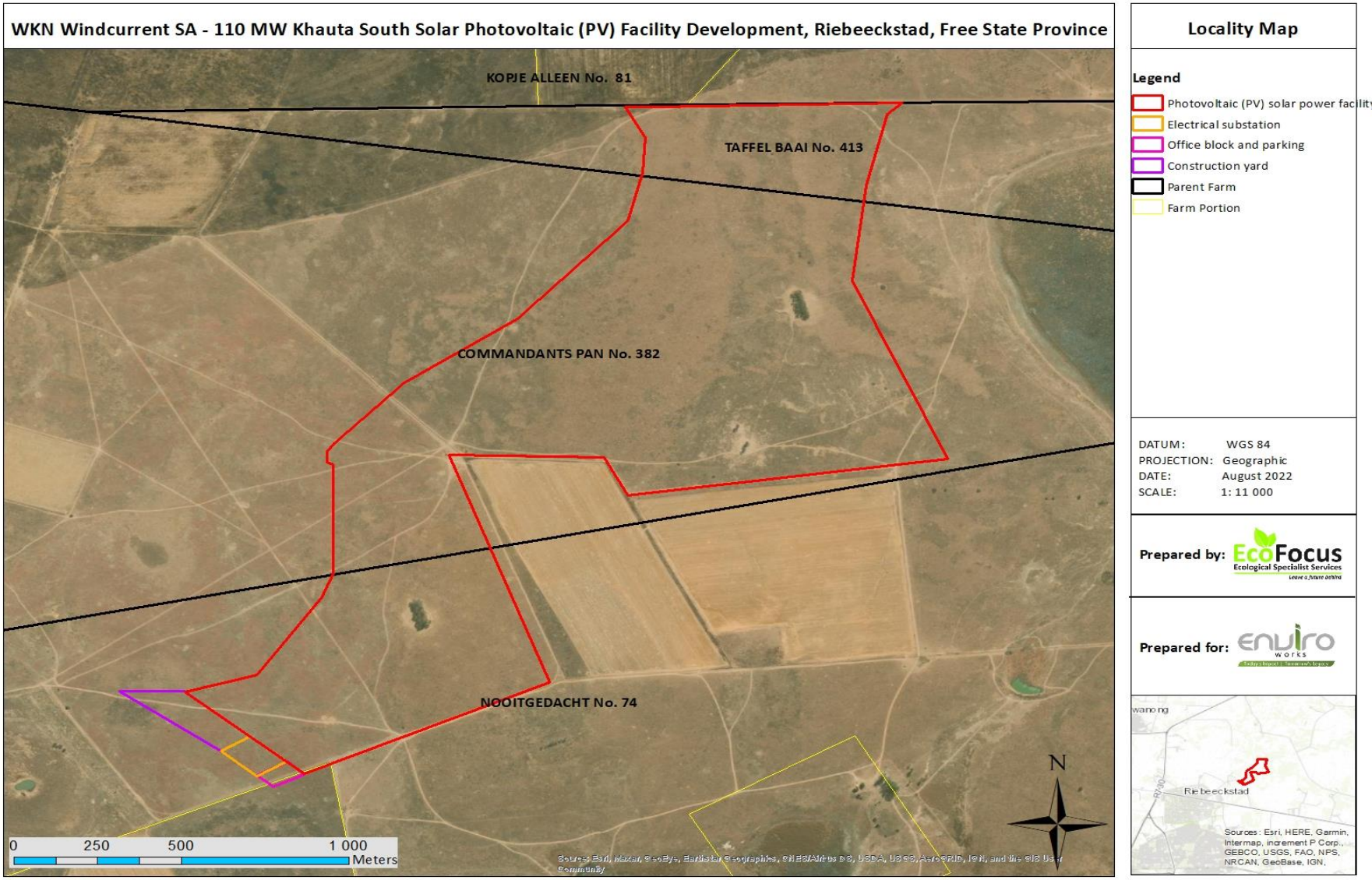

Figure 1: Locality map illustrating the proposed development area

5.1. Climate

The rainfall of the region peaks during the summer months and the Mean Annual Precipitation (MAP) of the area is approximately 577 mm (www.climate-data.org). The maximum average monthly temperature is approximately 23.3°C in the summer months while the minimum average monthly temperature is approximately 9.7°C during the winter. Maximum daily temperatures can reach up to 29.7°C in the summer months and dip to as low as 2.4°C during the winter.

5.2. 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 deep sandy to clayey alluvial soils developed over Quaternary alluvial sediments.

5.3. Vegetation Type and Conservation Status

Vegetation Type

According to SANBI (2006-2019), the proposed development area falls within the Highveld Alluvial Vegetation vegetation type (Aza 5). This vegetation type mainly consists of a flat topography supporting riparian thickets accompanied by seasonally flooded grasslands. This vegetation type is classified as Least Concerned (SANBI, 2006-2019).

'Ground truthing' during the site assessment however suggests that virtually the entire proposed development area rather forms part of a clayey terrestrial grassland landscape, based on vegetation structure, species composition and soil characteristics.

Aquatic Conservation Status

The Free State Province does not possess separate/specific spatial data for terrestrial and aquatic provincial biodiversity conservation statuses/categories. The relevant provincial information is rather combined into a single wholistic provincial biodiversity conservation status/category spatial data set, which sets out biodiversity priority areas in the province. This spatial data set is known as the Free State Provincial Spatial Biodiversity Plan 2018 (Collins, 2018).

Virtually the entire proposed development area is categorised as an Ecological Support Area one (ESA 1), in accordance with the Free State Provincial Spatial Biodiversity Plan 2018 (Collins, 2018). ESA's 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 Critical Biodiversity Area (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).

The south-eastern portion of the proposed development area is categorised as Other Natural Area (ONA), in accordance with the Free State Provincial Spatial Biodiversity Plan 2018 (Collins, 2018).

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

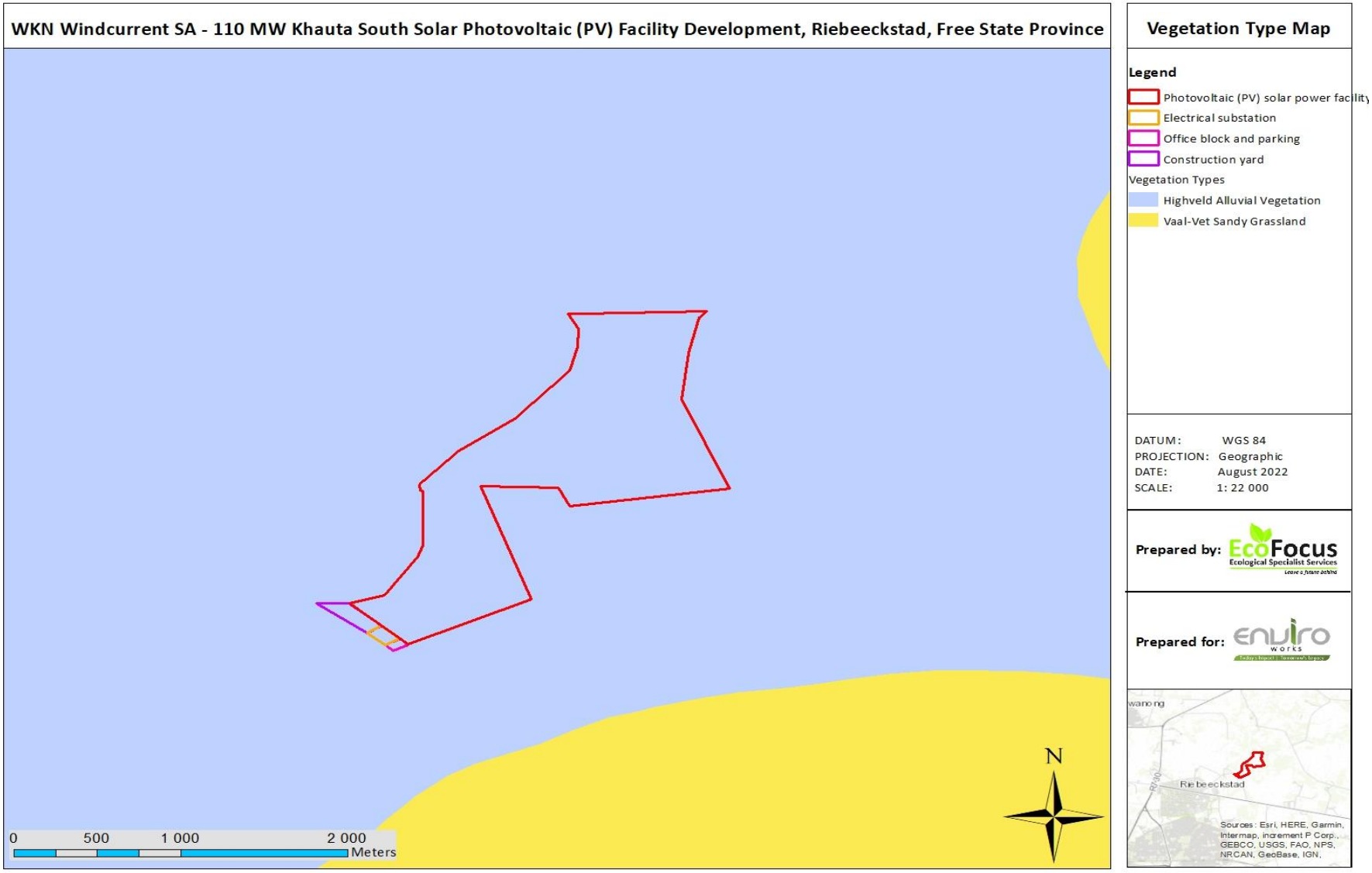

Figure 2: Vegetation type map illustrating the vegetation type associated with the proposed development area

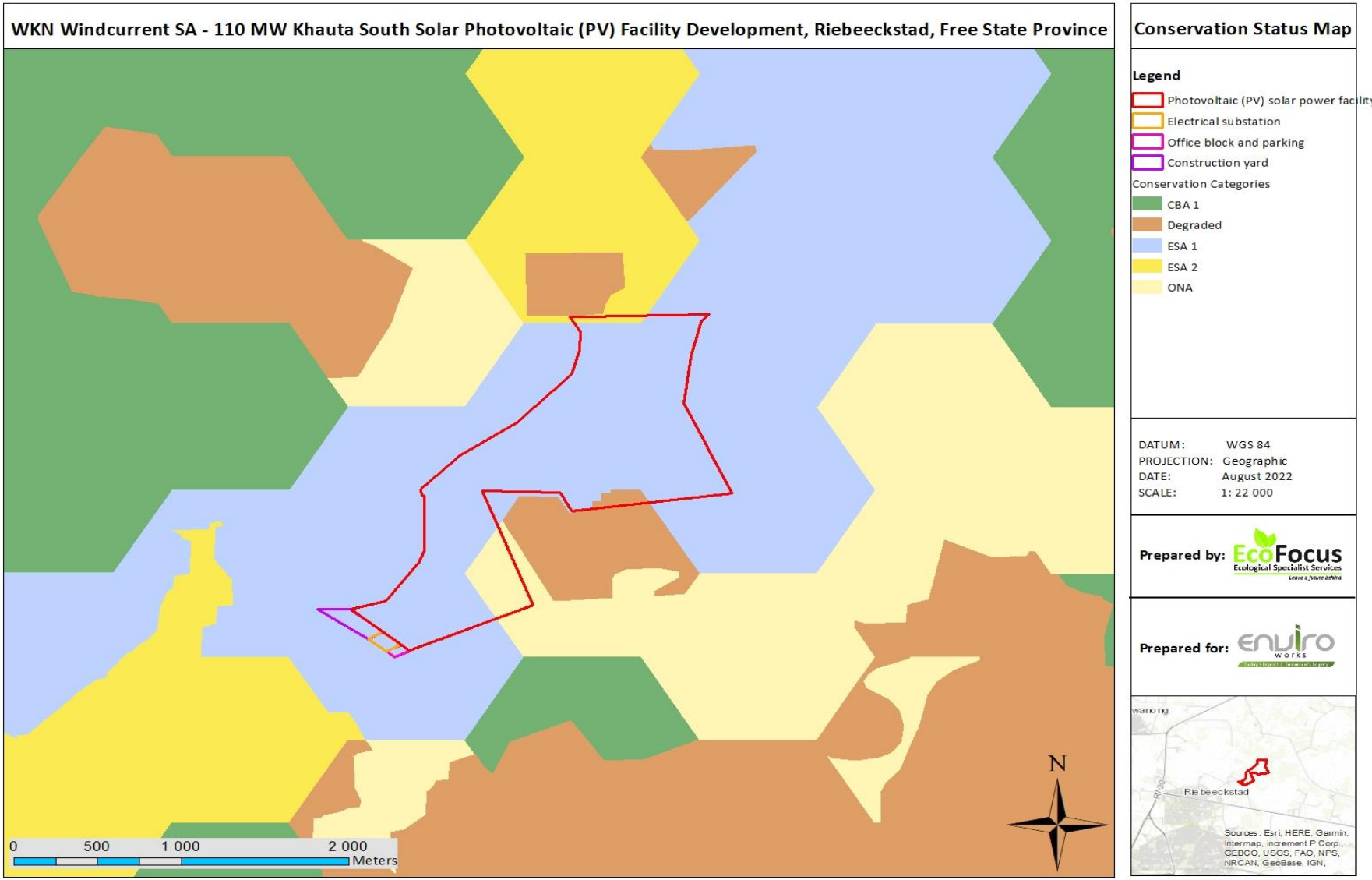

Figure 3: Conservation status map illustrating the conservation statuses/categories associated with the proposed development area

