

Appendix F: Impacts Assessment Methodology

Potential impacts (terrestrial ecology (including flora, fauna and avifauna), wetlands, soils, heritage, visual and social) were assessed through the Basic Assessment process for the proposed **Harmony Central Plant Solar PV Facility**, in the Free State Province. These impacts were identified through specialist reports included in **Appendix D** of the Basic Assessment Report. All the specialists followed the method outlined below to evaluate and assess the environmental impacts associated with the development.

Potential impacts associated with the construction and operation of the proposed solar energy facility and associated infrastructure are discussed below. The following methodology was used in assessing impacts related to the proposed development. All impacts are assessed according to the following criteria:

- » The **nature**, a description of what causes the effect, what will be affected, and how it will be affected.
- » The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. a score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
- » The **duration**, wherein it is indicated whether:
 - * The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1.
 - * The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2.
 - * Medium-term (5–15 years) – assigned a score of 3.
 - * Long-term (> 15 years) - assigned a score of 4.
 - * Permanent - assigned a score of 5.
- » The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
 - * 0 is small and will have no effect on the environment.
 - * 2 is minor and will not result in an impact on processes.
 - * 4 is low and will cause a slight impact on processes.
 - * 6 is moderate and will result in processes continuing but in a modified way.
 - * 8 is high (processes are altered to the extent that they temporarily cease).
 - * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- » The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
 - * 1–5, where 1 is very improbable (probably will not happen).
 - * 2 is improbable (some possibility, but low likelihood.)
 - * 3 is probable (distinct possibility).
 - * 4 is highly probable (most likely).
 - * 5 is definite (impact will occur regardless of any prevention measures).
- » The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- » The **status**, which is described as either positive, negative or neutral.
- » The degree to which the impact can be reversed.
- » The degree to which the impact may cause irreplaceable loss of resources.
- » The degree to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

$S = (E+D+M) P$; where

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- » **< 30 points:** Low (i.e., where this impact would not have a direct influence on the decision to develop in the area).
- » **30-60 points:** Medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated).
- » **60 points:** High (i.e., where the impact must have an influence on the decision process to develop in the area).

IMPACT ASSESSMENT

This appendix serves to assess the significance of the positive and negative environmental impacts (direct, and indirect) expected to be associated with the development of Harmony Central Plant Solar PV Facility and its associated infrastructure. This assessment has considered the construction of a PV facility with a contracted capacity of up to 14MW with a development footprint of approximately 28ha. The project will comprise the following key infrastructure and components:

- » modules and mounting structures.
- » Inverters and transformers a SCADA room, and maintenance room.
- » Cabling between the project components, to be laid underground where practical.
- » Access roads, internal roads and fencing around the development area.
- » Temporary and permanent laydown areas.
- » Grid connection infrastructure including an on-site facility substation and a switching substation to be connected to the existing Harmony North Substation via an overhead power line (located in the southern corner of the site)

The full extent of the project site was considered through the Assessment phase by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desk-top evaluations and field surveys. A development footprint for the PV facility within the project site was proposed by the developer through consideration of the sensitive environmental features and areas identified through the EIA process.

The development of Harmony Central Solar PV Facility will comprise the following phases:

- » **Pre-Construction and Construction** – will include pre-construction surveys; site preparation; establishment of access roads, laydown areas, and facility infrastructure (including PV panels, facility substation and O&M Hub); construction of foundations involving excavations; the transportation of components/construction equipment to site, manoeuvring and operating vehicles for unloading and installation of equipment; laying cabling; and commissioning of new equipment and site rehabilitation.
- » **Operation** – will include the operation of the PV facility and the generation of electricity, which will be fed into the mines substation via the facility on-site substation and an overhead power line. The operation phase is expected to be approximately 20 years (with maintenance).
- » **Decommissioning** – depending on the economic viability of the PV facility, the length of the operation phase may be extended beyond a 20-year period. At the end of the project's life, decommissioning will include site preparation, disassembling of the components of the PV facility, clearance of the relevant infrastructure at the site and appropriate disposal thereof, and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Therefore, these impacts are not considered separately within this chapter.

Environmental impacts associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to fauna, avifauna and flora, impacts to sites of heritage value, soil contamination, erosion and loss of agricultural land, nuisance from the movement of vehicles transporting equipment and materials.

Environmental impacts associated with the operation phase includes soil contamination, erosion and potential invasion by alien and invasive plant species. Other impacts include visual impacts and night time lighting impacts.

Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of Harmony Central Plant Solar PV facility relate to the direct loss of vegetation and species of special concern, disturbance of animals (including avifauna) and loss of habitat and impacts to soils. In order to assess the impacts associated, it is necessary to understand the extent of the affected area.

- The development area being assessed for Harmony Central Plant Solar PV facility is approximately 80ha in extent, of which the proposed infrastructure will occupy an area of approximately 28ha. This area includes infrastructure such as PV modules and mounting structures, Inverters and transformers, temporary and permanent laydown area, site offices and maintenance buildings, including workshop areas for maintenance and storage and site and internal access roads.
- The grid connection solution includes additional infrastructure, including a grid line servitude (up to 32m in width); on-site substation (footprint area up to 2ha in extent) and switching station (footprint area up to 2ha in extent).

1. TERRESTRIAL ECOLOGY AND WETLAND IMPACT ASSESSMENT

1.1. Terrestrial Ecology (including flora and fauna)

The majority of the ecological impacts associated with the development would occur during the construction phase as a result of the disturbance associated with site clearance, excavations, the operation of heavy machinery at the site and the presence of construction personnel. The significance of the impacts on terrestrial Ecology expected with the development of the Harmony Central Plant Solar PV facility has been assessed as medium to low, depending on the impact being considered, with the implementation of mitigation measures. Potential impacts and the relative significance of the impacts are summarised below.

Results of the Ecological Impact Assessment

The development area falls within the Vaal-Vet Sandy Grassland vegetation type. This vegetation type is currently listed as Endangered (EN) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004). Any remaining patches of natural grassland would therefore be regarded as being of very high conservation value. The vegetation type is currently heavily affected by extensive transformation by agriculture, urban expansion and mining operations.

The site in question is predominately listed as a Degraded area and is a result of extensive transformation of the majority of the site by previous ploughing as well as mining structures and infrastructure. These areas would also largely be of low conservation value. A few small patches on the site are however listed as Critical Biodiversity Area 1 (CBA 1) as these represent remnant patches of the threatened Vaal-Vet Sandy Grassland. These areas remain essential to maintaining the conservation targets for this vegetation type and they should all be regarded as having a very high conservation value. These areas regarded as CBA 1 should be excluded from the development and should be completely avoided by any associated activities.

As previously stated, the majority of the study area has already been transformed by agricultural land use and mining activities. The largest portions of the site has been transformed by previous ploughing for

agricultural crop production. The survey has also confirmed that these areas are completely transformed from the natural vegetation type and though a grass layer has been able to re-establish it is clearly dominated by pioneer species bearing no resemblance to the natural vegetation type. This vegetation is therefore of secondary establishment and will not be able to sustain a viable ecosystem.

Another large portion of the site, mainly in the south east has also been transformed by structures and infrastructure associated with mining operations. These buildings have since been demolished and the area cleared and rehabilitated though it is quite clear that these areas are heavily degraded and will not contribute toward the ecology of the area.

A few remnant patches of vegetation remain in the southern, western and northern corners of the site. These areas are also quite degraded, mostly by overgrazing by livestock but is clearly still dominated by natural vegetation and still fit within the characteristics of the natural vegetation type, Vaal-Vet Sandy Grassland. Since this vegetation type is listed as Endangered (EN) these patches will be regarded as having a very high conservation value and should be excluded from development. Since these areas are small and located along the borders it should not be difficult to exclude them.

In the southern portion of the site a few areas occur that clearly contain saturated soil conditions on a seasonal basis and has developed wetland conditions. The largest of these is clearly a natural system while surrounding smaller wetland areas may also be a result of poor drainage and accumulation of surface water associated with previous land uses. These areas will all be assessed in detail in the wetland assessment section of the report.

As indicated, historical ploughing for crop production and the activities associated with this is considered the main impact in this area. Though these ploughed areas have been able to re-establish a grass layer it is clearly of secondary establishment and does not represent the natural vegetation type. The historical mining structures and infrastructure is the second most prominent impact. These buildings and structures have since been removed but is clear that this area is transformed and contains a high amount of exotic weeds. These areas have also altered the surface runoff patterns of this area which results in the formation of a few artificial wetland areas. Other general disturbances include a woodlot of exotic trees, shallow excavations, an existing electrical substation, an extensive dirt track network and pipelines associated with the mining areas.

Anticipated impacts that the development will have is primarily concerned with the loss of habitat and species diversity but will also include impacts on the seepage wetland systems forming part of the study area

The following impacts on the ecosystem, ecology and biodiversity will be assessed:

- » Loss of vegetation and consequently habitat and species diversity as a result.
- » Loss of protected, rare or threatened plant species.
- » Impacts on watercourses, wetlands or the general catchment.
- » The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions.
- » Any increased erosion that the development may cause.
- » Fragmentation of habitat, disruption of ecological connectivity and -functioning in terms of the surrounding areas.
- » Impacts that will result on the mammal population on and around the site.
- » Any significant cumulative impacts that the development will contribute towards.

Terrestrial Fauna

Signs and tracks of mammals are present on the site but notably diminished when compared to natural areas. Natural vegetation has a high carrying capacity for mammals which decreases significantly where agriculture and mining transforms this natural vegetation and in such areas the mammal population is normally represented by a generalist mammal population. This was also notably the situation on the site which is dominated by generalist species while being largely modified from the natural mammal population. Rare and endangered mammals are often reclusive and avoid areas in close proximity to human activities and are also dependant on habitat in pristine condition. Such habitats are absent from the area and consequently it is unlikely that such species of high conservation value will still occur in this area. Wetland and riparian habitats also generally provide a higher abundance of resources and subsequently are also able to sustain a diverse and large mammal population. This will also be the case for the natural system in the southern portion of the site.

Though these areas are also disturbed to a significant extent and coupled with the close proximity of human activities, these wetlands will still be able to sustain a higher bio-load which in turn supports a larger mammal population. This also substantiates the need to avoid these wetland areas and exclude them from development.

The survey has indicated that the mammal population will consist largely of widespread, generalist species and it is considered unlikely that any endangered species will still occur in this area. However, one endangered mammal, African White-tailed Rat has been recorded in this area and there is a slight possibility that it may still occur in remnant patches of grassland. The exclusion of these remaining natural grassland areas should however avoid any impact on it should there still be specimens of these mammals left. A note should also be made of the Sungazer Lizard (*Smaug giganteus*). This is a highly endangered reptile known to occur in the sandy grassland habitats of this region. The survey also specifically targeted this species but was found to be absent from the area. This is also to be expected given the largely transformed condition of the area.

1.2. Wetlands

The surface water features of the study area are dominated by a large seepage system in the southern portion of the site. A smaller seepage area is also located to the east of this system and though heavily modified, is considered a natural wetland area. A few shallow excavations as well as surface obstructions (berms, roads and ditches) also promote the accumulation of surface water and consequent formation of artificial wetland areas but since they are undoubtedly artificial and do not form part of the natural drainage pattern, they will not be assessed and only discussed in overview.

The seepage wetlands were delineated by use of topography (land form and drainage pattern) and obligate wetland vegetation with limited soil sampling. Due to time constraints and the extent of the study area soil samples were only taken along a few transects of the seepage wetlands to confirm the presence of wetland conditions. The large wetland system and smaller wetland area to the east of it in the study area can be categorised as seepage wetlands (SANBI 2009).

The catchment of the wetland is dominated by previously ploughed fields and a large portion previously consisting of buildings and structures but now dominated by degraded land. The wetland itself is largely still intact though a few drainage ditches occur within it which will also have a high impact on the functioning of it. The seepage wetland system is affected by numerous impacts which result in a

significant level of modification. The associated wetland area to the east was also included within this assessment. A WET-Health determination was undertaken for the seepage wetland to determine its current condition given the impacts affecting it. The results of the WET-Health indicated an overall Present Ecological State of Category C: Moderately Modified. This is considered relatively accurate given the largely transformed catchment and impacts within the wetland. The EI&S of the seepage wetland system has been rated as being Moderate.