6. 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 115601)

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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
- South African Wetland Society **(SAWS)**
  - Membership number 220958

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

2022

- Aquatic Ecological Assessment for the proposed 178 ha A1 Groblershoop 50 MW PV Solar Plant Development, Northern Cape Province.
- Water Use License Application (WULA) Risk Assessment for the proposed 178 ha A1 Groblershoop 50 MW PV Solar Plant Development, Northern Cape Province.
- Proposed 14.3 ha North West Department of Education Ga-Maloka Primary School Expansion project in Ga-Maloka, North West Province.
- Aquatic Ecological Site Verification Report for the proposed 661 ha Khauta Solar PV Cluster Development, Riebeeckstad, Free State Province.
- Grazing and Invasive Species Assessment for the Farm Fourina No. 362 outside Fouriesburg, Free State Province.
- Desktop ecological assessment for the proposed 2.7 ha Muller Composting Abattoir and Composting Facility Development near Frankfort, Free State Province.
- Proposed 5.22 ha Equity Properties Midway Guesthouse Development in Bloemfontein, Free State Province.
- Proposed 1.5 ha Reeco Holdings (Pty) Ltd 15 Eco-villa Units Development near Ritchie, Northern Cape Province.

- Proposed 63.4 ha Kareeberg Local Municipality Carnarvon Residential Development, Northern Cape Province.
- Legal comments and responses for the Grazing and Invasive Species Assessment for the Farms Liebenbergsvlei No. 148 & Aasvogelkrans No. 96, outside Bethlehem, Free State Province.
- Legal comments and responses for the Grazing and Invasive Species Assessment for the Farm Erfenis No. 1014, outside Bethlehem, Free State Province.
- Proposed 16.8 ha Mafube Local Municipality Strasburg Mixed Land Use Development, Frankfort, Free State Province.
- Revision of the Basic Assessment process for a poultry broiler facility on the Farm Dwarsfontein 1 IQ, near Derby, North West Province.

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 167 agricultural development project outside Douglas, Northern Cape Province.
- Grazing and Invasive Species Assessment 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 Assessment for the Farms Nebo A no 957, Tevrede no 1088, Sarona no 1089 & Uitkyk no 1119, 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 182 ha Farm Selosesha no 900 mixed land use development project in Thaba Nchu, Free State Province.
- Water Use License Application (WULA) Risk Assessment for a proposed 182 ha Farm Selosesha no 900 mixed land use development project in Thaba Nchu, Free State 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.

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- *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.
- Aquatic Ecological Assessment for the proposed Farm Bullhoek Chicken Layer Houses and Evaporation Ponds Expansion near Swartruggens, North West Province.

- Water Use License Application (WULA) Risk Assessment for the proposed Farm Bullhoek Chicken Layer Houses and Evaporation Ponds Expansion near Swartruggens, North West Province.
- Grazing and Invasive Species Assessment for the Farm Kleine Fontein No 1160 outside Bergville, KwaZulu-Natal Province.
- Proposed 1.37 km Mantsopa Local Municipality Water Pipeline Development in Ladybrand, Free State Province.
- Water Use License Application (WULA) Risk Assessment for the proposed 1.37 km Mantsopa Local Municipality Water Pipeline Development in Ladybrand, Free State Province.
- Grazing and Invasive Species Assessment for the Farm Elizabeth No 220 outside Bethlehem, Free State Province.
- Grazing and Invasive Species Follow-up Assessment for the Farm Retiefs Nek No 123 outside Bethlehem, Free State Province.
- Grazing and Invasive Species Follow-up Assessment for the Farm Brakfontein No 244, outside Verkykerskop, Free State Province.
- Proposed 107.8 ha Danrika Boerdery Edms BPK NEMA Section 24G Development project near 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 1174 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 1063, 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 102, 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 1238, 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.

7. Objectives of the Assessment

- Identify, delineate and discuss any significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats, if potentially found to be present within the proposed development area or the approximate 500 m 'zone of influence' surrounding the proposed development area.
    - The delineations do not include formal 1:100-year floodline calculations, as this is deemed to be an engineering function.
- Describe the vegetation within the identified watercourses/wetlands and/or aquatic features/habitats and identify and list conservationally significant aquatic species encountered.
    - List any nationally- and/or provincially protected- and/or Red Data Listed aquatic species.
- Assess and discuss the Ecological Importance and Sensitivity (EIS) of the identified watercourses/wetlands and/or aquatic features/habitats, in order to provide an indication of their ecological sensitivity/conservational significance.
- 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 No. 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 proposed development area, for development purposes.
- A digital report (this document) as well as digital .KML files are also provided to the EAP, of any identified significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats, if potentially found to be present within the proposed development area or the approximate 500 m 'zone of influence' surrounding the proposed development area.

8. Methodology

- The proposed development area and the approximate 500 m 'zone of influence' surrounding the proposed development area, were assessed on foot and with the use of a vehicle.
    - An ATV/quad motorcycle had to be used to gain access to most areas, due to the inaccessibility of the broader area as a result of the abnormally high rainfall received during that time period.
- Visual observations/identifications were made of any significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats and their conditions, as well as relevant aquatic species present.
- Identified aquatic species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act No. 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), Alien and Invasive Species Regulations, 2014 as well as the Provincially Protected species of the Free State's Nature Conservation Ordinance (No 8 of 1969).
- Any significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats which were found to be present within the proposed development area and the approximate 500 m 'zone of influence' surrounding the proposed development area, were identified, delineated and discussed as per the accepted 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 significant watercourses/wetlands and/or other ecologically sensitive/conservationally significant aquatic features/habitats, as well as any Red Data Species Listed-, nationally- or provincially protected aquatic species if encountered. This was done 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 and/or aquatic features/habitats, was determined 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 and/or aquatic features/habitats, was determined 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.

9. Results and Discussion

A number of ecologically/conservationally significant and sensitive aquatic features/habitats and -species were identified throughout the original assessment area and the surrounding 500 m 'zone of influence'. Based on these findings and the subsequent initial recommendations of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were revised by the applicant. This was done proactively by the applicant, prior to the formal commencement of the Environmental Impact Assessment (EIA) process, in order to ensure that the proposed development area is adequately kept away from any of the identified ecologically/conservationally significant and sensitive aquatic features/habitats and -species. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area.

9.1. Proposed Development Area Clearance

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size. The proposed development area and surrounding 500 m 'zone of influence' consist of a mosaic of mainly natural undisturbed terrestrial grassland and to a lesser extent, old historically cultivated agricultural lands.

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints. The proposed development area could therefore likely be prone to significant potential surface soil erosion, due to the sloping landscape mainly towards the south-west but also towards the east (see discussion under heading 9.2), together with the loosening of surface materials and clearance of vegetation caused by construction activities, which usually binds the soil surface. Such soil erosion could potentially lead to a gradual, continual increase in sediment inputs into- and substantial contamination of the identified aquatic features to the south-west and east of the proposed development area as well as subsequent downstream waterbodies, over time.

It is therefore recommended that vegetation clearance should be avoided or at least minimised as far as practicably/reasonably possible and should only occur within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints, if required. Existing vegetation situated in- between these main physical footprint areas, should not be cleared or damaged in any way and should be left intact and adequately preserved, as far as practicably/reasonably possible. This must be done in order to sufficiently manage and prevent any significant soil erosion from occurring within and around the proposed development area, which could potentially lead to an increase in sediment inputs into- and contamination of the identified aquatic features to the south-west and east of the proposed development area as well as subsequent downstream waterbodies, over time.

9.2. Water Catchment and Drainage Information

The proposed development area and surrounding 500 m 'zone of influence' fall within the Middle Vaal Water Management Area (WMA 9). A local but extensive linear topographic highpoint/ridge apex traverses the proposed development area, which roughly lies in a south-west to north-east direction. This highpoint/ridge apex acts as the main natural linear surface water runoff- and drainage separator, between the C25B quaternary surface water catchment- and drainage area situated north of- and the C42J quaternary surface water catchment- and drainage area situated south of the highpoint/ridge apex, respectively. Surface water runoff from the local area consequently mainly drains either in a south-westerly- or easterly direction, depending on which side of the highpoint/ridge apex the area is situated. The majority of the proposed development area drains towards the south-west, while the substantial eastern portion drains towards the east.

9.3. Watercourse Baseline Information

No significant watercourses were found to be present throughout the proposed development area or surrounding 500 m 'zone of influence'.

9.4. Depression Pans

9.4.1. Aquatic Feature Description and Current Existing Vegetation

The Commandants Pan constitutes a well-known significantly sized naturally occurring depression pan, which is situated approximately 270 m east of the proposed development area. The pan is seasonally/temporarily inundated and its main inflow originates from a significantly sized unchanneled valley-bottom wetland, situated approximately 2.3 km north-east of the proposed development area as well as an associated watercourse. A broad surface water outflow is also evident on the southern side of the pan. This outflow constitutes a watercourse and water drainage plain/valley-bottom wetland (see discussion under heading 9.5), which gradually flows in a south-westerly direction and eventually flows into a second smaller depression pan, located approximately 200 m south-west of the proposed development area. A number of artificially constructed earth dams are present within this watercourse and water drainage plain/valley-bottom wetland, situated between the Commandants Pan and second pan. This second pan in turn, discharges into an artificially constructed earth dam, located approximately 230 m west of the proposed development area (see discussion under heading 9.6), which finally discharges into a significantly sized depression pan, located approximately 900 m west of the proposed development area.

The Commandants Pan also collects rainwater as well as general surface water runoff from a limited upstream area to its north, but which is still situated to the south of the highpoint/ridge apex as well as from the substantial eastern portion of the proposed development area, situated to its west.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

The Commandants Pan as well as the second pan house locally distinct and important semi-aquatic habitats within their basins and around their edges, which are mainly dominated by the hydrophytic grass species *Themeda triandra, Eragrostis curvula, E plana, Paspalum spp.* and *Setaria spp.* as well as the hydrophytic graminoid species *Cyperus spp.* The more terrestrial grass species *Panicum spp., Aristida spp., Digitaria eriantha, Eragrostis gummiflua, E superba, Cymbopogon pospischilii* and *Elionurus muticus* were also found to be present throughout the semi-aquatic habitats of the pans, but to a lesser extent.

The locally distinct and important semi-aquatic habitats of the Commandants Pan and to a lesser extent, the second pan are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Figure 4: Two images illustrating the presence of the naturally occurring Commandants Pan, which is situated approximately 270 m east of the proposed development area

Figure 5: Two images illustrating the presence of the second smaller naturally occurring depression pan, which is situated approximately 200 m south-west of the proposed development area

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

Present Ecological State (PES)

Table 5: PES table for the Commandants Pan (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.	4	The Commandants Pan is naturally occurring. The pan is seasonally/temporarily inundated and its main inflow originates from a significantly sized unchanneled valley-bottom wetland, situated approximately 2.3 km north-east of the proposed development area and an associated watercourse. A broad surface water outflow is also evident on the southern side of the pan. The Commandants Pan also collects rainwater as well as general surface water runoff from a limited upstream area to its north, but which is still situated to the south of the highpoint/ridge apex as well as from the substantial eastern portion of the proposed development area, situated to its west.
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	5	The Commandants Pan is naturally occurring. The pan is seasonally/temporarily inundated and its main inflow originates from a significantly sized unchanneled valley-bottom wetland, situated approximately 2.3 km north-east of the proposed development area and an associated watercourse. A broad surface water outflow is also evident on the southern side of the pan.

			The Commandants Pan also collects rainwater as well as general surface water runoff from a limited upstream area to its north, but which is still situated to the south of the highpoint/ridge apex as well as from the substantial eastern portion of the proposed development area, situated to its west.
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 Commandants Pan is naturally occurring. The pan is seasonally/temporarily inundated and its main inflow originates from a significantly sized unchanneled valley-bottom wetland, situated approximately 2.3 km north-east of the proposed development area and an associated watercourse. A broad surface water outflow is also evident on the southern side of the pan. The Commandants Pan also collects rainwater as well as general surface water runoff from a limited upstream area to its north, but which is still situated to the south of the highpoint/ridge apex as well as from the substantial eastern portion of the proposed development area, situated to its west.

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.	5	The Commandants Pan houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species. This locally distinct and important semi-aquatic habitat is also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.
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.	5	The Commandants Pan houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species. This locally distinct and important semi-aquatic habitat is also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.
Alien Fauna	Presence of alien fauna affecting faunal community structure.	5	At the time of the site assessment, no significant legally declared alien invasive species establishments were found to be present throughout the Commandants Pan.

Over utilisation of biota	Over gazing, over fishing etc.	3	The terrestrial grassland surrounding the Commandants Pan, is mainly utilised by the land owner for livestock grazing purposes. The semi-aquatic habitat of the pan, is subsequently also utilised by livestock for grazing purposes, but to a significantly lesser extent. Such periodic defoliation stimulation is in fact beneficial and necessary for the continued ecological functionality and -integrity of the relevant semi-aquatic habitat.
Total		**32/35**	
Class		**A**	

The Present Ecological State (PES) of the Commandants Pan is classified as Class A as it is unmodified, natural and pristine. The pan houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species. This locally distinct and important semi-aquatic habitat is also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna. The ecosystem functionality has therefore remained unchanged.

Table 6: PES table for the second smaller depression pan (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	The second smaller depression pan is naturally occurring. A number of artificially constructed earth dams are present within the watercourse and water drainage plain/valley-bottom wetland, which constitute the inflow of the pan. Significant anthropogenic impeding and modification of the original flow regime of the watercourse and water drainage plain/valley-bottom wetland has therefore taken place, towards the pan. A number of actively cultivated agricultural lands are situated directly adjacent south of the pan. These lands in all probability, continuously impede and impact on the flow regime towards the pan.
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	4	The second smaller depression pan is naturally occurring. A number of artificially constructed earth dams are present within the watercourse and water drainage plain/valley-bottom wetland, which constitute the inflow of the pan. Significant anthropogenic impeding and modification of the original flow regime of the watercourse and water drainage plain/valley-bottom wetland has therefore taken place, towards the pan. A number of actively cultivated agricultural lands are situated directly adjacent south of the pan. These lands in all probability, continuously impede and impact on the flow regime towards the pan.

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.	4	The second smaller depression pan is naturally occurring. A number of artificially constructed earth dams are present within the watercourse and water drainage plain/valley-bottom wetland, which constitute the inflow of the pan. Significant anthropogenic impeding and modification of the original flow regime of the watercourse and water drainage plain/valley-bottom wetland has therefore taken place, towards the pan. A number of actively cultivated agricultural lands are situated directly adjacent south of the pan. These lands in all probability, continuously impede and impact on the flow regime towards the pan.
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	Although a number of earth dams have been artificially constructed within the watercourse and water drainage plain/valley-bottom wetland which constitute the inflow of the pan, the pan still houses a locally distinct and important semi-aquatic habitat, which is mainly dominated by hydrophytic grass- and -graminoid species. . This locally distinct and important semi-aquatic habitat is also to a lesser extent than the Commandants Pan, visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

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.	4	Although a number of earth dams have been artificially constructed within the watercourse and water drainage plain/valley-bottom wetland which constitute the inflow of the pan, the pan still houses a locally distinct and important semi-aquatic habitat, which is mainly dominated by hydrophytic grass- and -graminoid species. . This locally distinct and important semi-aquatic habitat is also to a lesser extent than the Commandants Pan, visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.
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 pan.
Over utilisation of biota	Over gazing, over fishing etc.	3	The terrestrial grassland surrounding the pan, is mainly utilised by the land owner for livestock grazing purposes. The semi-aquatic habitat of the pan, is subsequently also utilised by livestock for grazing purposes, but to a significantly lesser extent. Such periodic defoliation stimulation is in fact beneficial and necessary for the continued ecological functionality and -integrity of the relevant semi-aquatic habitat.
Total		**26/35**	
Class		**C**	

The Present Ecological State (PES) of the pan is classified as Class C as it is moderately modified. Moderate loss and transformation of natural habitat and biota have occurred, mainly as a result of the artificial construction of a number of earth dams within the watercourse and water drainage plain/valley-bottom wetland, which constitute the inflow of the pan. Significant anthropogenic impeding and modification of the original flow regime of the watercourse and water drainage plain/valley-bottom wetland has therefore taken place, towards the pan.

The pan however still houses a locally distinct and important semi-aquatic habitat, which is mainly dominated by hydrophytic grass- and -graminoid species. This locally distinct and important semi-aquatic habitat is also to a lesser extent than the Commandants Pan, visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna. The basic ecosystem functionality has therefore remained predominantly unchanged.

Ecological Importance and Sensitivity (EIS)

Table 7: EIS table for the depression pans (0-5 indicates increase in significance)

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

The Ecological Importance and Sensitivity (EIS) of the pans is classified as Class C (moderate) as they are viewed as being ecologically important and sensitive on local and possibly provincial scale. Due to them forming an important part of the hydrological and aquatic ecological connectivity associated with the local and broader quaternary surface water catchment- and drainage area, the local area is viewed as being of moderate conservational significance/value for habitat preservation and ecological functionality persistence, in support of the surrounding aquatic ecosystem.

It is therefore recommended that the depression pans as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.

By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the pans, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the pans, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the pans.

Due to the locally distinct and important nature of the semi-aquatic habitats associated with the pans (the Commandants Pan in particular), along with the significant size of the Commandants Pan, the local areas are furthermore viewed as being of moderate to high conservational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding aquatic ecosystem and the associated habitat-specific waterbirds, amphibian species and aquatic invertebrates.

The significant noise generated by the construction activities, will likely cause substantial disturbance and subsequently impact negatively on the ecological integrity and -functionality of the semi-aquatic habitats of the pans and the local surrounding terrestrial grassland landscapes. The erection of permanent permitter fencing and associated night-time illumination infrastructure around the proposed solar power generation facility footprint area, furthermore poses a significant collision and mortality risk to nocturnal avifaunal species that utilise the area. The operations of the established solar power generation facility infrastructure will also result in continual emissions of significantly bright glare/shine into the surrounding landscape.

From an aquatic ecological/biodiversity perspective, the important semi-aquatic habitats therefore also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second pan. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.

It is further recommended that no bright light from any spotlights or perimeter lights should be emitted into the surrounding landscape towards the pans, during the night-time. As little light emissions as practicably/reasonably possible from the proposed development area, should occur during night time as this could lure nocturnal avifaunal species individuals towards the permitter fences and potentially result in collisions and mortality.

These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the pans and their associated semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans and in so doing, ensure the persistence/livelihood of semi-aquatic fauna and flora in the local and broader area.

As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.

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9.5. Unchanneled Valley-bottom Wetlands

9.5.1. Aquatic Feature Description and Current Existing Vegetation

A significantly sized, broad naturally occurring unchanneled valley-bottom wetland is present, approximately 80 m west of the proposed development area. This wetland is situated to the south of a local but extensive linear topographic highpoint/ridge apex, which roughly lies in a south-west to north-east direction (not the same ridge as discussed under heading 9.2). This highpoint/ridge apex acts as a natural linear surface water runoff- and drainage separator, between the areas situated south and north of the highpoint/ridge apex, respectively.

Surface water runoff from a substantial portion of the landscape to the south of the highpoint/ridge apex, consequently mainly channels and drains through this wetland, towards the lower lying south-west. The substantial central-western- and north-western portions of the proposed development area drain towards this wetland. Surface water flow from the east towards this wetland, will therefore be directly impacted by the proposed development.

The wetland gradually flows into a subsequent significantly sized naturally occurring unchanneled valley-bottom wetland, located approximately 300 m west of the proposed development area. The local topography flattens-out slightly in the vicinity of the subsequent wetland, which results in this subsequent wetland being seasonally/temporarily inundated. The outflow of this subsequent wetland further flows into an artificially constructed earth dam, located approximately 230 m west of the proposed development area (the same dam as mentioned under heading 9.4; also see discussion under heading 9.6), which finally discharges into a significantly sized depression pan, located approximately 900 m west of the proposed development area (the same pan as mentioned under heading 9.4).

Another naturally occurring water drainage plain/unchanneled valley-bottom wetland is present, approximately 100 m south-west of the proposed development area. As discussed under heading 9.4, this wetland forms part of the downstream outflow of the Commandants Pan and subsequent inflow into the second smaller pan. This wetland therefore channels and drains significant volumes of surface water runoff towards the west, into the pan (see discussion under heading 9.4). As discussed under heading 9.4, a number of artificially constructed earth dams are present within this wetland, directly upstream of the portion that is adjacent to the proposed development area.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

Due to the sloping topography of the area along with a lack of continuous water flow through the local area, the two wetlands do not possess any ecologically/conservationally significant semi-aquatic habitat. They rather house similar terrestrial grassland vegetation compositions and -structures, relative to the surrounding landscape, with merely slight variations in species representation. The wetlands are therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

The wetlands are mainly dominated by the terrestrial grass species *Eragrostis chloromelas, Themeda triandra, Cynodon dactylon* and *Sporobolus spp.* The grass species *Eragrostis curvula, E gummiflua, E superba, E plana, Panicum spp., Paspalum spp.* and *Setaria spp.* as well as the hydrophytic graminoid species *Cyperus spp.,* were also found to be present, but to a lesser extent.

As discussed earlier above, the subsequent wetland into which the first broad wetland gradually flows, is seasonally/temporarily inundated due to its local slightly flattened-out topography. It therefore houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by the hydrophytic grass species *Echinochloa holubii, Diplachne fusca, Eragrostis plana, Themeda triandra, Paspalum spp.* and *Setaria spp.* as well as the hydrophytic graminoid species *Cyperus spp.*

The locally distinct and important semi-aquatic habitat of the wetland is also likely utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

During the site assessment, a number of Marsh owl (*Asio capensis*) individuals were in fact found to be utilising the semi-aquatic habitat of the wetland as well as the surrounding terrestrial grassland landscape. Although not specifically observed during the site assessment as the focus of the assessment was not on avifauna, the wetland and local surrounding terrestrial grassland landscape also provide very suitable habitat for Grass owls (*Tyto capensis*). It is therefore likely that the semi-aquatic habitat of the identified wetland and local surrounding terrestrial grassland landscape are also utilised by individuals and/or pairs of this species as refuge and for breeding, foraging and/or persistence purposes. Both of these owl species are considered to be very habitat-specific and therefore range-limited. The latter species is nationally classified as a Vulnerable Red Data Listed bird species, due to extensive habitat degradation and loss.

Figure 6: Two images illustrating the presence of the naturally occurring broad unchanneled valley-bottom wetland, which is situated approximately 80 m west of the proposed development area and also south of the highpoint/ridge apex

Figure 7: Two images illustrating the presence of the naturally occurring unchanneled valley-bottom wetland, which is situated approximately 100 m south-west of the proposed development area; the extensive inundation visible in the images is merely temporary and was mainly as a result of the abnormally high rainfall received during that time period and a subsequent upstream dam wall failure

Figure 8: Two images illustrating the presence of the subsequent naturally occurring unchanneled valley-bottom wetland into which the first broad wetland gradually flows and which is situated approximately 300 m west of the proposed development area

The following wetland indicators were used to identify, classify and delineate the wetlands with a minimum 90 % confidence level:

- Terrain Unit Indicator (TUI)

The TUI takes into consideration the topography of the area to determine where it is most likely to support a wetland. The identified wetlands clearly form part of a broad, slow-moving surface water drainage area, which gradually gravitates towards the south-west. Due to the slightly sloping topography and even local slightly flattened-out topography in certain areas, standing water accumulation was also extensively evident.