The large main seepage wetland system has clearly been identified as the main wetland system on the site and is considered as still providing several essential functions and is therefore considered as highly sensitive and being of high conservation value. The wetland should therefore be completely excluded by the development and in order to ensure no further impacts on it occur, a 20-meter buffer zone should also be maintained around the edge of the wetland. As long as this is implemented successfully, the anticipated risk on the wetland should **remain low**.

The smaller seepage wetland approximately 200 meters to the east of the main wetland is quite heavily modified but still functions in terms of the surface water drainage of the area. It also forms part of an area of remaining natural vegetation which also contributes towards its conservation value.

Description of watercourses and wetlands

Watercourse name: #1 Seepage wetland – Main wetland in the south of the site	Coordinates of sampling: S 28.060238°, E 26.880505° S 28.059307°, E 26.879937°	Flow regime: Seasonal
Description of watercourse: The largest and most significant surface water feature in the area. This seepage wetland is quite large, with an approximate diameter of 300 meters and is clearly the largest wetland feature in the area. The wetland does not have a defined, channelled outflow but flow is clearly unidirectional along the gentle slope from north to south. The wetland is also largely fed by groundwater inflow from the north. The proposed development will therefore likely have a direct affect on it in terms of runoff generated by it and which will enter this system. Though this is a natural system it is clearly affected by several large impacts. The wetland itself contain a shallow drain which will have a large impact on the hydrology of it and which will contribute toward dewatering of the system. The catchment of the wetland is also completely transformed and this will undoubtedly also have an impact on the pan. Together with berms, ditches and surface modification of the catchment this has had a further modification of the hydrology of the wetland. The condition of the wetland would therefore seem to be poor.		
The wetland is fairly flat but may form a slight depression in the landscape with a slight incline along its northern border also aiding in accurate delineation of the system. Vegetation within the wetland is dominated by a few obligate wetland grasses and sedges which also confirm the presence of saturated soils. Terrestrial plants may also be abundant and this also indicates the seasonal nature of the wetland. Soil samples also reliably confirm the presence of wetland conditions which indicate a seasonal zone of wetness within the wetland.		
Dominant plant species: Seepage wetland: <i>Polygala hottentotta</i> , <i>Selago densiflora</i> , <i>Diplachne fusca</i> (OW), <i>Cyperus longus</i> (OW), <i>Cynidium tubulosum</i> subsp. <i>tubulosum</i> , <i>Lotononis listii</i> .		
Wetland border: <i>Searsia lancea</i> , <i>*Cestrum laevigatum</i> , <i>Vachellia karroo</i> , <i>*Schkuhria pinata</i> , <i>Themeda triandra</i> , <i>*Bidens bipinata</i> , <i>Moraea pallida</i> .		
Protected plant species: None observed.		
Soil sample:		



The seepage wetland is quite extensive and be visible as a slight depression in the landscape.



The wetland is domionated by obligate wetland grasses and sedges.



A drainage trench through the wetland also provide a visual indication of the saturation of soils and the shallow groundwater.

Watercourse name:
#2 Seepage wetland – smaller wetland
to east of the main wetland

Coordinates of sampling:
S 28.060514°, E 26.883067°

Flow regime:
Seasonal

Description of watercourse:

A much smaller wetland area that is situated approximately 200 meters to the east of the main seepage wetland. It is quite small with a diameter of approximately 50 meters. The wetland is poorly defined but clearly drains from north east to south west and towards the main wetland system. The wetland is also largely fed by groundwater inflow from the north. The proposed development will therefore likely have a direct affect on it in terms of runoff generated by it and which will enter this system. Though this is a natural system it is clearly affected by several large impacts. The wetland has been heavily modified as a result of a drainage channel to the west and a road acting as flow obstruction to the north. The condition of the wetland would therefore seem to be poor.

The wetland is fairly flat but may form a slight depression in the landscape with a slight slope from north east to south west. It is not well defined, also a consequence of its modified condition, which also makes accurate delineation difficult. Vegetation within the wetland is dominated by a few obligate wetland grasses and sedges which also confirm the presence of saturated soils. Exotic weeds are also abundant and confirm the modified condition. Soil samples also reliably confirm the presence of wetland conditions which indicate a seasonal zone of wetness within the wetland.

Dominant plant species:

Cyperus longus (OW), *Diplachne fusca* (OW), *Cyperus eragrostis* (OW), **Tegetes minuta*, **Bidens bipinnata*.

Protected plant species:

None observed.

Soil sample:





The wetland is not well defined but may be discerned as shallow depressions, dominated by wetland vegetation.

Watercourse name: #10 Artificial wetlands	Coordinates of sampling: S 28.057284°, E 26.879543° S 28.055119°, E 26.878540°	Flow regime: Artificial
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Description of watercourse:

The following two areas have been identified as being formed by artificial, human induced modifications in the landscape and are not regarded as forming either natural watercourses or wetlands. Due to surface modifications, they may contain surface water for some periods which may form artificial wetland conditions. These artificial wetland areas consist of the following:

- An elongated and shallow excavation forms a depression in the landscape and collects surface water runoff. As a consequence, a few artificial wetland areas has formed. They are not considered to play any role in the surface drainage pattern of the site and are therefore not considered to be of consequence to the development. They are however simply listed here to confirm that they have been surveyed and confirmed to be of low sensitivity in terms of the development.
- A series of storm water outlets discharge into the surrounding area where the buildings and structures previously required storm water discharge. These areas have formed indistinct and poorly defined wetland areas. These areas do indicate poor storm water management in the area and should the development take place, a comprehensive storm water management system will have to be implemented which should also prevent these areas of poor drainage forming.



A shallow excavation which accumulates surface water and now forms artificial wetland conditions.



Areas where storm water discharges form poorly defined artificial wetland patches.

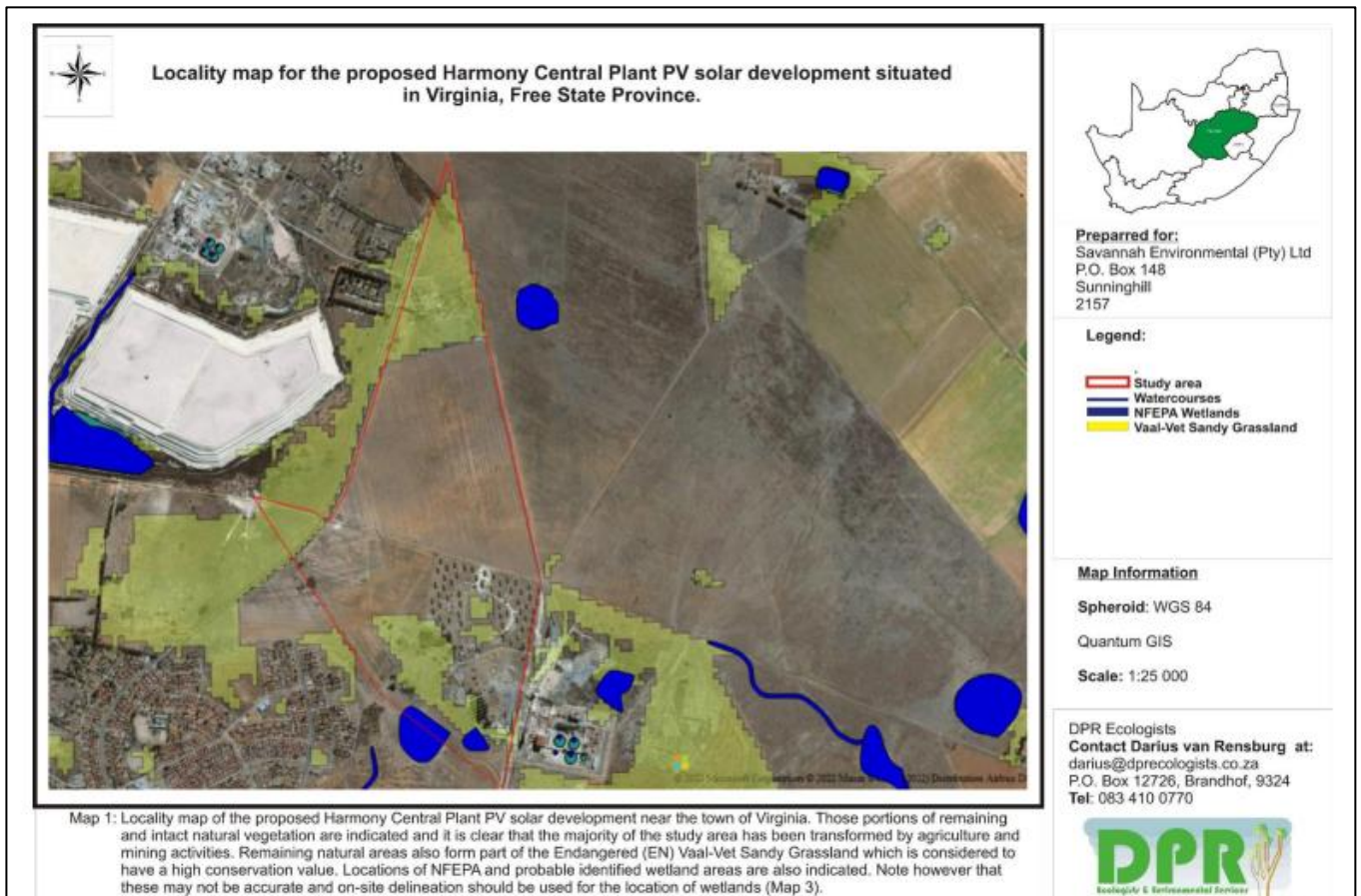


Figure 1: Locality Map indicating vegetation types, watercourses and wetlands close to the development area.