- Soil Form Indicator (SFI)

The SFI relies on classifying soils according to the Soil Classification Working Group. It takes into account the identification of hydromorphic soils that display unique characteristics resulting from prolonged and repeated saturation. Prolonged periods of saturation results in the soil eventually becoming anaerobic and subsequently reduced. The soils within the identified wetlands are classified as a Willowbrook soil type, consisting of a Melanic A horizon (40 cm – 50 cm) on top of a G horizon (a G1 and G2 is also evident within the first wetland), which is indicative of water saturated soils and subsurface water movement.

- Soil Wetness Indicator (SWI)

The colours of various soil components are often the most diagnostic indicator of hydromorphic soils. Colours of these components are strongly influenced by the frequency and duration of soil saturation. The Melanic A horizon of the identified wetlands has a dark grey colour with high clay content, while the G horizon possesses a moderate clay content. Coloured mottles are also clearly present.

Figure 9: Image illustrating from left to right, the Melanic A horizon, followed by the G 1 and G2 horizons of the wetland soils

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

Present Ecological State (PES)

Table 8: PES table for the first unchanneled valley-bottom wetland and the subsequent unchanneled valley-bottom wetland into which the first one gradually flows (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.	4	The unchanneled valley-bottom wetlands are naturally occurring. They are situated to the south of the highpoint/ridge apex and their surrounding landscapes therefore mainly slope towards the south. Surface water runoff from a substantial portion of the landscape to the south of the highpoint/ridge apex, consequently mainly channels and drains through these wetlands, towards the lower lying south-west. A number of old historically cultivated agricultural lands are situated approximately 100 m north-west of the first wetland. It is however not anticipated that these lands should significantly impede or impact on the flow regime towards the wetlands.

Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	5	The unchanneled valley-bottom wetlands are naturally occurring. They are situated to the south of the highpoint/ridge apex and their surrounding landscapes therefore mainly slope towards the south. Surface water runoff from a substantial portion of the landscape to the south of the highpoint/ridge apex, consequently mainly channels and drains through these wetlands, towards the lower lying south-west. A number of old historically cultivated agricultural lands are situated approximately 100 m north-west of the first wetland. It is however not anticipated that these lands should significantly impede or impact on the flow regime towards the wetlands.
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 unchanneled valley-bottom wetlands are naturally occurring. They are situated to the south of the highpoint/ridge apex and their surrounding landscapes therefore mainly slope towards the south. Surface water runoff from a substantial portion of the landscape to the south of the highpoint/ridge apex, consequently mainly channels and drains through these wetlands, towards the lower lying south-west. A number of old historically cultivated agricultural lands are situated approximately 100 m north-west of the first wetland. It is however not anticipated that these lands should significantly impede or impact on the flow regime towards the wetlands.

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 & 5	Due to the sloping topography of the area along with a lack of continuous water flow through the local area, the first wetland does not possess any ecologically/conservationally significant semi-aquatic habitat. It rather houses a similar terrestrial grassland vegetation composition and -structure, relative to the surrounding landscape with merely slight variations in species representation. The wetland is therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna. The subsequent wetland into which the first broad wetland gradually flows, is however seasonally/temporarily inundated due to its local slightly flattened-out topography. It therefore houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species. This locally distinct and important semi-aquatic habitat is also likely utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

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.	5	Due to the sloping topography of the area along with a lack of continuous water flow through the local area, the first wetland does not possess any ecologically/conservationally significant semi-aquatic habitat. It rather houses a similar terrestrial grassland vegetation composition and -structure, relative to the surrounding landscape with merely slight variations in species representation. The wetland is therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna. The subsequent wetland into which the first broad wetland gradually flows, is however seasonally/temporarily inundated due to its local slightly flattened-out topography. It therefore houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species. This locally distinct and important semi-aquatic habitat is also likely utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Alien Fauna	Presence of alien fauna affecting faunal community structure.	5	At the time of the site assessment, no significant legally declared alien invasive species establishments were found to be present throughout the wetlands.
Over utilisation of biota	Over gazing, over fishing etc.	3 & 4	The grassland of the first wetland and surrounding landscape, is mainly utilised by the land owner for livestock grazing purposes. The terrestrial grassland surrounding the subsequent wetland into which the first broad wetland gradually flows, is also utilised by the land owner for livestock grazing purposes. The semi-aquatic habitat of the wetland, is subsequently also utilised by livestock for grazing purposes, but to a significantly lesser extent. Such periodic defoliation stimulation is in fact beneficial and necessary for the continued ecological functionality and -integrity of the relevant grassland and semi-aquatic habitat.
Total		**31/35 & 33/35**	
Class		**B & A**	

The Present Ecological State (PES) of the first unchanneled valley-bottom wetland is classified as Class B as it is largely natural. A small change in natural habitats and biota may have taken place, mainly as a result of continual livestock grazing activities. The ecosystem functionality has however remained essentially unchanged.

Due to the sloping topography of the area along with a lack of continuous water flow through the local area, the wetland does not possess any ecologically/conservationally significant semi-aquatic habitat. It rather houses a similar terrestrial grassland vegetation composition and -structure, relative to the surrounding landscape with merely slight variations in species representation. The wetland is therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

The Present Ecological State (PES) of the subsequent unchanneled valley-bottom wetland into which the first one gradually flows, is classified as Class A as it is unmodified, natural and pristine. The wetland is seasonally/temporarily inundated due to its local slightly flattened-out topography. It therefore houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species. This locally distinct and important semi-aquatic habitat is also likely utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna. The ecosystem functionality has therefore remained unchanged.

Table 9: PES table for the third unchanneled valley-bottom wetland, which is situated approximately 100 m south-west of the proposed development area (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.	2	The unchanneled valley-bottom wetland is naturally occurring. A number of artificially constructed earth dams are present within this wetland, directly upstream of the portion that is adjacent to the proposed development area. Significant anthropogenic impeding and modification of the original flow regime of the wetland has therefore taken place.
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	3	The unchanneled valley-bottom wetland is naturally occurring. A number of artificially constructed earth dams are present within this wetland, directly upstream of the portion that is adjacent to the proposed development area. Significant anthropogenic impeding and modification of the original flow regime of the wetland has therefore taken place.
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.	3	The unchanneled valley-bottom wetland is naturally occurring. A number of artificially constructed earth dams are present within this wetland, directly upstream of the portion that is adjacent to the proposed development area. Significant anthropogenic impeding and modification of the original flow regime of the wetland has therefore taken place.

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	Although a number of earth dams have been artificially constructed within this wetland directly upstream of the portion that is adjacent to the proposed development area, the wetland still houses similar terrestrial grassland vegetation composition and -structure, relative to the surrounding landscape, with merely slight variations in species representation. The wetland is therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.
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.	4	Although a number of earth dams have been artificially constructed within this wetland directly upstream of the portion that is adjacent to the proposed development area, the wetland still houses similar terrestrial grassland vegetation composition and -structure, relative to the surrounding landscape, with merely slight variations in species representation. The wetland is therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.
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 wetland.

Over utilisation of biota	Over gazing, over fishing etc.	3	The grassland of the wetland and surrounding landscape, is mainly utilised by the land owner for livestock grazing purposes. Such periodic defoliation stimulation is in fact beneficial and necessary for the continued ecological functionality and -integrity of the relevant grassland.
Total		**23/35**	
Class		**C**	

The Present Ecological State (PES) of the wetland is classified as Class C as it is moderately modified. Moderate loss and transformation of natural habitat and biota have occurred, mainly as a result of the artificial construction of a number of earth dams within this wetland, directly upstream of the portion that is adjacent to the proposed development area. Significant anthropogenic impeding and modification of the original flow regime of the wetland has therefore taken place.

The wetland however still houses similar terrestrial grassland vegetation composition and -structure, relative to the surrounding landscape, with merely slight variations in species representation. The wetland is therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna. The basic ecosystem functionality has therefore remained predominantly unchanged.

Ecological Importance and Sensitivity (EIS)

Table 10: EIS table for the first unchanneled valley-bottom wetland and the third unchanneled valley-bottom wetland, which is situated approximately 100 m south-west of the proposed development area (0-5 indicates increase in significance)

Determinant	Score
1. Rare and Endangered Species	1
2. Population of Unique Species	1
3. Species/taxon Richness	1
4. Diversity of Habitat Types or Features	1
5. Migration route/breeding and feeding site for wetland species.	1
6. Sensitivity to changes in Natural Hydrological Regime.	2
7. Sensitivity to water quality changes.	2
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	3
9. Protected Status	2
10. Ecological Integrity	4
Total	**18/50**
Overall Ecological Sensitivity and Importance	**C**

The Ecological Importance and Sensitivity (EIS) of the wetlands is classified as Class C (moderate) as they are viewed as being ecologically important and sensitive on local scale. Due to them forming an important part of the hydrological and aquatic ecological connectivity associated with the local and broader quaternary surface water catchment- and drainage area, the local area is viewed as being of moderate conservational significance/value for habitat preservation and ecological functionality persistence, in support of the surrounding aquatic ecosystem.

It is therefore recommended that the first unchanneled valley-bottom wetland and the third unchanneled valley-bottom wetland, which is situated approximately 100 m south-west of the proposed development area as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.

By implementing the relevant Department of Water and Sanitation (DWS) Wetland buffer calculation tool, a minimum Water Quality- and Biodiversity Buffer distance of approximately 60 m from the wetlands, was determined. Due to the extensive vegetation clearance and associated significantly increased sediment input into the wetlands, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality- and Biodiversity Buffer distance is therefore recommended to be implemented around the wetlands.

These recommended buffer zones must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the wetlands and subsequent downstream waterbodies and their associated semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the wetlands and in so doing, ensure the persistence/livelihood of semi-aquatic fauna and flora in the local and broader area.

As stated earlier under heading 9, based on this recommendation which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.

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Table 11: EIS table for the subsequent unchanneled valley-bottom wetland into which the first one gradually flows (0-5 indicates increase in significance)

Determinant	Score
1. Rare and Endangered Species	3
2. Population of Unique Species	2
3. Species/taxon Richness	2
4. Diversity of Habitat Types or Features	2
5. Migration route/breeding and feeding site for wetland species.	2
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	2
10. Ecological Integrity	4
Total	**25/50**
Overall Ecological Sensitivity and Importance	**C**

The Ecological Importance and Sensitivity (EIS) of the wetland is classified as Class C (moderate) as it is viewed as being ecologically important and sensitive on local and possibly provincial scale.

It is therefore recommended that the subsequent unchanneled valley-bottom wetland into which the first one gradually flows as well as a portion of the surrounding natural undisturbed terrestrial grassland, must be adequately buffered out. No current or future development is allowed to take place within this buffered zone.

By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the wetland, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the wetland, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the wetland.

Due to the locally distinct and important nature of the semi-aquatic habitat associated with the wetland, the local area is furthermore viewed as being of moderate to high conservational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding aquatic ecosystem and the associated actual confirmed presence of ecologically important, habitat-specific and range-limited bird species.

The significant noise generated by the construction activities, will likely cause substantial disturbance and subsequently impact negatively on the ecological integrity and -functionality of the semi-aquatic habitat of the wetland and the local surrounding terrestrial grassland landscape. The erection of permanent permitter fencing and associated night-time illumination infrastructure around the proposed solar power generation facility footprint area, furthermore poses a significant collision and mortality risk to the relevant owl species that likely utilise the area. The operations of the established solar power generation facility infrastructure will also result in continual emissions of significantly bright glare/shine into the surrounding landscape.

From an aquatic ecological/biodiversity perspective, the important semi-aquatic habitat therefore also needs to be adequately preserved. After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the wetland. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.

It is further recommended that no bright light from any spotlights or perimeter lights should be emitted into the surrounding landscape towards the wetland, during the night-time. As little light emissions as practicably/reasonably possible from the proposed development area, should occur during night time as this could lure owl and other nocturnal avifaunal species individuals towards the permitter fences and potentially result in collisions and mortality.

This recommended buffer zone and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the wetland and its associated semi-aquatic habitat along with the local surrounding terrestrial grassland landscape. It must prevent any significant increase in sediment inputs and contamination of the wetland and in so doing, ensure the persistence/livelihood of semi-aquatic fauna and flora in the local and broader area.