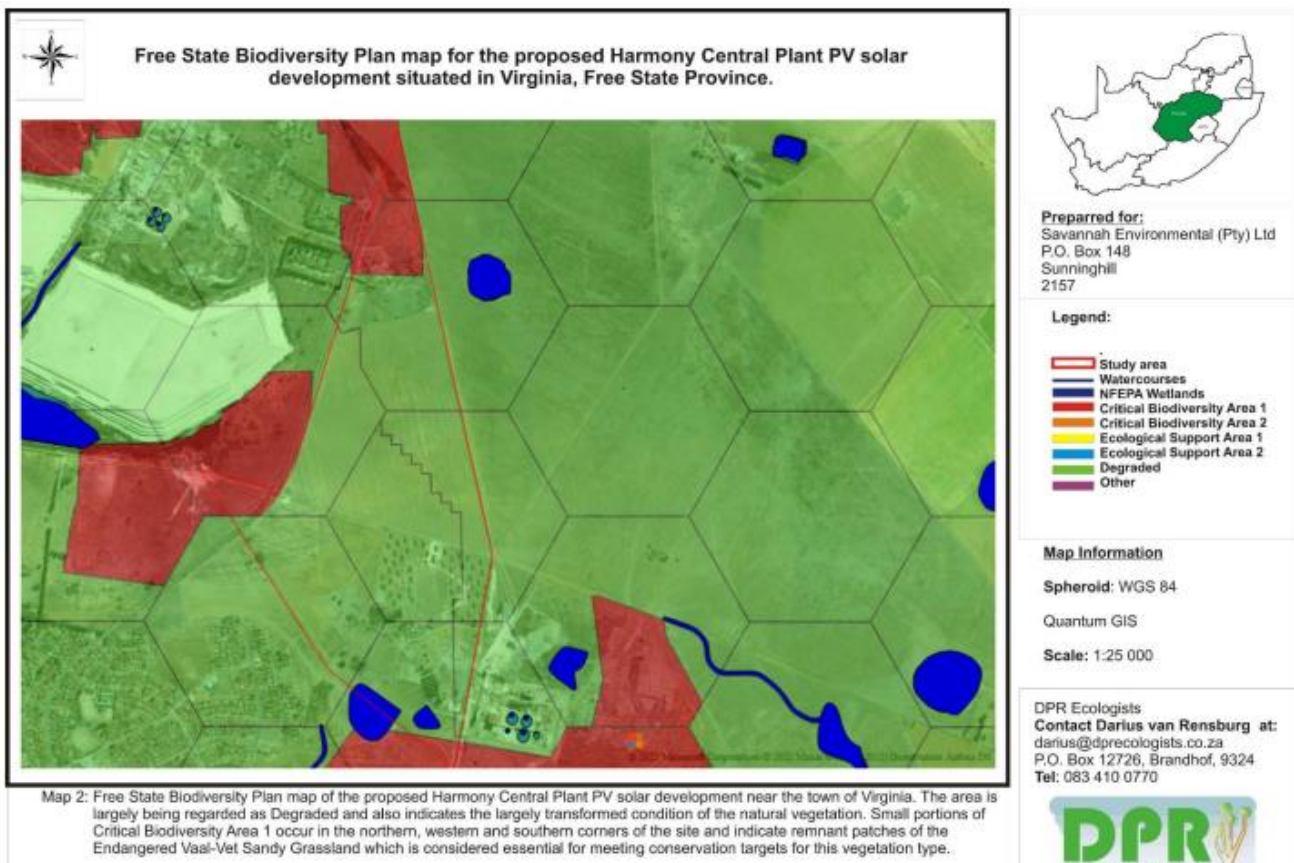


Figure 2: Free State Biodiversity Plan map

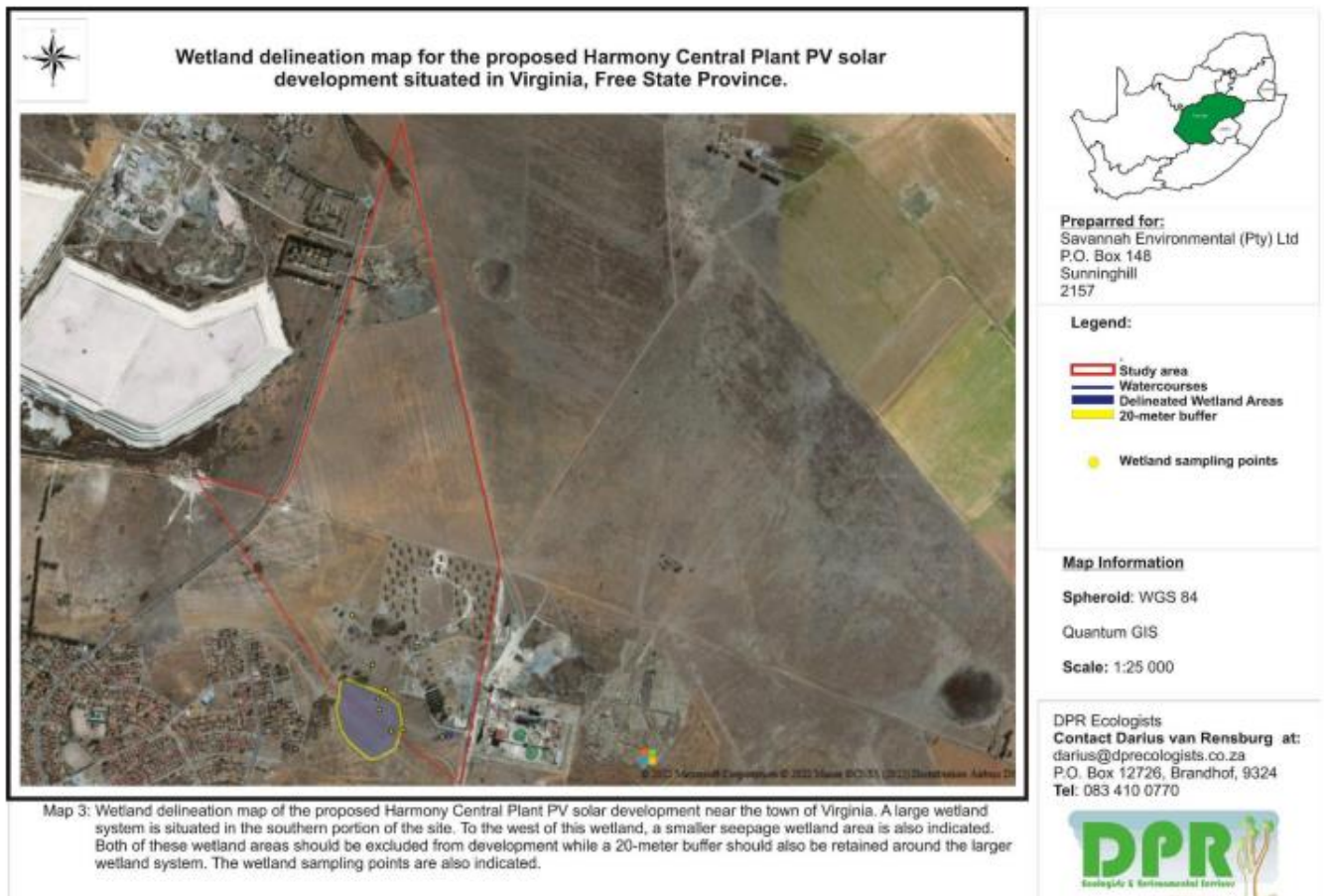


Figure 3: Delineated wetland systems within the development area

1.4. Impact Assessment Tables

Construction Phase

Nature:

Loss of vegetation and consequently habitat and species diversity as a result.

Impact description: Solar PV developments usually entail the removal of surface vegetation and may also involve modification of the surface topography. This therefore has a large impact in terms of the loss of vegetation, vegetation type and consequently habitat. As indicated from the discussion of the study area, the majority of the area has already been transformed by agricultural and mining operations. These areas will have a low level of sensitivity and since these areas have already been transformed the anticipated impact should remain low. However, small patches of remaining natural grassland consists of Vaal-Vet Sandy Grassland which is listed as Endangered (EN) and will therefore have a very high conservation value. This is also confirmed by the Free State Province Biodiversity Management Plan (2015) which regards the majority of these remaining natural areas as Critical Biodiversity Area 1 (CBA 1) and which is consequently of very high sensitivity.

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	5	Permanent transformation of vegetation	High Negative (85)
Extent	2	Limited development footprint	
Magnitude	10	Loss of a Threatened Ecosystem	
Probability	5	Impact is unavoidable	

Mitigation/Enhancement Measures

Mitigation:

As long as the development footprint is retained within areas of low sensitivity and these patches of remaining natural grassland are avoided, the anticipated impact should remain fairly low.

Post Mitigation/Enhancement Measures			
Duration	5	Permanent transformation of vegetation	Low Negative (16)
Extent	1	Decreased development extent maintained within transformed areas	
Magnitude	2	Development limited to areas of transformation	
Probability	2	Impact probability is low since development is limited to already transformed areas	

Cumulative impacts:

The area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact that this has had is extensive. Therefore, should the proposed development further encroach into natural areas it will have a high cumulative impact. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts in this area.

Residual Risks:

As long as the development footprint is retained within areas of low sensitivity and these patches of remaining natural grassland are avoided, the anticipated impact should remain fairly low.

Nature:

Loss of protected, rare or threatened plant species.

Impact description: Given the largely transformed condition of the site no protected or endangered plant species were noted. Although the possibility remains that may be present in those patches of remaining natural grassland, the likelihood is considered fairly low. The anticipated impact on the loss of protected or endangered plant species is therefore fairly low.

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	5	Permanent loss of protected species	Low Negative (18)
Extent	2	Limited development footprint	
Magnitude	2	Unlikely loss of protected species	
Probability	2	Occurrence of protected species unlikely and therefore probability is low	

Mitigation/Enhancement Measures

Mitigation:

None required

Post Mitigation/Enhancement Measures			
Duration	5	Permanent loss of protected species	Low Negative (8)
Extent	1	Decreased development extent maintained within transformed areas	
Magnitude	2	Unlikely loss of protected species	
Probability	1	Occurrence of protected species unlikely and therefore probability is low	

Cumulative impacts:

The area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact that this has had is extensive. Therefore, should the proposed development further encroach into natural areas it will have a high cumulative impact including any impact on protected species. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore

not contribute significantly toward the cumulative impacts in this area including any cumulative impacts on protected species.

Residual Risks:

Given the largely transformed condition of the site no protected or endangered plant species were noted (Appendix B). Although the possibility remains that may be present in those patches of remaining natural grassland, the likelihood is considered fairly low. The anticipated impact on the loss of protected or endangered plant species is therefore fairly low.

Nature:

Impacts on watercourses, wetlands or the general catchment.

Impact description: The survey of the site has identified the presence of a large seepage wetland as well as a smaller wetland to the east of it . These systems will most probably be affected by the proposed development. Solar developments are well known to have significant impacts on surface water features as a result of the rain shadow caused by the panels and the coupled runoff and infiltration patterns, erosion caused by these runoff patterns and disruption of surface watercourses. These identified wetland areas should therefore be excluded from the development and the necessary mitigation implemented to ensure no indirect impacts affect the wetland systems. Development within 500 meters of these wetland areas will require authorisation from DWS. Refer to the risk assessment. for a more detailed discussion on the likely risks and impacts that the development will have on these wetland areas. Should these wetland areas be excluded from the development and measures as indicated implemented the anticipate impact should remain low.

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	5	Permanent transformation of wetland areas	High Negative (90)
Extent	3	Spill over of impacts into downstream areas	
Magnitude	10	Direct wetland loss	
Probability	5	Impact is unavoidable	

Mitigation/Enhancement Measures

Mitigation:

Should these wetland areas be excluded from the development and measures as indicated implemented the anticipate impact should remain low. Refer to the risk assessment for a more detailed discussion on the likely risks and impacts that the development will have on these wetland areas.

Post Mitigation/Enhancement Measures

Duration	5	Permanent transformation of wetland areas	Low Negative (20)
Extent	1	Wetlands excluded from development footprint	
Magnitude	4	Impacts on wetland still significant	
Probability	2	Impact probability is low	

Cumulative impacts:

The area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact that this has had is extensive, including the impacts on wetlands in the area. Therefore, should the proposed development further encroach into natural areas (including wetlands) it will have a high cumulative impact. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas and exclude wetland areas, it should therefore not contribute significantly toward the cumulative impacts in this area (including wetlands).

Residual Risks:

Should these wetland areas be excluded from the development and measures as indicated implemented the anticipated impact should remain low.

Nature:

The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions.

Impact description: As was observed during the survey of the study area it contains several exotic weed and invader species. In addition, development (especially construction) will increase disturbance and exacerbate conditions susceptible to the establishment of exotic weeds and invaders. Without mitigation this will significantly increase the establishment of exotics and is likely to spread into the surrounding areas. It is therefore recommended that weed control be judiciously and continually practised. Monitoring of weed establishment should form a prominent part of management of the development area. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	4	Long-term infestation	High Negative (70)
Extent	3	Spreading of infestation into neighbouring areas	
Magnitude	8	Infestation of a Threatened Ecosystem	
Probability	5	Impact is unavoidable	

Mitigation/Enhancement Measures

Mitigation:

It is recommended that weed control be judiciously and continually practised. Monitoring of weed establishment should form a prominent part of management of the development area. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

Post Mitigation/Enhancement Measures

Duration	3	Limited duration if monitoring and eradication is maintained	Moderate Negative (30)
Extent	1	Limiting extent through monitoring and eradication	
Magnitude	6	Limited but unavoidable infestation	
Probability	3	Moderate probability remains	

Cumulative impacts:

The area has a long history of transformation by mining, agriculture and urban expansion which increases the cumulative impact of increased infestation by exotics. Therefore, should the proposed development further encroach into natural areas and contribute to increased infestation it will have a high cumulative impact. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts associated with increased exotic vegetation infestation.

Residual Risks:

Without mitigation this will significantly increase the establishment of exotics and is likely to spread into the surrounding areas.

Nature:

Any increased erosion that the development may cause.