As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.

9.6. Artificially Constructed Earth Dam

9.6.1. Aquatic Feature Description and Current Existing Vegetation

An artificially constructed earth dam is present, approximately 230 m west of the proposed development area (the same dam as mentioned under headings 9.4 and 9.5). The inflow of this dam mainly constitutes the second depression pan (see discussion under heading 9.4; also the same pan as mentioned under heading 9.5) as well as the unchanneled valley-bottom wetlands (see discussion under heading 9.5). Also as mentioned under headings 9.4 and 9.5, the outflow of this dam discharges into a subsequent significantly sized depression pan, located approximately 900 m west of the proposed development area.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

The dam constitutes the main convergence point where virtually all surface water flow from the local and broader landscape to the north-east, east and south-east of the dam, comes together. Significant anthropogenic impeding and modification of the original flow regime of the local and broader landscape has therefore taken place.

The dam however still houses locally distinct and important aquatic and semi-aquatic habitats within its basin and around its edges, which are mainly dominated by the hydrophytic grass species *Eragrostis curvula, E plana, Themeda triandra, Andropogon appendiculatus, Echinochloa holubii, Paspalum spp.* and *Setaria spp.* as well as the hydrophytic graminoid species *Cyperus spp.* The more terrestrial grass species *Panicum spp., Aristida spp.* and *Digitaria eriantha* were also found to be present throughout the semi-aquatic habitat of the dam, but to a lesser extent.

The locally distinct and important aquatic and semi-aquatic habitats of the dam are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Figure 10: Two images illustrating the presence of the artificially constructed earth dam, which is situated approximately 230 m west of the proposed development area

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

Present Ecological State (PES)

Table 12: PES table for the artificially constructed earth dam (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.	2	The earth dam has been artificially constructed. The dam constitutes the main convergence point where virtually all surface water flow from the local and broader landscape to the north-east, east and south-east of the dam, comes together. Significant anthropogenic impeding and modification of the original flow regime of the local and broader landscape has therefore taken place.
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	3	The earth dam has been artificially constructed. The dam constitutes the main convergence point where virtually all surface water flow from the local and broader landscape to the north-east, east and south-east of the dam, comes together. Significant anthropogenic impeding and modification of the original flow regime of the local and broader landscape has therefore taken place.
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.	3	The earth dam has been artificially constructed. The dam constitutes the main convergence point where virtually all surface water flow from the local and broader landscape to the north-east, east and south-east of the dam, comes together. Significant anthropogenic impeding and modification of the original flow regime of the local and broader landscape has therefore taken place.

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	Although the earth dam has been artificially constructed, the dam still houses locally distinct and important aquatic and semi-aquatic habitats within its basin and around its edges, which are mainly dominated by hydrophytic grass- and -graminoid species. These locally distinct and important aquatic and semi-aquatic habitats are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.
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.	4	Although the earth dam has been artificially constructed, the dam still houses locally distinct and important aquatic and semi-aquatic habitats within its basin and around its edges, which are mainly dominated by hydrophytic grass- and -graminoid species. These locally distinct and important aquatic and semi-aquatic habitats are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.
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 artificially constructed earth dam.

Over utilisation of biota	Over gazing, over fishing etc.	4	The terrestrial grassland surrounding the dam, is mainly utilised by the land owner for livestock grazing purposes. The semi-aquatic habitat of the dam, is subsequently also utilised by livestock for grazing purposes, but to a significantly lesser extent. Such periodic defoliation stimulation is in fact beneficial and necessary for the continued ecological functionality and -integrity of the relevant aquatic and semi-aquatic habitats.
Total		**24/35**	
Class		**C**	

The Present Ecological State (PES) of the artificially constructed earth dam is classified as Class C as it is moderately modified. Moderate loss and transformation of natural habitat and biota have occurred, mainly as a result of the dam being artificially constructed. The dam constitutes the main convergence point where virtually all surface water flow from the local and broader landscape to the north-east, east and south-east of the dam, comes together. Significant anthropogenic impeding and modification of the original flow regime of the local and broader landscape has therefore taken place.

The dam however still houses locally distinct and important aquatic and semi-aquatic habitats, which are mainly dominated by hydrophytic grass and graminoid species. These locally distinct and important aquatic and semi-aquatic habitats are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna. The basic ecosystem functionality has therefore remained predominantly unchanged.

Ecological Importance and Sensitivity (EIS)

Table 13: EIS table for the artificially constructed earth dam (0-5 indicates increase in significance)

Determinant	Score
1. Rare and Endangered Species	2
2. Population of Unique Species	2
3. Species/taxon Richness	2
4. Diversity of Habitat Types or Features	2
5. Migration route/breeding and feeding site for wetland species.	1
6. Sensitivity to changes in Natural Hydrological Regime.	3
7. Sensitivity to water quality changes.	3
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	4
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 artificially constructed earth dam is classified as Class C (moderate) as it is viewed as being ecologically important and sensitive on local scale. Due to it forming an important part of the hydrological and aquatic ecological connectivity associated with the local and broader quaternary surface water catchment- and drainage area, the local area is viewed as being of moderate conservational significance/value for habitat preservation and ecological functionality persistence, in support of the surrounding aquatic ecosystem.

It is therefore recommended that the artificially constructed earth dam as well as a portion of the surrounding natural undisturbed terrestrial grassland, must be adequately buffered out. No current or future development is allowed to take place within this buffered zone.

By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the dam.

Due to the locally distinct and important nature of the aquatic and semi-aquatic habitats associated with the dam, the local area is furthermore viewed as being of moderate conservational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding aquatic ecosystem and the associated habitat-specific waterbirds, amphibian species and aquatic invertebrates.

The significant noise generated by the construction activities, will likely cause substantial disturbance and subsequently impact negatively on the ecological integrity and -functionality of the aquatic and semi-aquatic habitats of the dam and the local surrounding terrestrial grassland landscape. The erection of permanent permitter fencing and associated night-time illumination infrastructure around the proposed solar power generation facility footprint area, furthermore poses a significant collision and mortality risk to nocturnal avifaunal species that utilise the area. The operations of the established solar power generation facility infrastructure will also result in continual emissions of significantly bright glare/shine into the surrounding landscape.

From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats therefore also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 200 m Biodiversity Buffer distance is therefore recommended to be implemented around the dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.

It is further recommended that no bright light from any spotlights or perimeter lights should be emitted into the surrounding landscape towards the dam, during the night-time. As little light emissions as practicably/reasonably possible from the proposed development area, should occur during night time as this could lure nocturnal avifaunal species individuals towards the permitter fences and potentially result in collisions and mortality.

This recommended buffer zone and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the dam and its associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscape. It must prevent any significant increase in sediment inputs and contamination of the dam and in so doing, ensure the persistence/livelihood of semi-aquatic fauna and flora in the local and broader area.

As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.

9.7. Aquatic Ecological Site Sensitivity Map

The site sensitivity map below (see A3 sized map in the Appendices) illustrates the approximate delineations of the identified two depression pans, the three unchanneled valley-bottom wetlands and the artificially constructed earth dam, which are present throughout the proposed development area and surrounding 500 m 'zone of influence'. The recommended buffer zones to be implemented around the various aquatic features, are also illustrated.

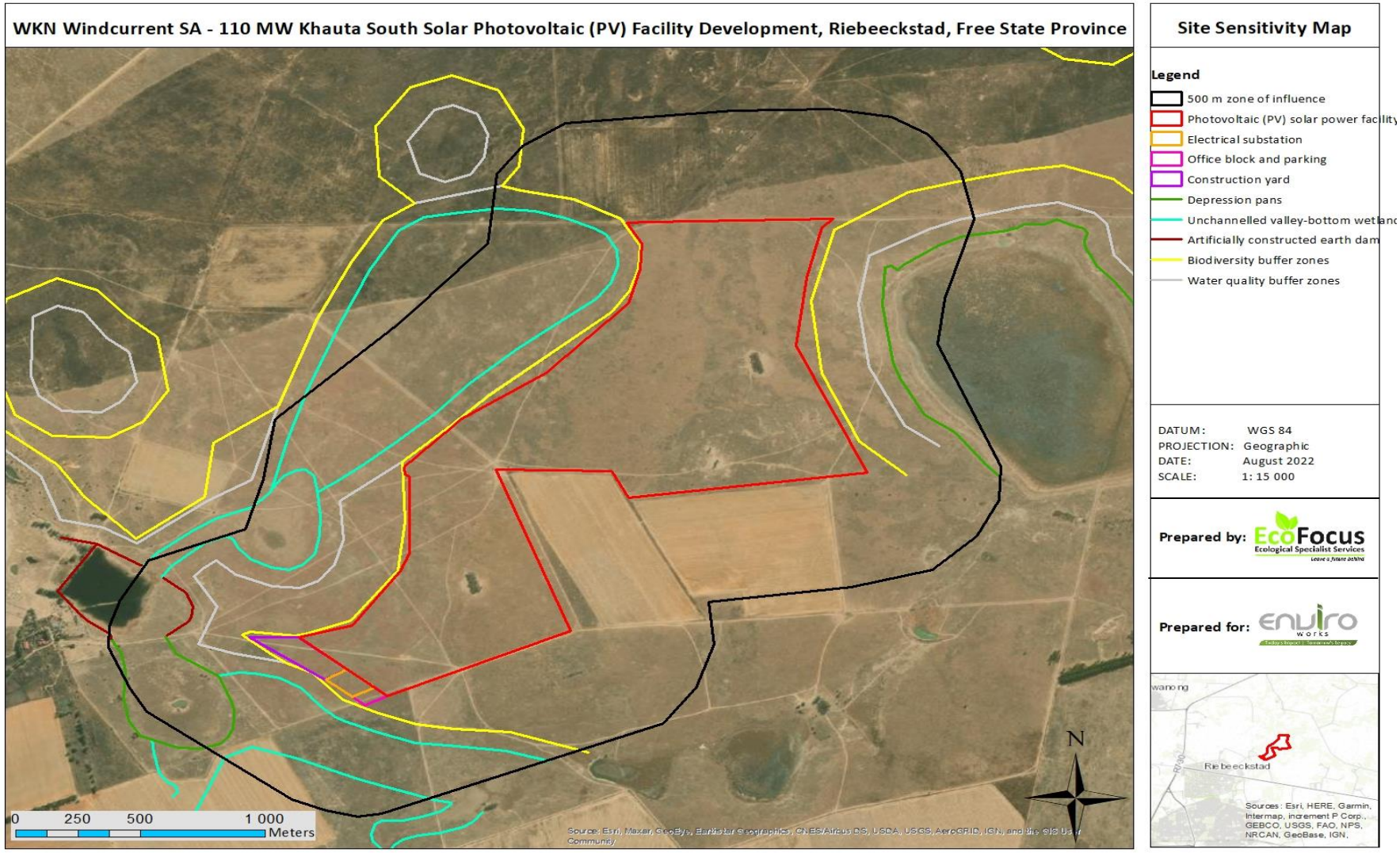

Figure 11: Site sensitivity map illustrating the approximate delineations of the identified two depression pans, the three unchanneled valley-bottom wetlands and the artificially constructed earth dam, which are present throughout the proposed development area and surrounding 500 m 'zone of influence'; the recommended buffer zones to be implemented around the various aquatic features, are also illustrated

10. 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.

10.1. Construction Phase

Disturbance of-/damage to semi-aquatic faunal habitats, associated with the identified two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints.

The significant noise generated by the construction activities, will likely cause substantial disturbance and subsequently impact negatively on the ecological integrity and -functionality of the aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland into which the first one gradually flows (300 m west), artificially constructed earth dam and the local surrounding terrestrial grassland landscapes. The erection of permanent permitter fencing and associated night-time illumination infrastructure around the proposed solar power generation facility footprint area, furthermore poses a significant collision and mortality risk to the relevant owl and other nocturnal avifaunal species that utilise the area. The operations of the established solar power generation facility infrastructure will also result in continual emissions of significantly bright glare/shine into the surrounding landscape.

The two depression pans and unchanneled valley-bottom wetland (300 m west) house locally distinct and important semi-aquatic habitats within their basins and around their edges, which are mainly dominated by hydrophytic grass- and -graminoid species.

The locally distinct and important semi-aquatic habitat of the unchanneled valley-bottom wetland (300 m west) is also likely utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

During the site assessment, a number of Marsh owl (*Asio capensis*) individuals were in fact found to be utilising the semi-aquatic habitat of the unchanneled valley-bottom wetland (300 m west) as well as the surrounding terrestrial grassland landscape. Although not specifically observed during the site assessment as the focus of the assessment was not on avifauna, the wetland and local surrounding terrestrial grassland landscape also provide very suitable habitat for Grass owls (*Tyto capensis*). It is therefore likely that the semi-aquatic habitat of the identified wetland and local surrounding terrestrial grassland landscape are also utilised by individuals and/or pairs of this species as refuge and for breeding, foraging and/or persistence purposes. Both of these owl species are considered to be very habitat-specific and therefore range-limited. The latter species is nationally classified as a Vulnerable Red Data Listed bird species, due to extensive habitat degradation and loss.

Although the earth dam has been artificially constructed, the dam still houses locally distinct and important aquatic and semi-aquatic habitats within its basin and around its edges, which are mainly dominated by hydrophytic grass- and -graminoid species.

The locally distinct and important semi-aquatic habitats of the Commandants Pan and to a lesser extent, the second depression pan (200 m south-west) as well as the aquatic and semi-aquatic habitats of the artificially constructed earth dam, are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Due to the sloping topography of the area along with a lack of continuous water flow through the local area, the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west) do not possess any ecologically/conservationally significant semi-aquatic habitat. They rather house similar terrestrial grassland vegetation compositions and -structures, relative to the surrounding landscape, with merely slight variations in species representation. The unchanneled valley-bottom wetlands are therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

The significance of this potential impact will be medium-high for the unchanneled valley-bottom wetland (300 m west), Commandants Pan and artificially constructed earth dam, medium for the second depression pan (200 m south-west) and zero for the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west).

Mitigation measures to reduce impacts are recommended under heading 10.4.

Terrestrial and aquatic alien invasive species establishment within the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam

At the time of the site assessment, no significant legally declared alien invasive species establishments were found to be present throughout the two depression pans, three unchanneled valley-bottom wetlands or artificially constructed earth dam.

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints.

The proposed development area could therefore potentially be prone to slight to moderate alien invasive species establishment, due to surface disturbance and vegetation clearance caused by construction activities. The presence of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, could further also potentially act as significant transport/distribution vectors for numerous terrestrial and aquatic alien invasive species into the broader region.

The significance of this potential impact will be low for the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam.
Mitigation measures to reduce impacts are recommended under heading 10.4.

Contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by surface material erosion

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints. The proposed development area could therefore likely be prone to significant potential surface soil erosion, due to the sloping landscape mainly towards the south-west but also towards the east, together with the loosening of surface materials and clearance of vegetation caused by construction activities, which usually binds the soil surface. Such soil erosion could potentially lead to a gradual, continual increase in sediment inputs into- and substantial contamination of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as subsequent downstream waterbodies, over time.

The significance of this potential impact will be low for the Commandants Pan and three unchanneled valley-bottom wetlands and medium for the second depression pan (200 m south-west) and artificially constructed earth dam.

Mitigation measures to reduce impacts are recommended under heading 10.4.

Contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by dust generation and emissions

The construction activities associated with the proposed solar development, could potentially result in significant 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 two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam.

The significance of this potential impact will be low for the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam.

Mitigation measures to reduce impacts are recommended under heading 10.4.

Impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area

The proposed development area and surrounding 500 m 'zone of influence' fall within the Middle Vaal Water Management Area (WMA 9) and the associated C25B and C42J quaternary surface water catchment- and drainage areas.

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints.

The construction activities associated with the proposed development, could potentially result in significant impeding of natural surface water flow through the proposed development area towards the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, 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 significant contamination of natural surface water flow through the proposed development area towards the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, 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 medium for the Commandants Pan and three unchanneled valley-bottom wetlands and medium-high for the second depression pan (200 m south-west) and artificially constructed earth dam.

Mitigation measures to reduce impacts are recommended under heading 10.4.

10.2. Operational Phase

Disturbance of-/damage to semi-aquatic faunal habitats, associated with the identified two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam as well as impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the construction phase of the proposed development.

Once the construction phase of the proposed development has been completed, the subsequent operational phase should not result in any significant additional potential aquatic ecological impacts, apart from the potential long-term ecological impacts, as discussed under heading 10.1.

A number of the already discussed potential aquatic ecological impacts could however change in nature (duration and severity) during the operational phase and could continue throughout the entire operational phase and lifespan of the proposed development. A number of additional slight potential aquatic ecological impacts could also likely occur during the operational phase. The following continued and additional potential aquatic ecological impacts could take place during the operational phase:

Continued contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by dust generation and emissions

The operational activities associated with the proposed solar development, could potentially result in continued moderate fugitive dust emissions, due to the area having been mechanically cleared and subsequently being devoid of significant portions of surface vegetation cover. Continued movement of machinery and equipment will likely also increase the significance of fugitive dust emissions. Generated dust could continue to spread into the surrounding undeveloped landscape and contaminate the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam.

The significance of this potential impact will be low for the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam.

Mitigation measures to reduce impacts are recommended under heading 10.4.

Continued impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area

The established solar facility could potentially continuously and significantly impede on natural surface water flow through the proposed development area towards the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area, due to continued artificial obstruction of flow during rainfall events.

The operations of the solar facility could further also potentially result in continued contamination of natural surface water flow within the associated local and broader quaternary surface water catchment- and drainage area, due to dirty surface water runoff as a result of the area having been mechanically cleared and subsequently being devoid of significant portions of surface vegetation cover.

The significance of this potential impact will be medium-high for the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam.

Mitigation measures to reduce impacts are recommended under heading 10.4

Over-extraction of operational water from a borehole

The operational phase of the proposed solar facility will require significant volumes of raw and potable water to maintain the processes. According to the information received from the EAP, water for the operational processes associated with the proposed solar facility, will either be sourced from the local municipality (if adequate capacity is available) or be extracted from a borehole. Significant volumes of groundwater will therefore in all probability continually be extracted from the borehole, which could potentially lead to over extraction from the aquifer over time, if not adequately managed.

The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 10.4.

10.3. Cumulative Impacts

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size. The proposed development area and surrounding 500 m 'zone of influence' consist of a mosaic of mainly natural undisturbed terrestrial grassland and to a lesser extent, old historically cultivated agricultural lands.

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints.

The local and broader region surrounding the proposed development area forms a mosaic of undeveloped natural landscapes intertwined with extensive agricultural cultivation transformation.

The various aquatic features identified within the 500 m 'zone of influence' surrounding the proposed development area, all scored moderate Ecological Importance and Sensitivity (EIS) values and are viewed as being of moderate to high conservational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding aquatic ecosystem and the associated habitat-specific waterbirds, amphibian species and aquatic invertebrates along with the actual confirmed presence of ecologically important, habitat-specific and range-limited bird species.

Disturbance of-/damage to semi-aquatic faunal habitats, associated with the identified two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam as well as impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the construction phase of the proposed development.

Continued impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area as well as over-extraction of operational water from a borehole, were furthermore identified and addressed as significant potential long-term aquatic ecological impacts, associated with the operational phase of the proposed development.

The proposed development merely forms a small part of a significantly sized and extensive combined solar power generation facility cluster, which is envisaged and consequently being applied for throughout the local and broader landscape surrounding the proposed development area. This extensive combined cluster development and subsequent transformation in the same geographical area, which will highly likely take place, will therefore lead to substantial cumulative aquatic ecological impacts.

The significant potential long-term aquatic ecological impacts identified for the proposed development, could therefore potentially add moderate to moderately-high cumulative impact to the existing and anticipated future negative impacts, associated with the envisaged significantly sized and extensive combined solar power generation facility cluster.

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 add any significant residual cumulative aquatic ecological impacts to the surrounding environment, if all 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 from an aquatic ecological and hydrological perspective, that the proposed development area is of low sensitivity and 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.

10.4. 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.

10.4.1. Construction Phase

Table 14: Environmental Risk and Significance Ratings

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Identified Environmental Impact	**Disturbance of-/damage to semi-aquatic faunal habitats, associated with the identified two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam**		
Magnitude of Negative or Positive Impact	-	-	High (8)
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	-	-	High (4)
Cumulative Impact Rating prior to mitigation	-	-	Medium-High

Environmental Significance Score and Rating prior to mitigation	-	-	Medium-High (84)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Identified Environmental Impact	**Disturbance of-/damage to semi-aquatic faunal habitats, associated with the identified two depression pans, unchanneled valley-bottom wetland and artificially constructed earth dam**		
Magnitude of Negative or Positive Impact	Medium (6)	Low (4)	Medium (6)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Local (2)	Local (2)	Local (2)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Low (2)	Moderate (3)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Medium	Medium	Medium

Environmental Significance Score and Rating prior to mitigation	Medium-High (76)	Medium (64)	Medium-High (76)
Mitigation Measures to be implemented	**It is recommended that the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.** **By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam.** **From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second depression pan and artificially constructed earth dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.**		

	After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the unchanneled valley-bottom wetland (300 m west). It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment. **It is further recommended that no bright light from any spotlights or perimeter lights should be emitted into the surrounding landscape towards the two depression pans, unchanneled valley-bottom wetland (300 m west) or artificially constructed earth dam, during the night-time. As little light emissions as practicably/reasonably possible from the proposed development area, should occur during night time as this could lure owl and other nocturnal avifaunal species individuals towards the permitter fences and potentially result in collisions and mortality.** These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam and their associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans, wetland and dam and in so doing, ensure the persistence/livelihood of aquatic and semi-aquatic fauna and flora in the local and broader area. **As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.** 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 local or broader natural landscape surrounding the proposed development area, may take place.

	No site construction basecamps may be established within the local or broader natural landscape surrounding the proposed development area. Adequately cordon off the proposed development construction footprint area and ensure that no construction activities, -machinery or -equipment operate or impact within the local or broader surrounding natural 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. Existing roads and farm tracks in close proximity to the proposed development construction footprint area, must be used during the construction phase. No new temporary roads or tracks may be constructed or implemented through the local or broader natural landscape surrounding the proposed development area. Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction.

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Cumulative Impact Rating after mitigation implementation	-	-	Low
Environmental Significance Score and Rating after mitigation implementation	-	-	Low (32)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (28)	Low (13)	Low (28)

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Identified Environmental Impact	**Terrestrial and aquatic alien invasive species establishment within the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam**		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	Low (4)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	High (2)	High (2)	High (2)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (48)	Low (48)	Low (48)

	Commandants Pan	Depression pan (200 m south-west)	Artificially constructed earth dam
Identified Environmental Impact	**Terrestrial and aquatic alien invasive species establishment within the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam**		
Magnitude of Negative or Positive Impact	Low (4)	Very low (2)	Low (4)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Low (2)	Moderate (3)
Reversibility of Impact	High (2)	High (2)	High (2)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (48)	Low (39)	Low (48)

Mitigation Measures to be implemented	Implement an adequate Alien Invasive Species Management and Prevention Plan during the construction and operational phases. Such a Management Plan must be compiled by a suitably qualified and experienced ecologist. **It is recommended that the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.** **By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam.** **By implementing the relevant Department of Water and Sanitation (DWS) Wetland buffer calculation tool, a minimum Water Quality- and Biodiversity Buffer distance of approximately 60 m from the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), was determined. Due to the extensive vegetation clearance and associated significantly increased sediment input into the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality- and Biodiversity Buffer distance is therefore recommended to be implemented around the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west).**

	From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second depression pan and artificially constructed earth dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment. **After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the unchanneled valley-bottom wetland (300 m west). It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.** These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam and their associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans, wetlands and dam and in so doing, ensure the persistence/livelihood of aquatic and semi-aquatic fauna and flora in the local and broader area. **As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.** Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction.