Impact description: As indicated, because solar PV developments result in the removal of vegetation, this reduces infiltration and promotes runoff. Coupled with the rain shadow caused by panels and the resulting dripline, this increases runoff and erosion. This may also have a moderate impact on the wetland systems adjacent to the site. In order to reduce this impact, the development should implement a comprehensive storm water management system which should ensure that the surface runoff patterns are retained as is, especially pertaining to solar panels, and that the development does not contribute toward increased surface flow, erosion and any impacts on downslope areas.

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	5	Permanent modification of surface topography	Moderate Negative (56)
Extent	3	Spreading of erosion into neighbouring areas	
Magnitude	6	Limited magnitude due to the flat topography	
Probability	4	Highly likely to take place	

Mitigation/Enhancement Measures

Mitigation:

In order to reduce this impact, the development should implement a comprehensive storm water management system which should ensure that the surface runoff patterns are retained as is, especially pertaining to solar panels, and that the development does not contribute toward increased surface flow, erosion and any impacts on downslope areas.

Post Mitigation/Enhancement Measures

Duration	5	Permanent modification of surface topography	Low Negative (20)
Extent	1	Limiting extent through storm water management	
Magnitude	4	Limited magnitude due to the flat topography	
Probability	2	Unlikely to occur as long as storm water management is maintained	

Cumulative impacts:

The area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact (including surface erosion) that this has had is extensive. Therefore, should the proposed development further encroach into natural areas it will have a high cumulative impact (including surface erosion). However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas and successfully implement a storm water management system it should not contribute significantly toward the cumulative erosion in this area.

Residual Risks:

Erosion may also have a significant impact on the wetland systems adjacent to the site.

Nature:

Fragmentation of habitat, disruption of ecological connectivity and -functioning in terms of the surrounding areas.

Impact description: The majority of this area is already transformed to a large extent and is therefore greatly affected by habitat fragmentation and the disruption of ecosystem processes. Therefore, should the development encroach into any remaining natural areas this will have significant additional impacts in terms of habitat fragmentation. However, as indicated, the area is largely transformed and should the development be able to avoid remaining natural patches of grassland the impact on habitat fragmentation and the loss of ecosystem processes would remain low.

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	5	Permanent loss and fragmentation of habitat	Moderate Negative (60)
Extent	2	Limited loss of natural areas	
Magnitude	8	High impact due to fragmentation of a Threatened Ecosystem	
Probability	4	Highly likely to take place	

Mitigation/Enhancement Measures

Mitigation:

The area is largely transformed and should the development be able to avoid remaining natural patches of grassland the impact on habitat fragmentation and the loss of ecosystem processes would remain low.

Post Mitigation/Enhancement Measures

Duration	5	Permanent loss and fragmentation of habitat	Low Negative (8)
Extent	1	Limiting extent by excluding remaining natural areas	
Magnitude	2	Limited magnitude due to limiting development to already transformed areas	
Probability	1	Low probability as long as development is limited to already transformed areas	

Cumulative impacts:

As previously indicated, the area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact that this has had is extensive. Therefore, should the proposed development further encroach into natural areas it will have a high cumulative impact. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts in this area.

Residual Risks:

The area is largely transformed and should the development be able to avoid remaining natural patches of grassland the impact on habitat fragmentation and the loss of ecosystem processes would remain low.

Nature:

Impacts that will result on the mammal population on and around the site.

Impact description: The most significant impact on mammals anticipated on the site itself is primarily concerned with the loss and fragmentation of available habitat. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. Since the area is already largely transformed, the mammal population will already be heavily modified and the impact caused by the proposed development should be fairly low. Additional measures which will further mitigate these impacts include the exclusion of remnants of natural grassland and the exclusion of natural wetland areas in the southern portion of the site. Construction itself may also affect the mammal population and care should therefore be taken to ensure none of the faunal species on site is harmed.

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	4	Limited to a semi-permanent impact if some vegetation re-establishes within the development	Low Negative (24)
Extent	2	Limited loss of natural areas	
Magnitude	4	Moderate given the already modified mammal population	
Probability	2	Moderate given the already modified mammal population	

Mitigation/Enhancement Measures

Mitigation:

Additional measures which will further mitigate these impacts include the exclusion of remnants of natural grassland and the exclusion of natural wetland areas in the southern portion of the site. Construction itself may also affect the mammal population and care should therefore be taken to ensure none of the faunal species on site is harmed. The hunting, capturing or harming in any way of mammals on the site should not be allowed. Voids and excavations

may also act as pitfall traps to fauna and these should continuously be monitored and any trapped fauna removed and released in adjacent natural areas.

Post Mitigation/Enhancement Measures

Duration	4	Limited to a semi-permanent impact if some vegetation re-establishes within the development	Low Negative (24)
Extent	2	Limited loss of natural areas	
Magnitude	4	Moderate given the already modified mammal population	
Probability	2	Moderate given the already modified mammal population	

Cumulative impacts:

The area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact that this has had on the mammal population is extensive. Therefore, should the proposed development further encroach into natural areas it will have a further increased cumulative impact on the mammal population. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts on the local mammal population.

Residual Risks:

Transformation of the indigenous vegetation on the site will result in a decrease in the mammal population size as available habitat decreases.

1.5 Cumulative Impact

Any significant cumulative impacts that the development will contribute towards. As previously indicated, the area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact that this has had is extensive. Therefore, should the proposed development further encroach into natural areas it will have a high cumulative impact. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts in this area.

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	2	3
Duration	5	4
Magnitude	10	8
Probability	5	5
Significance	High (85)	High (70)
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes

Confidence in findings: **High**

Mitigation:

Since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts in this area.

1.6. Conclusion

As previously indicated, the area has a long history of transformation by mining, agriculture and urban expansion and the cumulative impact that this has had is extensive. Therefore, should the proposed

development further encroach into natural areas it will have a high cumulative impact. However, since transformation is already so extensive the proposed development has the opportunity to make use of these transformed areas and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts in this area.

The most significant impact on mammals anticipated on the site itself is primarily concerned with the loss and fragmentation of available habitat. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. Since the area is already largely transformed, the mammal population will already be heavily modified and the impact caused by the proposed development should be fairly low. Additional measures which will further mitigate these impacts include the exclusion of remnants of natural grassland and the exclusion of natural wetland areas in the southern portion of the site. Construction itself may also affect the mammal population and care should therefore be taken to ensure none of the faunal species on site is harmed. The hunting, capturing or harming in any way of mammals on the site should not be allowed. Voids and excavations may also act as pitfall traps to fauna and these should continuously be monitored and any trapped fauna removed and released in adjacent natural areas.

The impact significance has been determined and should development take place without mitigation it is anticipated that several moderate-high to high impacts will occur. The impact on remaining natural patches of grassland as well as the wetland systems in the southern portion of the site will especially be heavily affected. However, should adequate mitigation be implemented as described these can all be reduced to moderate and low-moderate impacts. This is however subject to the development footprint being within areas of low sensitivity and avoiding any patches of remaining natural grassland as well as the wetland systems on the site.

Should development of the solar facility be able remain within transformed areas, this will greatly decrease the anticipated impacts. Being a mining area, this results in transformation and degradation of large portions of land. The cumulative impact of development and mining in this area is therefore high. The proposed solar development should therefore first consider the development of areas considered as already transformed and of low sensitivity. These include the old ploughed fields and areas which previously consisted of buildings and structures. Only if no remaining options remain should the development consider encroaching into remaining natural areas. However, in this instance it will result in high impacts. Likewise the remaining natural wetland areas in the southern portion of the site will also have a high level of sensitivity and should be avoided by development but will be discussed in greater detail in the wetland assessment section of the report.

Due to the largely transformed nature of the development area, no protected or endangered plant species were noted. Although the possibility remains that may be present in those patches of remaining natural grassland, the likelihood is considered fairly low. The area does however contain quite a substantial infestation of invasive trees, and this will pose a risk of spreading into surrounding natural areas, especially as construction of the solar development will increase disturbance in the area. The proposed development will also have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species are removed from the area and prevented from re-establishing.

Given the largely transformed condition of the site no protected or endangered plant species were noted. Although the possibility remains that may be present in those patches of remaining natural grassland, the likelihood is considered fairly low. The anticipated impact on the loss of protected or endangered plant species is therefore fairly low

2. AVIFAUNA IMPACT ASSESSMENT

From an avifaunal perspective it is evident that bird diversity is positively correlated with vegetation structure, and floristic richness is not often regarded to be a significant contributor of patterns in bird abundance and their spatial distributions. Although grasslands are generally poor in woody plant species, and subsequently support lower bird richness values, it is often considered as an important habitat for many terrestrial bird species such as larks, pipits, korhaans, cisticolas, widowbirds including large terrestrial birds such as Secretary birds, cranes and storks. Many of these species are also endemic to South Africa and display particularly narrow distribution ranges. Due to the restricted spatial occurrence of the Grassland Biome and severe habitat transformation, many of the bird species that are restricted to the grasslands are also threatened or experiencing declining population sizes.

Conservation Areas, Protected Areas, and Important Bird Areas

The study site does not coincide with any conservation area or Important Bird and Biodiversity Area (IBA). The nearest conservation area to the proposed study site is the Willem Pretorius Game Reserve, which is located 35 km south-east of the study site. The Willem Pretorius Game Reserve is also a recognised IBA (SA044).

Results of the Avifauna Impact Assessment

Apart from the regional vegetation type, the local composition and distribution of the vegetation associations on the study site are a consequence of a combination of factors simulated by historical disturbance regimes and soil moisture regimes which have culminated in a number of habitat types that deserve further discussion:

- » **Untransformed grassland:** This unit is located on the northern and western parts of the study site. The graminoid structure and composition is essentially of an untransformed nature and dominated by a variety of *Eragrostis* species as well as *Themeda triandra*, of which the graminoid composition appears to be more diverse when compared to historically disturbed areas (e.g. secondary grassland). The bird composition is typified by widespread grassland species such as Crowned Lapwing (*Vanellus coronatus*), Cape Longclaw (*Macronyx capensis*), African Pipit (*Anthus cinnamomeus*) and Cloud Cisticola (*Cisticola textrix*).
- » **Old cultivated land and secondary grassland:** This unit is prominent on the central section of the study site was probably utilised as cultivation in the past. It represents a grassland sere with a secondary albeit monotonous composition that is dominated by *Cynodon dactylon*, *Eragrostis cf. lehmanniana*, *Aristida congesta*, *Chloris gayana* and *Gomphocarpus fruticosus*. The bird composition is represented by cryptic grassland and nomadic species including high numbers of Red-capped Lark (*Calandrella cinerea*) and Desert Cisticola (*Cisticola aridulus*). It also provides ephemeral foraging habitat for a small sub-population of the collision-prone species, namely the Northern Black Korhaan (*Afrotis afroides*).
- » **Bush clump mosaics:** This unit is localised and located on the southern part of the study site where it is represented by a distinct woody canopy dominated by *Vachellia karroo*. The eminent increase in vertical heterogeneity provided by the woody layer is colonised by a "Bushveld" bird association consisting of insectivorous passerines such as Black-chested Prinia (*Prinia flavicans*), Chestnut-vented Warbler (*Sylvia subcoerulea*), Kalahari Scrub Robin (*Cercotrichas paena*), African Red-eyed Bulbul (*Pycnonotus nigricans*) as well as granivores such as Yellow Canary (*Crithagra flaviventris*) and

Southern Masked Weaver (*Ploceus velatus*). Non-passerine bird taxa are represented by Laughing Dove (*Spilopelia senegalensis*), Ring-necked Dove (*Streptopelia capicola*), Acacia Pied Barbet (*Tricholaema leucomelas*) and White-backed Mousebird (*Colius colius*). It also provides nesting and roosting habitat for the White-browed Sparrow-weaver (*Plocepasser mahali*).

- » **Transformed and landscaped (manicured) areas:** These areas are represented by build-up land and landscaped areas of which the tree cover is predominantly composed of exotic species. These features are invariably also artificial although colonised by widespread and generalist bird species such as the Laughing Dove (*Spilopelia senegalensis*), Ring-necked Dove (*Streptopelia capicola*) and Southern Fiscal (*Lanius collaris*).
- » **Nearby ephemeral pans** north of the study site were inundated and provide foraging habitat for waterbird taxa such as Reed Cormorant (*Microcarbo capensis*), Glossy Ibis (*Plegadis falcinellus*), Little Grebe (*Tachybaptus ruficollis*), Red-knobbed Coot (*Fulica cristata*) and Common Moorhen (*Gallinula chloropus*).

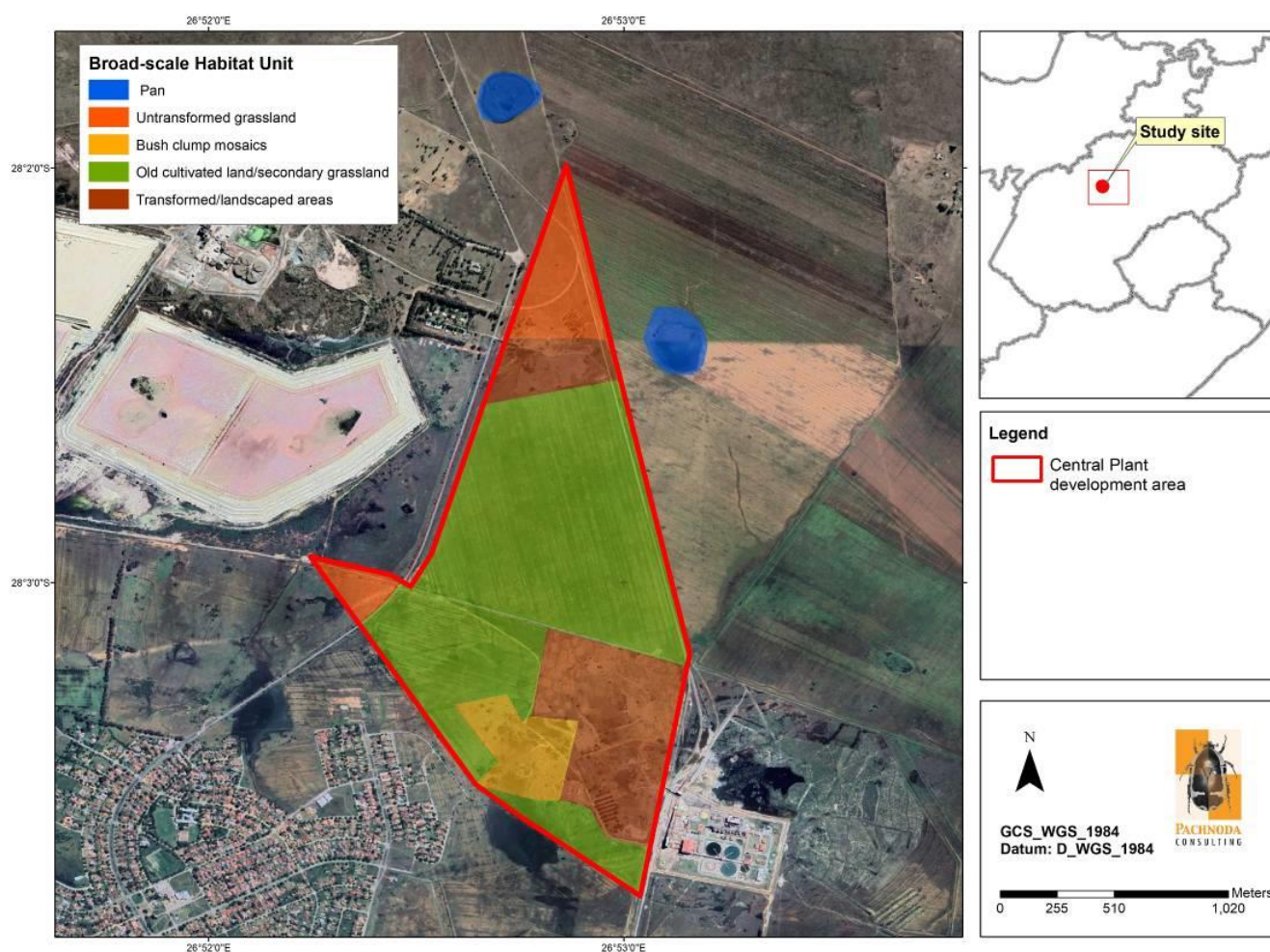


Figure XXX: A map illustrating the avifaunal habitat types on the study site.

Species Richness and Summary statistics

Approximately 152 bird species are expected to occur in the study area. The expected richness was inferred from the South African Bird Atlas Project (SABAP1 & SABAP2)¹ (Harrison et al., 1997; www.sabap2.birdmap.africa) and the presence of suitable habitat in the study area. This equates to 15 % of the approximate 987² species listed for the southern African subregion³ (and approximately 17 % of the 871 species recorded within South Africa⁴). The average number of species for each full protocol card submitted (for observation of two hours or more) is 50.2 species (range = 25 - 82 species).

Table 1: A summary table of the total number of species, Red listed species (according to Taylor et al., 2015 and the IUCN, 2022), endemics and biome-restricted species (Marnewick et al., 2015) expected (*sensu* SABAP1 and SABAP2) to occur in the study site and immediate surroundings.

Description	Expected Richness Value (study area and surroundings) ^{***}	Observed Richness Value (study area) ^{****}
Total number of species*	152 (17 %)	85 (56 %)
Number of Red Listed species*	5 (4 %)	1 (20 %)
Number of biome-restricted species – Zambezan and Kalahari-Highveld Biomes*	3 (21 %)	3 (100 %)
Number of local endemics (BirdLife SA, 2022)*	2 (5 %)	1 (50 %)
Number of local near-endemics (BirdLife SA, 2022)*	5 (17 %)	4 (80 %)
Number of regional endemics (Hockey et al., 2005)**	14 (13 %)	11 (79 %)
Number of regional near-endemics (Hockey et al., 2005)**	14 (23 %)	11 (79 %)

Table 2: Expected biome-restricted species (Marnewick et al, 2015) likely to occur on the study area.

Species	Kalahari-Highveld	Zambezan	Expected Frequency of occurrence
Kalahari Scrub-robin (<i>Cercotrichas paena</i>)	X		Fairly Common
White-throated Robin-chat (<i>Cossypha humeralis</i>)		X	Uncommon (overlooked)
White-bellied Sunbird (<i>Cinnyris talatala</i>)		X	Uncommon

¹ The expected richness statistic was derived from the pentad grid 2800_2650 (including adjacent 8 grids) totalling 154 bird species (based on 43 submitted cards, 31 being full protocol cards and 12 being ad hoc cards).

² *sensu* www.zestforbirds.co.za (Hardaker, 2020) including four recently confirmed bird species (vagrants).

³ A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, eSwatini and Lesotho).

⁴ With reference to South Africa (including Lesotho and eSwatini (BirdLife South Africa, 2022)).

Table 3: Endemic bird species and species of conservation concern occurring in the broader study area which could collide and/ or become displaced by the proposed PV infrastructure.

Common Name	Scientific name	Regional Status	Global Status	Observed (June/July 2022)	Collision with power lines	Collision with PV panels	Displacement (disturbance & loss of habitat)
South African Shelduck	<i>Tadorna cana</i>	End		1	1	1	
Cape Shoveller	<i>Anas smithii</i>	End		1	1	1	
Northern Black Korhaan	<i>Afrotis afraoides</i>	End		1	1		1
White-backed Mousebird	<i>Colius colius</i>	End		1			1
Karoo Thrush	<i>Turdus smithi</i>	End					1
Ant-eating Chat	<i>Myrmecocichla formicivora</i>	End		1			1
Pied Starling	<i>Lamprotornis bicolor</i>	End		1			1
Cape Longclaw	<i>Macronyx capensis</i>	End		1			1
Fiscal Flycatcher	<i>Sigelus silens</i>	End		1			1
Fairy Flycatcher	<i>Stenostira scita</i>	End		1			1
White-throated Robin-chat	<i>Cossypha humeralis</i>	End		1			1
South African Cliff Swallow	<i>Petrochelidon spilodera</i>	End					1
Cape White-eye	<i>Zosterops virens</i>	End					1
Orange River White-eye	<i>Zosterops pallidus</i>	End		1			1
Pale Chanting Goshawk	<i>Melierax canorus</i>	N-end			1		
Orange River Francolin	<i>Scleroptila gutturalis</i>	N-end			1		1
Acacia Pied Barbet	<i>Tricholaema leucomelas</i>	N-end		1			1
Eastern Clapper Lark	<i>Mirafrasi fasciolata</i>	N-end					1
Pink-billed Lark	<i>Spizocorys conirostris</i>	N-end		1			1
African Red-eyed Bulbul	<i>Pycnonotus nigricans</i>	N-end		1			1
Kalahari Scrub Robin	<i>Cercotrichas paena</i>	N-end		1			1
Chestnut-vented Warbler	<i>Curruca subcoerulea</i>	N-end		1			1
Pirit Batis	<i>Batis pirit</i>	N-end		1			1
Cape Sparrow	<i>Passer melanurus</i>	N-end		1			1

Scaly-feathered Weaver	<i>Sporopipes squamifrons</i>	N-end		1			1
Red-headed Finch	<i>Amadina erythrocephala</i>	N-end		1			1
Yellow Canary	<i>Crithagra flaviventris</i>	N-end		1			1
Cloud Cisticola	<i>Cisticola textrix</i>	N-end		1			1
Secretarybird	<i>Sagittarius serpentarius</i>	EN	EN		1		1
Lesser Flamingo	<i>Phoeniconaias minor</i>	NT	NT		1	1	
Greater Flamingo	<i>Phoenicopterus roseus</i>	NT			1	1	
<u>Black Stork</u>	<i>Ciconia ciconia</i>	VU			1		
<u>Falcon, Lanner</u>	<i>Falco biarmicus</i>	VU		1	1		
	Totals:	33	2	23	10	4	26

Bird species of conservation concern

Table 4 provides an overview of bird species of conservation concern that could occur on the development area based on their historical distribution ranges and the presence of suitable habitat. According to Table 4, a total of five species have been recorded in the wider study area (sensu SABAP2) which include one globally threatened species, one globally near threatened species, two regionally threatened species and one regionally near threatened species.

It is evident from Table 4 that these species occur at low reporting rates (< 5% for full protocol cards), which suggests that these species are highly irregular visitors to the study site. The occurrence of most of these species on the study area (sensu pentad grid 2800_2650) was based on single observations which confirm the low probability for these species to occur.

However, the vulnerable Lanner Falcon (*Falco biarmicus*) was observed flying in a north-easterly direction to a series of pylon structures on 07 June 2022 (Figure 14). The status of this species on the study area remains uncertain, although it is considered to be an occasional foraging visitor to the area.

Both the globally near threatened Lesser Flamingo (*Phoeniconaias minor*) and the regionally near threatened Greater Flamingo (*Phoenicopterus roseus*) have been observed from pans and dams in the wider study area. These species are regarded as regular foraging visitors to the nearby pans and dams although these species are probably absent on the physical study site due to the absence of any suitable habitat on the study site. Nevertheless, birds dispersing or commuting between the nearby pans and dams could potentially fly over the study site and could interact (collide) with the PV panels and associated electrical infrastructure.

Table 4: Bird species of conservation concern that could utilise the study area based on their historical distribution range and the presence of suitable habitat. Red list categories according to the IUCN (2022)* and Taylor et al. (2015)**.