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (12)	Low (12)	Low (12)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (12)	Low (11)	Low (12)

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Identified Environmental Impact	**Contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by surface material erosion**		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	Low (4)
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Moderate (3)	Moderate (3)	Moderate (3)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (45)	Low (45)	Low (45)

	Commandants Pan	Depression pan (200 m south-west)	Artificially constructed earth dam
Identified Environmental Impact	**Contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by surface material erosion**		
Magnitude of Negative or Positive Impact	Low (4)	Medium (6)	Medium (6)
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Moderate (3)	Moderate (3)	Moderate (3)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (45)	Medium (51)	Medium (51)

Mitigation Measures to be implemented	**It is recommended that vegetation clearance should be avoided or at least minimised as far as practicably/reasonably possible and should only occur within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints, if required. Existing vegetation situated in- between these main physical footprint areas, should not be cleared or damaged in any way and should be left intact and adequately preserved, as far as practicably/reasonably possible. This must be done in order to sufficiently manage and prevent any significant soil erosion from occurring within and around the proposed development area, which could potentially lead to an increase in sediment inputs into- and contamination of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as subsequent downstream waterbodies, over time.** An adequate Stormwater and Erosion Management Plan must be implemented during the construction- and operational phases of the proposed development. This must be done to sufficiently manage storm water runoff and clean/dirty water separation, in order to prevent any significant soil erosion in and around the proposed development area. **It is recommended that the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.** **By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam.**

	By implementing the relevant Department of Water and Sanitation (DWS) Wetland buffer calculation tool, a minimum Water Quality- and Biodiversity Buffer distance of approximately 60 m from the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), was determined. Due to the extensive vegetation clearance and associated significantly increased sediment input into the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality- and Biodiversity Buffer distance is therefore recommended to be implemented around the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west). **From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second depression pan and artificially constructed earth dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.** **After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the unchanneled valley-bottom wetland (300 m west). It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.**

	These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam and their associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans, wetlands and dam and in so doing, ensure the persistence/livelihood of aquatic and semi-aquatic fauna and flora in the local and broader area. **As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.** Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction.

	Unchanneled valley-bottom wetland (80 m west)	**Unchanneled valley-bottom wetland (100 m south-west)**	**Unchanneled valley-bottom wetland (300 m west)**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (11)	Low (11)	Low (11)

	Commandants Pan	Depression pan (200 m south-west)	Artificially constructed earth dam
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (11)	Low (13)	Low (13)
	Unchanneled valley-bottom wetland (80 m west)	**Unchanneled valley-bottom wetland (100 m south-west)**	**Unchanneled valley-bottom wetland (300 m west)**
Identified Environmental Impact	**Contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by dust generation and emissions**		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	Low (4)
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)

Reversibility of Impact	Moderate (3)	Moderate (3)	Moderate (3)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (45)	Low (45)	Low (45)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Identified Environmental Impact	**Contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by dust generation and emissions**		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	Low (4)
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)

Reversibility of Impact	Moderate (3)	Moderate (3)	Moderate (3)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (45)	Low (45)	Low (45)
Mitigation Measures to be implemented	**It is recommended that vegetation clearance should be avoided or at least minimised as far as practicably/reasonably possible and should only occur within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints, if required. Existing vegetation situated in- between these main physical footprint areas, should not be cleared or damaged in any way and should be left intact and adequately preserved, as far as practicably/reasonably possible. This must be done in order to sufficiently manage and prevent any significant fugitive dust emissions from occurring within and around the proposed development area, which could potentially lead to an increase in sediment inputs into- and contamination of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as subsequent downstream waterbodies, over time.** 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 two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.** **By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam.** **By implementing the relevant Department of Water and Sanitation (DWS) Wetland buffer calculation tool, a minimum Water Quality- and Biodiversity Buffer distance of approximately 60 m from the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), was determined. Due to the extensive vegetation clearance and associated significantly increased sediment input into the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality- and Biodiversity Buffer distance is therefore recommended to be implemented around the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west).**

	From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second depression pan and artificially constructed earth dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment. **After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the unchanneled valley-bottom wetland (300 m west). It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.** These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam and their associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans, wetlands and dam and in so doing, ensure the persistence/livelihood of aquatic and semi-aquatic fauna and flora in the local and broader area. **As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.**

	Disturbed areas within and immediately surrounding the proposed development footprint area must be adequately rehabilitated as soon as practicably possible after construction.		
	Unchanneled valley-bottom wetland (80 m west)	**Unchanneled valley-bottom wetland (100 m south-west)**	**Unchanneled valley-bottom wetland (300 m west)**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (11)	Low (11)	Low (11)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (11)	Low (11)	Low (11)

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Identified Environmental Impact	**Impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area**		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	Medium (6)
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Medium	Medium	Medium

Environmental Significance Score and Rating prior to mitigation	Medium (72)	Medium (72)	Medium (72)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Identified Environmental Impact	**Impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area**		
Magnitude of Negative or Positive Impact	Medium (6)	High (8)	High (8)
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Medium	Medium	Medium

Environmental Significance Score and Rating prior to mitigation	Medium (72)	Medium-High (80)	Medium-High (80)
Mitigation Measures to be implemented	**It is recommended that vegetation clearance should be avoided or at least minimised as far as practicably/reasonably possible and should only occur within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints, if required. Existing vegetation situated in- between these main physical footprint areas, should not be cleared or damaged in any way and should be left intact and adequately preserved, as far as practicably/reasonably possible. This must be done in order to sufficiently manage and prevent any significant soil erosion from occurring within and around the proposed development area, which could potentially lead to an increase in sediment inputs into- and contamination of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as subsequent downstream waterbodies, over time.** **It is recommended that sufficient continued stormwater runoff within- and through the proposed development area mainly towards the south but also towards the east, must still be ensured and sufficiently managed. An adequate Stormwater and Erosion Management Plan must be implemented during the construction- and operational phases of the proposed development, in order to assist with this and allow for continued flow within the local catchment. This must be done to attempt to maintain the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area, towards the west.** **It is recommended that the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.**		

	By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam. **By implementing the relevant Department of Water and Sanitation (DWS) Wetland buffer calculation tool, a minimum Water Quality- and Biodiversity Buffer distance of approximately 60 m from the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), was determined. Due to the extensive vegetation clearance and associated significantly increased sediment input into the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality- and Biodiversity Buffer distance is therefore recommended to be implemented around the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west).** **From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second depression pan and artificially constructed earth dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.**

	After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the unchanneled valley-bottom wetland (300 m west). It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment. These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam and their associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans, wetlands and dam and in so doing, ensure the persistence/livelihood of aquatic and semi-aquatic fauna and flora in the local and broader area. **As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.** 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/feasibly possible from the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam.

	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.		
	Unchanneled valley-bottom wetland (80 m west)	**Unchanneled valley-bottom wetland (100 m south-west)**	**Unchanneled valley-bottom wetland (300 m west)**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (24)	Low (24)	Low (24)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (24)	Low (28)	Low (28)

10.4.2. Operational Phase

Table 15: Environmental Risk and Significance Ratings

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Identified Environmental Impact	**Continued contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by dust generation and emissions**		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	Low (4)
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	Medium term (3)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Moderate (3)	Moderate (3)	Moderate (3)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low

Environmental Significance Score and Rating prior to mitigation	Low (48)	Low (48)	Low (48)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Identified Environmental Impact	**Continued contamination of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam by dust generation and emissions**		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	Low (4)
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	Medium term (3)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Moderate (3)	Moderate (3)	Moderate (3)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low

Environmental Significance Score and Rating prior to mitigation	Low (48)	Low (48)	Low (48)
Mitigation Measures to be implemented	All the recommended mitigation measures for the construction phase must be adequately implemented and managed. Implement suitable dust management and prevention measures during the operational phase of the proposed development. 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.		
	Unchanneled valley-bottom wetland (80 m west)	**Unchanneled valley-bottom wetland (100 m south-west)**	**Unchanneled valley-bottom wetland (300 m west)**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (12)	Low (12)	Low (12)

	Commandants Pan	Depression pan (200 m south-west)	Artificially constructed earth dam
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (12)	Low (12)	Low (12)
	Unchanneled valley-bottom wetland (80 m west)	**Unchanneled valley-bottom wetland (100 m south-west)**	**Unchanneled valley-bottom wetland (300 m west)**
Identified Environmental Impact	**Continued impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area**		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	Medium (6)
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	Medium term (3)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)

Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Medium	Medium	Medium
Environmental Significance Score and Rating prior to mitigation	Medium-High (76)	Medium-High (76)	Medium-High (76)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Identified Environmental Impact	**Continued impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area**		
Magnitude of Negative or Positive Impact	Medium (6)	High (8)	High (8)
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	Medium term (3)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)

Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Medium	Medium-High	Medium-High
Environmental Significance Score and Rating prior to mitigation	Medium-High (76)	Medium-High (84)	Medium-High (84)
Mitigation Measures to be implemented	If all the recommended mitigation measures for the construction phase are adequately implemented and managed, it should prove sufficient in preventing any continued impeding-, contamination of- or significant impact within the associated local and broader quaternary surface water catchment- and drainage area. The recommended buffer zones must be adequately maintained and no current or future development is allowed to encroach into the buffered zones, over time. It is recommended that sufficient continued stormwater runoff within- and through the proposed development area mainly towards the south but also towards the east, must still be ensured and sufficiently managed. An adequate Stormwater and Erosion Management Plan must be implemented during the construction- and operational phases of the proposed development, in order to assist with this and allow for continued flow within the local catchment. This must be done to attempt to maintain the ecological functionality and -integrity of the local and broader quaternary surface water catchment- and drainage area, towards the west.		

	Unchanneled valley-bottom wetland (80 m west)	Unchanneled valley-bottom wetland (100 m south-west)	Unchanneled valley-bottom wetland (300 m west)
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (26)	Low (26)	Low (26)
	Commandants Pan	**Depression pan (200 m south-west)**	**Artificially constructed earth dam**
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (26)	Low (30)	Low (30)

	Proposed development area
Identified Environmental Impact	**Over-extraction of operational water from a borehole**
Magnitude of Negative or Positive Impact	High (8)
Duration of Negative or Positive Impact	Medium term (3)
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	Medium (3)
Cumulative Impact Rating prior to mitigation	Medium
Environmental Significance Score and Rating prior to mitigation	Medium (66)

Mitigation Measures to be implemented	A Geo-hydrological assessment must be conducted of the proposed borehole, in order to determine whether the borehole will able to provide a sustainable yield that can adequately and sustainably supply the required volumes of water necessary for the operational phase of the proposed solar facility. 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 utilised. A flow meter is to 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 construction and operational phases of the proposed solar development. Environmentally responsible water use practices and activities must be adopted for the construction and operational phases of the proposed solar development. Provide training interventions for the relevant construction and operations personnel on correct environmentally responsible water use practices and activities.

Cumulative Impact Rating after mitigation implementation	Low
Environmental Significance Score and Rating after mitigation implementation	Low (34)

11. Summary and Conclusion

A number of ecologically/conservationally significant and sensitive aquatic features/habitats and -species were identified throughout the original assessment area and the surrounding 500 m 'zone of influence'. Based on these findings and the subsequent initial recommendations of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were revised by the applicant. This was done proactively by the applicant, prior to the formal commencement of the Environmental Impact Assessment (EIA) process, in order to ensure that the proposed development area is adequately kept away from any of the identified ecologically/conservationally significant and sensitive aquatic features/habitats and -species. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area.

The proposed development area constitutes a combined single footprint area of approximately 168 ha in size. The proposed development area and surrounding 500 m 'zone of influence' consist of a mosaic of mainly natural undisturbed terrestrial grassland and to a lesser extent, old historically cultivated agricultural lands.

The mechanical clearance associated with the proposed solar power generation facility development, will in all probability completely transform the majority of the existing surface vegetation within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints. The proposed development area could therefore likely be prone to significant potential surface soil erosion, due to the sloping landscape mainly towards the south-west but also towards the east, together with the loosening of surface materials and clearance of vegetation caused by construction activities, which usually binds the soil surface. Such soil erosion could potentially lead to a gradual, continual increase in sediment inputs into- and substantial contamination of the identified aquatic features to the south-west and east of the proposed development area as well as subsequent downstream waterbodies, over time.

It is therefore recommended that vegetation clearance should be avoided or at least minimised as far as practicably/reasonably possible and should only occur within the PV grid-, internal access/services road network- and other associated facility infrastructure footprints, if required. Existing vegetation situated in- between these main physical footprint areas, should not be cleared or damaged in any way and should be left intact and adequately preserved, as far as practicably/reasonably possible. This must be done in order to sufficiently manage and prevent any significant soil erosion from occurring within and around the proposed development area, which could potentially lead to an increase in sediment inputs into- and contamination of the identified aquatic features to the south-west and east of the proposed development area as well as subsequent downstream waterbodies, over time.