Species	Global Conservation Status*	National Conservation Status**	SABAP2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
Falco biarmicus (Lanner Falcon)	-	Vulnerable	9.52	Varied, but prefers to breed in mountainous areas although also using old disused mine voids.	An occasional foraging visitor to the study site. One individual was observed on 07 June 2022 while flying in a north-easterly direction toward existing pylon structures
Ciconia ciconia (Black Stork)	-	Vulnerable	4.76	Breeds in mountainous regions. Preferred foraging habitat include inundated pans and large impoundments.	Probably absent on the physical study site due to the absence of suitable habitat. Birds dispersing between pans could potentially fly over the site and may interact with the PV panels en electrical infrastructure. It is only known from a single observation on the study area (19 January 2022).
Phoeniconaias minor (Lesser Flamingo)	Near-threatened	Near-threatened	-	Restricted to large saline pans and other inland water bodies containing cyanobacteria.	Probably a regular foraging visitor to the nearby pans and dams. Probably absent on the physical study site due to the absence of suitable habitat. Birds dispersing between the pans and dams in the area could potentially fly over the site and may interact with the PV panels en electrical infrastructure.
Phoenicopterus roseus (Greater Flamingo)	-	Near-threatened	4.76	Restricted to large saline pans and other inland water bodies.	Probably a regular foraging visitor to the nearby pans and dams. Probably absent on the physical study site due to the absence of suitable habitat. Birds dispersing

					between the pans and dams in the area could potentially fly over the site and may interact with the PV panels en electrical infrastructure.
Sagittarius serpentarius (Secretarybird)	Endangered	Endangered	4.76	Prefers open grassland or lightly wooded habitat.	A highly irregular foraging visitor and probably absent on the study site. Historically displaced due to anthropogenic activities.

The following bird associations are relevant to the study site and immediate surroundings:

- » Association on inundated pans
 - Dominant species: Red-billed Quelea (*Quelea quelea*), Levaillant's Cisticola (*Cisticola finniens*) and Long-tailed Widowbird (*Euplectes progne*).
 - Indicator species⁵: Mainly waterbirds such as Red-knobbed Coot (*Fulica cristata*), Reed Cormorant (*Microcarbo africanus*), Little Grebe (*Tachybaptus ruficollis*) and Common Moorhen (*Gallinula chloropus*).
- » Association on open grassland in the absence of any tree cover
 - Dominant species: Red-capped Lark (*Calandrella cinerea*), Crowned Lapwing (*Vanellus coronatus*), African Pipit (*Anthus cinnamomeus*), Desert Cisticola (*Cisticola aridulus*) and Ant-eating Chat (*Myrmecocichla formicivora*).
 - Indicator species: Cape Longclaw (*Macronyx capensis*), Northern Black Korhaan (*Afrotis afraoides*) and Spike-heeled Lark (*Chersomanes albofasciata*).
- » Association on habitat with a prominent tree canopy cover
 - Dominant species: Ring-necked Dove (*Streptopelia capicola*), White-browed Sparrow-weaver (*Plocepasser mahali*), Chestnut-vented Warbler (*Curruca subcoerulea*), Southern Masked Weaver (*Ploceus velatus*) and Yellow Canary (*Crithagra flaviventris*).
 - Indicator species: Acacia Pied Barbet (*Tricholaema leucomelas*), Kalahari Scrub-robin (*Cercotrichas paena*), Cape Starling (*Lamprotornis nitens*), African Red-eyed Bulbul (*Pycnonotus nigricans*) and Black-throated Canary (*Crithagra atrogularis*).

The highest number of bird species on the study area was observed from habitat with a high prevalence of tree/woody cover, while the highest number of bird individuals was observed from the nearby pans. The lowest number of bird species was recorded from the pans, while the lowest number of bird individuals occurred on grassland habitat.

Movements/dispersal of Collision-prone birds

The only deterministic daily flight routes were observed for waterbirds dispersing between the two pans on the northern part on the study site (Figure 18). Although not observed, it is possible that other waterbirds taxa, especially migrating flamingo species could fly over the study site. Flamingos migrate invariably at night, which makes predictions regarding their movements on the study area difficult. However, most of

⁵ Indicator species refers to a species with high numbers that is restricted to a particular habitat.

the large pans are located north and north-west of the study site where a high rate of dispersal is predicted for flamingo taxa between the pans and water features.

In addition, the home ranges of approximately four and five pairs of Northern Black Korhaan (*Afrotis afroides*) correspond to the study site (Figure 18). These individuals have a high probability to become displaced due to the loss of habitat during the construction phase.

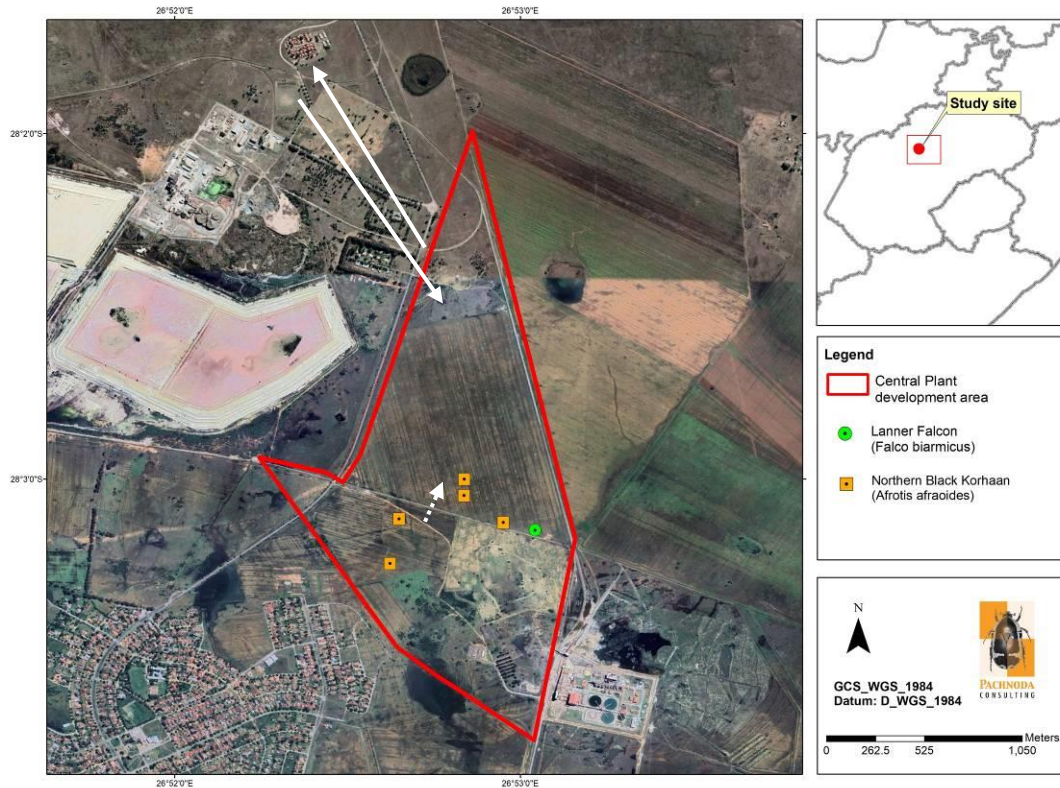


Figure 1: A map of the study site illustrating the occurrence and movements of collision-prone birds. Solid arrows illustrates the movements/dispersal of waterbirds between two pans,

Areas of high sensitivity

The pans and their respective buffers are of high sensitivity. These features provide habitat for a variety of collision-prone bird species which include many waterbird and shorebird taxa. In addition, most of the pans in the region support large congregations of waterfowl and shorebird taxa, including globally and regionally threatened and near threatened species (e.g. flamingo taxa). These pans are also important from a functional and dynamic perspective at the landscape level since it forms part of an "inter-connected" system or "stepping stones" within the regional catchment, meaning that environmental conditions at these pans (e.g. water levels, salinity, food availability, availability of shoreline habitat) are constantly changing. Therefore, none of the pans within the study area are similar to each, thereby providing a continuous supply of resources for waterbirds. The placement of electrical infrastructure and PV panels in close proximity to these pans/dams as well as on areas where the frequency of fly-overs by waterbirds are high could increase potential avian collisions with the infrastructure.

Areas of medium sensitivity

Areas of medium sensitivity include the bush clump mosaics and untransformed grassland units. Both these units contained fairly high numbers of bird species when compared to the transformed and secondary grasslands.

Areas of low sensitivity

These habitat units are represented by transformed habitat types and include the secondary grasslands and landscaped/manicured areas.

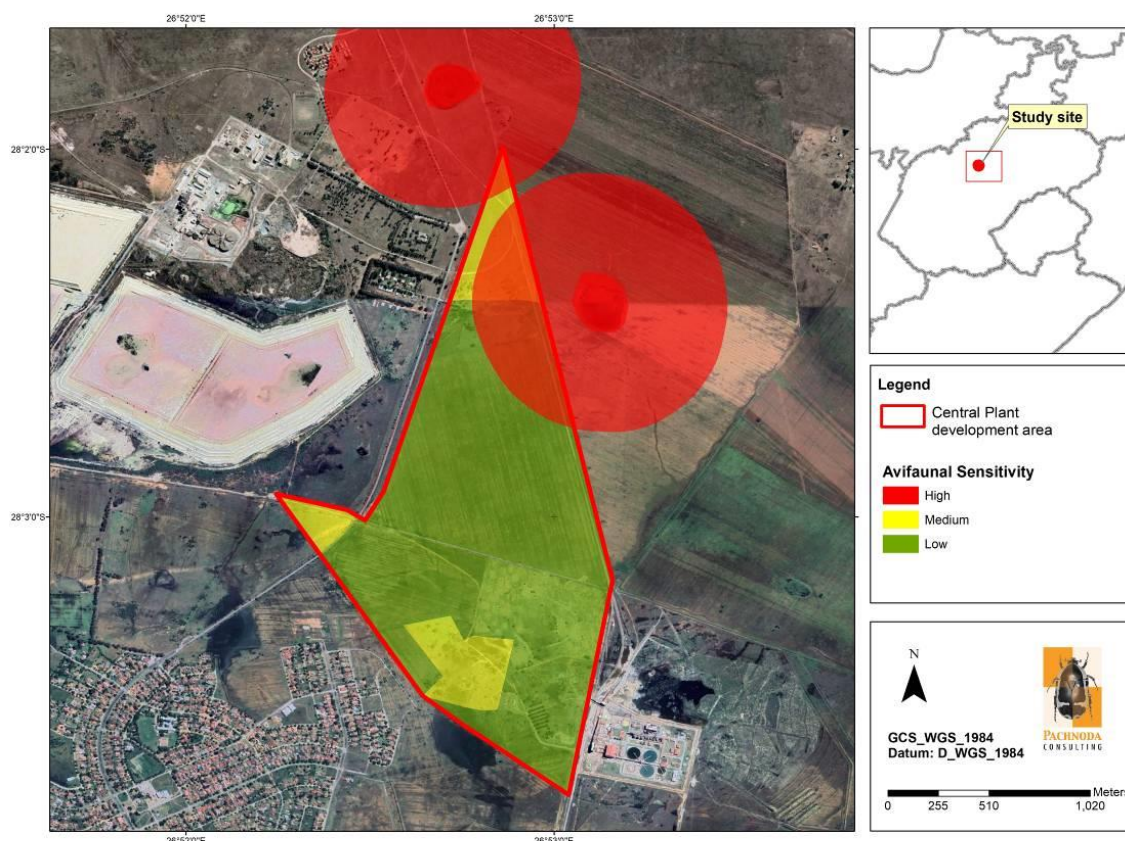


Figure 2: A map illustrating the avifaunal sensitivity of the study site based on habitat types supporting bird taxa of conservation concern and important ecological function (the pans include a 500m buffer area which should be viewed as sensitive).

2.1. Impact Assessment Tables

Nature:		
Losses of natural habitat and displacement of birds through physical transformation, modifications, removals and land clearance. This impact is mainly restricted to the construction phase and is permanent.		
PV Layout (and associated infrastructure)	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)

Probability	Definite (5)	Probable (3)
Significance	Medium (50)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, to some extent	Yes, to some extent

Mitigation:

It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. Both the PV facility and associated infrastructure occur predominantly on habitat types of low to medium sensitivity. The best practicable mitigation will be to consolidate infrastructure (e.g. proposed powerline) to areas where existing impacts occur (e.g. placing the proposed powerline alongside existing powerlines).

Residual:

Decreased bird species richness, low evenness values and subsequent loss of avian diversity on a local scale. The impact will also result in increased fragmentation of habitat.

Nature:

The creation of novel or new avian habitat for commensal bird species or superior competitive species. This is expected to occur during the operation phase of the facility.

PV Layout (and associated infrastructure)	Without mitigation	With mitigation
Extent	Footprint (1)	Footprint (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Low (18)	Low (12)
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, with experimentation	Yes

Mitigation:

Apply bird deterrent devices and remove nest structures constructed on infrastructure associated with the PV facility under the guidance of the ECO.

Residual:

Secondary displacement by competitive bird species such as crows and increased fecundity rate for commensal bird species that are adapted to anthropogenic activities. The impact is regarded as low.

Nature:

Avian collision impacts related to the PV facility during the operation phase (collision with the PV panels).

PV Layout (and associated infrastructure)	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Moderate (6)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (56)	Medium (36)
Status (positive or negative)	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of endemic/near-endemic waterfowl and waterbird species.	Yes, potential loss of endemic/near-endemic waterfowl and waterbird species.
Can impacts be mitigated?	Yes, with experimentation	Yes, with experimentation

Mitigation:

Apply bird deterrent devices such as rotating flashers/reflectors to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels - these should be placed at panels nearest (facing) to pans and other water features. Bird deterrent devices should also include light-emitting devices to increase the visibility of the PV infrastructure for waterbird species that migrate at night (e.g. flamingo species). Security/CCTV cameras may be installed to quantify mortalities (cameras are also installed along the perimeter fence for security measures and may also prove to be effective to quantify mortalities). Buffer pans by at least 500m (arrays should be positioned at least 500m away from pans). If post-construction monitoring predicts and/or confirms any bird mortalities, an option is to employ video cameras at selected areas to document bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis.

Residual:

Direct mortality is possible and may still occur irrespective of applied mitigation measures. Regular and systematic monitoring is proposed to assess the efficacy of applied mitigation and further research and testing is suggested to improve mitigation measures (e.g. bird deterrent devices). The residual impact is regarded as moderate.

Nature:

Avian collision impacts related to overhead power lines during operation.

Grid Corridor	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes (to some extent), owing to the potential loss of collision-prone waterbird species.	Yes
Can impacts be mitigated?	Yes	Yes

Mitigation:

Apply bird deterrent devices to the power lines and make use of "bird-friendly" pylon structures. To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to conduct direct observations and carcass searches on a regular and systematic basis. Collisions will be reduced if the corridor is placed alongside existing powerlines.

Residual:

Direct mortality is possible and may still happen irrespective of applied mitigation measures. The residual impact will be low.

Nature:

Avian electrocution related to the new distribution lines during operation.

Grid Corridor	Without mitigation	With mitigation
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)

Probability	Probable (3)	Probable (3)
Significance	Low (30)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes (to some extent), owing to the potential loss of collision-prone waterbird species.	Yes (to some extent), owing to the potential loss of collision-prone waterbird species.
Can impacts be mitigated?	Yes, to some extent	Yes, to some extent
Mitigation: Make use of bird-friendly pylons and bird guards as recommended by EWT. Align corridor alongside existing powerlines.		
Residual: Direct mortality is possible and may still happen irrespective of applied mitigation measures. The residual impact will be low.		

2.2. Cumulative Impact Assessment

Cumulative impacts are defined as impacts that result from additional or incremental activities caused by past or present actions together with the current project. Therefore, cumulative impacts are those that will affect the general avifaunal community on the study area due to other planned solar farm projects and electrical infrastructure in the region.

Another PV facility (Harmony One Plant Solar PV facility) of 30MW on 75ha of land is planned approximately 10km north-west of the proposed Harmony Central Plant Solar PV facility.

The cumulative impacts are likely to increase the displacement and loss of habitat. In addition while the grid connection (via overhead powerlines) of these facilities could potentially contribute towards bird strikes with powerlines and avian mortalities due to collision in the region.

1. Nature: Regional losses of natural habitat and subsequent displacement of birds.		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
<i>Extent</i>	Local (2)	Local and immediate surroundings (3)
<i>Duration</i>	Long-term (4)	Long-term (4)
<i>Magnitude</i>	Low (4)	Low (4)
<i>Probability</i>	Probable (3)	Probable (3)
Significance	Medium (30)	Medium (33)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	Low	Low
<i>Loss of resources?</i>	Yes	Yes
<i>Can impacts be mitigated?</i>	No	
Confidence in findings: High.		
Mitigation:		

It is difficult to mitigate against the loss of habitat without considering alternative sites. The best practicable mitigation will be to consolidate infrastructure to areas where existing impacts occur (e.g. placing the proposed powerline alongside existing powerlines).

2. Nature:

Avian collision impacts related to the PV facility during the operational phase (collision with the PV panels).

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
<i>Extent</i>	Local (2)	Local (2)
<i>Duration</i>	Long-term (4)	Long-term (4)
<i>Magnitude</i>	Moderate (6)	High (8)
<i>Probability</i>	Probable (3)	Highly Probable (4)
<i>Significance</i>	Medium (36)	Medium (60)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	Low	Low
<i>Irreplaceable loss of resources?</i>	Yes (to some extent), owing to the potential loss of waterbird taxa.	Yes (to some extent), owing to the potential loss of waterbird taxa and potential threatened and near threatened waterbird taxa
<i>Can impacts be mitigated?</i>	Yes, to some extent	Yes, to some extent

Confidence in findings:

Low.

Mitigation:

Apply bird deterrent devices to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels. To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to employ video cameras to document any bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis.

Nature:

Avian collision impacts related to the powerline reticulation and new distribution lines during operation.

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
<i>Extent</i>	Local (2)	Local (2)
<i>Duration</i>	Long-term (4)	Long-term (4)
<i>Magnitude</i>	Minor (2)	Moderate (6)
<i>Probability</i>	Probable (3)	Probable (3)
<i>Significance</i>	Low (24)	Medium (39)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	Low	Low
<i>Irreplaceable loss of resources?</i>	Yes (to some extent), owing to the potential loss of waterbird taxa.	Yes (to some extent), owing to the potential loss of waterbird taxa and potential threatened and near threatened waterbird taxa
<i>Can impacts be mitigated?</i>	Yes, to some extent	Yes, to some extent

Confidence in findings:

High.

Mitigation:

Apply bird deterrent devices to the power line and make use of "bird-friendly" pylon structures. Allow for construction of new powerlines parallel to existing lines. To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to conduct direct observations and carcass searches on a regular and systematic basis. As a priority, all new power lines should be marked with bird diverters.

4. Nature:

Avian electrocution related to the powerline reticulation and new distribution lines during operation.

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
<i>Extent</i>	Local (2)	Local (2)
<i>Duration</i>	Long-term (4)	Long-term (4)
<i>Magnitude</i>	Minor (2)	Low (4)
<i>Probability</i>	Probable (3)	Probable (3)
<i>Significance</i>	Low (24)	Low (30)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	Low	Low
<i>Irreplaceable loss of resources?</i>	Yes (to some extent), owing to the potential loss of waterbird taxa.	Yes (to some extent), owing to the potential loss of waterbird taxa and potential threatened and near threatened waterbird taxa
<i>Can impacts be mitigated?</i>	Yes, to some extent	

Confidence in findings:

Moderate.

Mitigation:

Apply bird deterrent devices to the power line and make use of "bird-friendly" pylon structures. As a priority, all new power lines should be marked with bird diverters. Make use of bird-friendly pylons and bird guards. Position electrical infrastructure in close proximity to existing infrastructure.

2.3. Conclusion

Five avifaunal habitat types were identified on the study site and surroundings, ranging from untransformed and secondary grassland, bush clump mosaics to transformed and landscape/manicured areas. The study site was also surrounded by a number of pans, which provided habitat for a high diversity of waterbird taxa. Approximately 152 bird species are expected to occur in the wider study area, of which 85 species were observed in the study area (during two surveys). The expected richness included five threatened or near threatened species, 14 southern African endemics and 14 near-endemic species. The vulnerable Lanner Falcon (*Falco biarmicus*) was observed on the study site (during a fly-over). Eleven southern African endemics and 11 near-endemic species were confirmed on the study site.

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was moderate to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (including flamingo taxa) colliding with the PV infrastructure remained eminent due to the presence of inundated pans in the study area. Post-construction monitoring was recommended along with the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds.

No fatal-flaws were identified during the assessment, although it was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project.

3. SOILS AND AGRICULTURAL POTENTIAL IMPACT ASSESSMENT

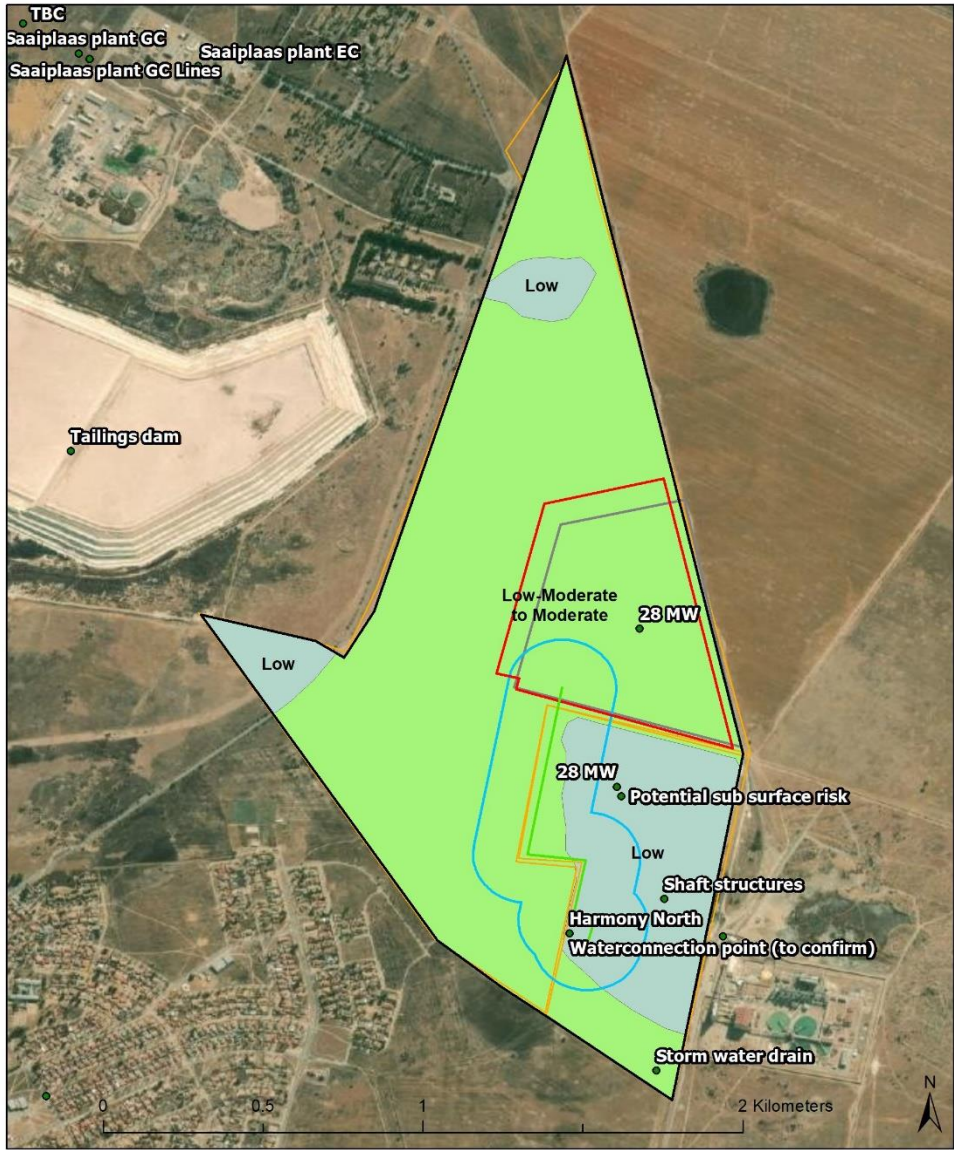
Approximately 60 to 65% of the development area consists of land with High agricultural sensitivity. The High sensitivity area occurs largely in a wide horizontal strip across the middle of the area while smaller isolated areas of High sensitivity are present along the southern and eastern boundaries of the area. The remaining areas within the development area, consist of land with Medium sensitivity.