Water Catchment and Drainage Information

The proposed development area and surrounding 500 m 'zone of influence' fall within the Middle Vaal Water Management Area (WMA 9). A local but extensive linear topographic highpoint/ridge apex traverses the proposed development area, which roughly lies in a south-west to north-east direction. This highpoint/ridge apex acts as the main natural linear surface water runoff- and drainage separator, between the C25B quaternary surface water catchment- and drainage area situated north of- and the C42J quaternary surface water catchment- and drainage area situated south of the highpoint/ridge apex, respectively. Surface water runoff from the local area consequently mainly drains either in a south-westerly- or easterly direction, depending on which side of the highpoint/ridge apex the area is situated. The majority of the proposed development area drains towards the south-west, while the substantial eastern portion drains towards the east.

Watercourse Baseline Information

No significant watercourses were found to be present throughout the proposed development area or surrounding 500 m 'zone of influence'.

Depression Pans

The Commandants Pan constitutes a well-known significantly sized naturally occurring depression pan, which is situated approximately 270 m east of the proposed development area. The pan is seasonally/temporarily inundated and its main inflow originates from a significantly sized unchanneled valley-bottom wetland, situated approximately 2.3 km north-east of the proposed development area as well as an associated watercourse. A broad surface water outflow is also evident on the southern side of the pan. This outflow constitutes a watercourse and water drainage plain/valley-bottom wetland, which gradually flows in a south-westerly direction and eventually flows into a second smaller depression pan, located approximately 200 m south-west of the proposed development area. A number of artificially constructed earth dams are present within this watercourse and water drainage plain/valley-bottom wetland, situated between the Commandants Pan and second pan. This second pan in turn, discharges into an artificially constructed earth dam, located approximately 230 m west of the proposed development area, which finally discharges into a significantly sized depression pan, located approximately 900 m west of the proposed development area.

The Commandants Pan also collects rainwater as well as general surface water runoff from a limited upstream area to its north, but which is still situated to the south of the highpoint/ridge apex as well as from the substantial eastern portion of the proposed development area, situated to its west.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

The pans house locally distinct and important semi-aquatic habitats within their basins and around their edges, which are mainly dominated by hydrophytic grass- and -graminoid species.

The locally distinct and important semi-aquatic habitats of the Commandants Pan and to a lesser extent, the second pan are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Unchanneled Valley-bottom Wetlands

A significantly sized, broad naturally occurring unchanneled valley-bottom wetland is present, approximately 80 m west of the proposed development area. This wetland is situated to the south of a local but extensive linear topographic highpoint/ridge apex, which roughly lies in a south-west to north-east direction (not the same ridge as discussed earlier above). This highpoint/ridge apex acts as a natural linear surface water runoff- and drainage separator, between the areas situated south and north of the highpoint/ridge apex, respectively.

Surface water runoff from a substantial portion of the landscape to the south of the highpoint/ridge apex, consequently mainly channels and drains through this wetland, towards the lower lying south-west. The substantial central-western- and north-western portions of the proposed development area drain towards this wetland. Surface water flow from the east towards this wetland, will therefore be directly impacted by the proposed development.

The wetland gradually flows into a subsequent significantly sized naturally occurring unchanneled valley-bottom wetland, located approximately 300 m west of the proposed development area. The local topography flattens-out slightly in the vicinity of the subsequent wetland, which results in this subsequent wetland being seasonally/temporarily inundated. The outflow of this subsequent wetland further flows into an artificially constructed earth dam, located approximately 230 m west of the proposed development area (the same dam as mentioned earlier above), which finally discharges into a significantly sized depression pan, located approximately 900 m west of the proposed development area (the same pan as mentioned earlier above).

Another naturally occurring water drainage plain/unchanneled valley-bottom wetland is present, approximately 100 m south-west of the proposed development area. As discussed earlier above, this wetland forms part of the downstream outflow of the Commandants Pan and subsequent inflow into the second smaller pan. This wetland therefore channels and drains significant volumes of surface water runoff towards the west, into the pan. As discussed earlier above, a number of artificially constructed earth dams are present within this wetland, directly upstream of the portion that is adjacent to the proposed development area.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

Due to the sloping topography of the area along with a lack of continuous water flow through the local area, the two wetlands do not possess any ecologically/conservationally significant semi-aquatic habitat. They rather house similar terrestrial grassland vegetation compositions and -structures, relative to the surrounding landscape, with merely slight variations in species representation. The wetlands are therefore not expected to be specifically utilised by any habitat-specific waterbirds, amphibian species and/or aquatic invertebrates as refuge or for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

As discussed earlier above, the subsequent wetland into which the first broad wetland gradually flows, is seasonally/temporarily inundated due to its local slightly flattened-out topography. It therefore houses a locally distinct and important semi-aquatic habitat within its basin and around its edges, which is mainly dominated by hydrophytic grass- and -graminoid species.

This locally distinct and important semi-aquatic habitat is also likely utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

During the site assessment, a number of Marsh owl (*Asio capensis*) individuals were in fact found to be utilising the semi-aquatic habitat of the wetland as well as the surrounding terrestrial grassland landscape. Although not specifically observed during the site assessment as the focus of the assessment was not on avifauna, the wetland and local surrounding terrestrial grassland landscape also provide very suitable habitat for Grass owls (*Tyto capensis*). It is therefore likely that the semi-aquatic habitat of the identified wetland and local surrounding terrestrial grassland landscape are also utilised by individuals and/or pairs of this species as refuge and for breeding, foraging and/or persistence purposes. Both of these owl species are considered to be very habitat-specific and therefore range-limited. The latter species is nationally classified as a Vulnerable Red Data Listed bird species, due to extensive habitat degradation and loss.

Artificially Constructed Earth Dam

An artificially constructed earth dam is present, approximately 230 m west of the proposed development area (the same dam as mentioned earlier above). The inflow of this dam mainly constitutes the second depression pan as well as the unchanneled valley-bottom wetlands. Also as mentioned earlier above, the outflow of this dam discharges into a subsequent significantly sized depression pan, located approximately 900 m west of the proposed development area.

It is therefore evident that all these aquatic features along with their associated in- and outflows, form an important part of the hydrological and aquatic ecological connectivity of the local and broader quaternary surface water catchment- and drainage area, towards the west.

The dam constitutes the main convergence point where virtually all surface water flow from the local and broader landscape to the north-east, east and south-east of the dam, comes together. Significant anthropogenic impeding and modification of the original flow regime of the local and broader landscape has therefore taken place.

Although the earth dam has been artificially constructed, the dam still houses locally distinct and important aquatic and semi-aquatic habitats within its basin and around its edges, which are mainly dominated by hydrophytic grass- and -graminoid species

These locally distinct and important aquatic and semi-aquatic habitats are also visibly utilised by various common and habitat-specific waterbirds, amphibian species and aquatic invertebrates as refuge and for breeding, foraging and/or persistence purposes, although the focus of the site assessment was not on avifauna.

Buffer Zone- and Other Recommendations

It is recommended that the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam as well as portions of the surrounding natural undisturbed terrestrial grasslands, must be adequately buffered out. No current or future development is allowed to take place within these buffered zones.

By implementing the relevant Department of Water and Sanitation (DWS) Watercourse buffer calculation tool, a minimum Water Quality Buffer distance of approximately 60 m from the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, was determined. Due to the extensive vegetation clearance and the subsequently anticipated significantly increased sediment input into the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam, it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality Buffer distance is therefore recommended to be implemented around the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam.

By implementing the relevant Department of Water and Sanitation (DWS) Wetland buffer calculation tool, a minimum Water Quality- and Biodiversity Buffer distance of approximately 60 m from the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), was determined. Due to the extensive vegetation clearance and associated significantly increased sediment input into the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west), it is however highly recommended that the proposed buffer distance should be increased by a further approximately 20 m. A minimum approximately 80 m Water Quality- and Biodiversity Buffer distance is therefore recommended to be implemented around the other two unchanneled valley-bottom wetlands (80 m west and 100 m south-west).

The significant noise generated by the construction activities, will likely cause substantial disturbance and subsequently impact negatively on the ecological integrity and -functionality of the aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland into which the first one gradually flows (300 m west), dam and the local surrounding terrestrial grassland landscapes. The erection of permanent permitter fencing and associated night-time illumination infrastructure around the proposed solar power generation facility footprint area, furthermore poses a significant collision and mortality risk to the relevant owl and other nocturnal avifaunal species that utilise the area. The operations of the established solar power generation facility infrastructure will also result in continual emissions of significantly bright glare/shine into the surrounding landscape.

From an aquatic ecological/biodiversity perspective, the important aquatic and semi-aquatic habitats of the two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam also need to be adequately preserved. When taking into account the significant visual impacts of the glare/shine on waterbirds as well as the significant collision and mortality risk to nocturnal avifaunal species, a minimum approximately 250 m Biodiversity Buffer distance is therefore recommended to be implemented around the Commandants Pan and a minimum approximately 200 m buffer distance around the second depression pan and artificially constructed earth dam. It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.

After consultation with well-known and recognized avifaunal specialists and due to the actual confirmed presence of the owl species on site, it is however recommended that a minimum approximately 300 m Biodiversity Buffer distance be implemented around the unchanneled valley-bottom wetland (300 m west). It is however recommended that the appointed Avifaunal Specialist must provide final recommendations on suitable aquatic avifaunal species- and habitat buffer zones, after completion of his/her assessment.

It is further recommended that no bright light from any spotlights or perimeter lights should be emitted into the surrounding landscape towards the two depression pans, unchanneled valley-bottom wetland (300 m west) or artificially constructed earth dam, during the night-time. As little light emissions as practicably/reasonably possible from the proposed development area, should occur during night time as this could lure owl and other nocturnal avifaunal species individuals towards the permitter fences and potentially result in collisions and mortality.

These recommended buffer zones and associated recommendations must be implemented to attempt to maintain the hydrological and ecological functionality and -integrity of the two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam and their associated aquatic and semi-aquatic habitats along with the local surrounding terrestrial grassland landscapes. They must prevent any significant increase in sediment inputs and contamination of the pans, wetlands and dam and in so doing, ensure the persistence/livelihood of aquatic and semi-aquatic fauna and flora in the local and broader area.

As stated earlier under heading 9, based on these recommendations which initially formed part of the Site Verification Report, the original proposed development area was significantly reduced in size and the design layouts of the Photovoltaic (PV) grid were proactively revised by the applicant. The proposed development area discussed in this report, therefore constitutes this final acceptably reduced and revised area, which adheres to the relevant buffer zone recommendations.

Conclusion

The various aquatic features identified within the 500 m 'zone of influence' surrounding the proposed development area, all scored moderate Ecological Importance and Sensitivity (EIS) values and are viewed as being of moderate to high conservational significance/value for habitat preservation and ecological functionality persistence in support of the surrounding aquatic ecosystem and the associated habitat-specific waterbirds, amphibian species and aquatic invertebrates along with the actual confirmed presence of ecologically important, habitat-specific and range-limited bird species.

Disturbance of-/damage to semi-aquatic faunal habitats, associated with the identified two depression pans, unchanneled valley-bottom wetland (300 m west) and artificially constructed earth dam as well as impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area, were identified and addressed as significant potential long-term aquatic ecological impacts, associated with the construction phase of the proposed development.

Continued impeding and contamination of the flow regimes of the identified two depression pans, three unchanneled valley-bottom wetlands and artificially constructed earth dam, within the associated local and broader quaternary surface water catchment- and drainage area as well as over-extraction of operational water from a borehole, were furthermore identified and addressed as significant potential long-term aquatic ecological impacts, associated with the operational phase of the proposed development.

The proposed development merely forms a small part of a significantly sized and extensive combined solar power generation facility cluster, which is envisaged and consequently being applied for throughout the local and broader landscape surrounding the proposed development area. This extensive combined cluster development and subsequent transformation in the same geographical area, which will highly likely take place, will therefore lead to substantial cumulative aquatic ecological impacts.

The significant potential long-term aquatic ecological impacts identified for the proposed development, could therefore potentially add moderate to moderately-high cumulative impact to the existing and anticipated future negative impacts, associated with the envisaged significantly sized and extensive combined solar power generation facility cluster.

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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 add any significant residual cumulative aquatic ecological impacts to the surrounding environment, if all 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 from an aquatic ecological and hydrological perspective, that the proposed development area is of low sensitivity and 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.

12. References

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