Outside of the development area, the areas north west, south west and south east of the development area consists mainly of land with Medium agricultural sensitivity while the areas to the north east and the south west, consists mainly of land with High sensitivity. Approximately three-quarters of the area has High sensitivity while the most southern part has Medium sensitivity.

In addition to the relative agricultural sensitivity of the area prescribed the spatial data of the HPAA's of the Free State Province were evaluated. According to this data, the entire development area falls is located outside any HPAA. The nearest HPAA, is a rainfed agricultural area with Category B priority rating (with Class A being the highest priority). This area is located between 5 and 7km to the east of the Harmony Central development area and the proposed development will therefore not affect the HPAA or result in fragmentation of it.

The development area was visited twice. The first site visit was on 9 and 10 June 2022 (winter). The site assessment included a soil classification survey, the collection of soil samples as well as the collection of photographic evidence about the current land uses. The season has no effect on the outcome of the assessment. The soil profiles were examined to a maximum depth of 1.5 m or the point of refusal using a hand-held soil auger. Observations were made regarding soil texture, structure, colour and soil depth at each survey point. A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. The soils are described using the S.A. Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018).

For the proposed Harmony Central development area, the agricultural potential was derived from the soil classification of the site and its potential for rainfed production of grain crops. The delineation is shown in **figure xxx**



Legend

Agricultural Potential

- Low-Moderate to Moderate (166.3 ha)
- Low (44.4 ha)

Plant Layout

- 132kV OHL Option (995.7 m)
- Affected Properties (215.1 ha)
- Facility Layout (30.9 ha)

- Grid Corridor (300m) (35.1 ha)
- Development area (210.7 ha)
- Development footprint (34.3 ha)



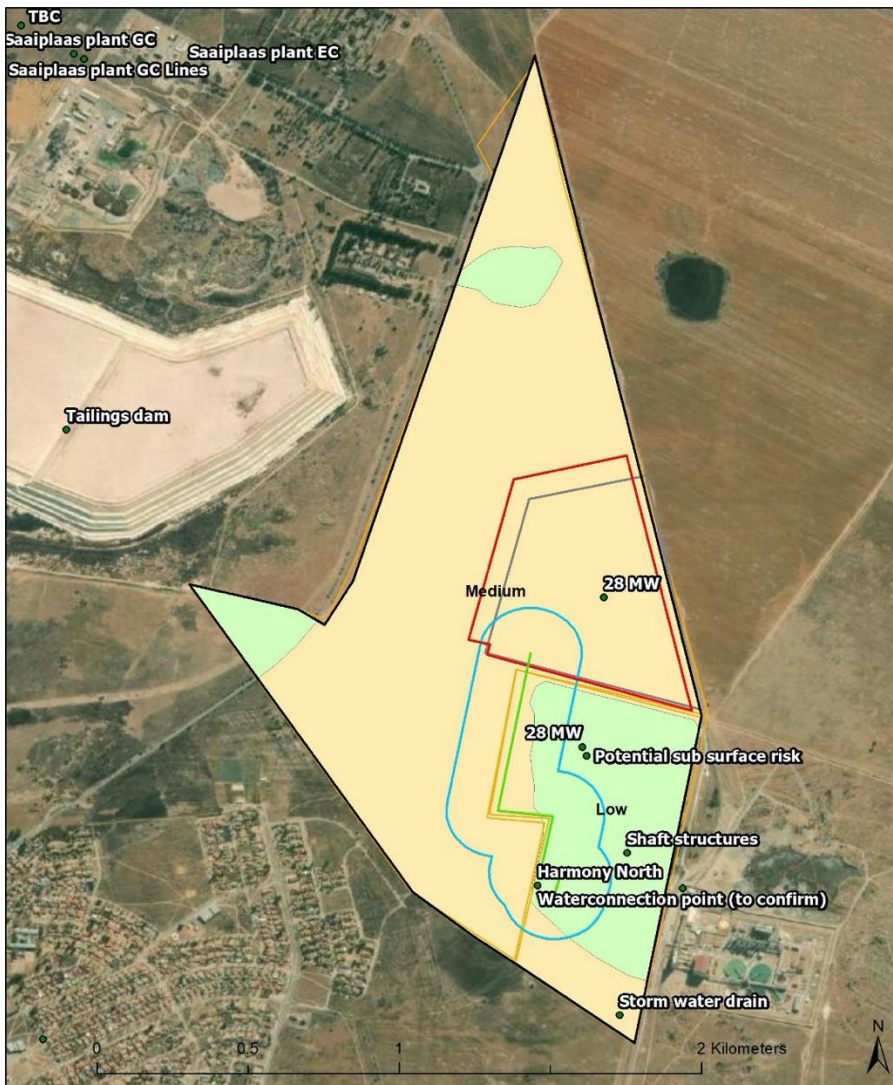
Figure **xxx** Agricultural potential of the Harmony Central development area

Within the development area, the areas where soil has been disturbed by activities associated with the nearby mining infrastructure, and that has been classified as Technosols, have Low agricultural potential. The areas are no longer suitable for rainfed crop production and has limited suitability for livestock farming because of the uneven terrain in these areas.

The rest of the development area has Low-Moderate to Moderate agricultural potential, depending on the effective depth of the Avalon and Bainsvlei profiles. The northern and western parts of the development area have shallower profiles and the yield potential of the soils are limited by a thick soft

plinthic horizon present at depths between 300 and 500mm. The deeper profiles along the eastern side of the development area have better potential for rainfed agriculture with greater effective depth for root development and lower risk of water saturated conditions during wet years, such as the past year.

Following the consideration of all the baseline and desktop data discussed in the sections above, the proposed Harmony Central Solar PV facility development area can be categorised as either Medium or Low sensitivity. The largest part of the development area has Medium sensitivity (166.3 ha or 79% of the project site), while the areas with Low sensitivity are present at 44.4 ha (or 21% of the project site). To illustrate the extent of the proposed land use change from agriculture to renewable energy, the development footprint (as received from the applicant), was superimposed on the agricultural sensitivity map and the areas measured that will be affected.



Legend

- | | | |
|--------------------|--------------------------------|---------------------------------|
| Sensitivity | Plant Layout | Grid Corridor (300m) (35.1 ha) |
| Medium (166.3 ha) | 132kV OHL Option (995.7 m) | Development area (210.7 ha) |
| Low (44.4 ha) | Affected Properties (215.1 ha) | Development footprint (34.3 ha) |
| | Facility Layout (30.9 ha) | |



Figure 3 Agricultural sensitivity of the Harmony Central development area

The most significant impacts of the proposed Harmony Central solar PV facility project on soil and agricultural productivity, will occur during the construction phase when the vegetation is removed, and the soil surface is prepared for infrastructure commissioning. During the operational phase, the risk remains that soil will be polluted by the waste generated during the operational phase or in the case of a spill incident. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface. Below follows a rating of the significance of each of the impacts.

3.1. Impact Assessment Tables

Impact: Change in land use from livestock grazing to energy generation

Nature: Prior to construction of the thermal generation plant, the area will be fenced off and livestock farming will be excluded from 34.3ha of land. The area where infrastructure will be constructed will be stripped of vegetation and will no longer be suitable for livestock grazing.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Medium duration (3)	Medium duration (3)
Magnitude	Low (4)	Low (4)
Probability	Definite (4)	Definite (4)
Significance	Medium (32)	Medium (28)
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	N/A

Mitigation:

- Vegetation clearance must be restricted to areas where infrastructure is constructed.
- No materials removed from development area must be allowed to be dumped in nearby livestock farming areas.
- Prior arrangements must be made with the landowners to ensure that livestock and game animals are moved to areas where they cannot be injured by vehicles traversing the area.
- No boundary fence must be opened without the landowners' permission.
- All left-over construction material must be removed from site once construction on a land portion is completed.
- No open fires made by the construction teams are allowable during the construction phase.

Residual Impacts:

The residual impact from the construction and operation of the Harmony Central solar PV facility is considered medium.

Cumulative Impacts:

Any additional infrastructure development in support of the Harmony Central solar PV facility, will result in additional areas where grazing veld will be disturbed.

Impact: Soil erosion

Nature: All areas where vegetation is removed from the soil surface in preparation for the infrastructure construction, will result in exposed soil surfaces that will be prone to erosion. Both wind and water

erosion are a risk and even though the project area is in the arid climate, the intensity of single rainstorm may result in soil particles being transported away.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (30)	Low (16)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A

Mitigation:

- Land clearance must only be undertaken immediately prior to construction activities and only within the development footprint;
- Unnecessary land clearance must be avoided;
- Level any remaining soil removed from excavation pits that remained on the surface instead of allowing small stockpiles of soil to remain on the surface.
- Where possible, conduct the construction activities outside of the rainy season.

Residual Impacts:

The residual impact from the construction and operation of the proposed Harmony Central solar PV facility Thermal Facility on the susceptibility to erosion is considered low.

Cumulative Impacts:

Any additional infrastructure development in support of the Harmony Central solar PV facility, will result in additional areas where exposed to soil erosion through wind and water movement.

Impact: Soil compaction

Nature: The clearing and levelling of land for both the thermal plant infrastructure as well as the access road, will result in soil compaction. In the area where access roads will be constructed, topsoil will be removed and the remaining soil material will be deliberately compacted to ensure a stable road surface.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (30)	Low (16)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A

Mitigation:

- Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint;
- Unnecessary land clearance must be avoided;
- Where possible, conduct the construction activities outside of the rainy season; and
- Vehicles and equipment must park in designated parking areas.

Residual Impacts:

The residual impact from the construction and operation of the proposed Harmony Central solar PV facility on soil compaction is considered low.

Cumulative Impacts:

Any additional infrastructure development in support of the Harmony Central solar PV facility, will result in additional areas exposed to soil compaction.

Impact: Soil pollution

Nature: The following construction activities can result in the chemical pollution of the soil:

1. Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the removal of vegetation as part of site preparation.
2. Spills from vehicles transporting workers, equipment, and construction material to and from the construction site.
3. The accidental spills from temporary chemical toilets used by construction workers.
4. The generation of domestic waste by construction workers.
5. Spills from fuel storage tanks during construction.
6. Pollution from concrete mixing.
7. Pollution from road-building materials.
8. Any construction material remaining within the construction area once construction is completed.
9. Containment breaches related to the battery units and any inadvertent chemical exposure therefrom.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	Medium (36)	Low (14)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A

Mitigation:

- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Any waste generated during construction, must be stored into designated containers and removed from the site by the construction teams.
- Any left-over construction materials must be removed from site.
- Ensure battery transport and installation by accredited staff / contractors.
- Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.

Residual Impacts:

The residual impact from the construction and operation of the proposed project will be low to negligible.

Cumulative Impacts:

Any additional infrastructure that will be constructed to strengthen and support the operation of the Harmony Central solar PV facility and where waste is not removed to designated waste sites, will increase the cumulative impacts associated with soil pollution in the area.

Operational phase

Impact: Soil erosion

Nature: The areas where vegetation was cleared, will remain at risk of soil erosion, especially during a rainfall event when runoff from the cleared surfaces will increase the risk of soil erosion in the areas directly surrounding the Harmony Central solar PV facility.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	Medium (30)	Low (16)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A

Mitigation:

- The area around the development footprint must regularly be monitored to detect early signs of soil erosion on-set.
- If soil erosion is detected, the area must be stabilised by the use of geo-textiles and facilitated re-vegetation.

Residual Impacts:

The residual impact from the operation of the proposed Harmony Central solar PV facility on the susceptibility to erosion is considered low.

Cumulative Impacts:

Any additional infrastructure that will be constructed to strengthen and support the operation of the Harmony Central solar PV facility, will result in additional areas where exposed to soil erosion through wind and water movement.

Impact: Soil pollution

Nature: During the operational phase, potential spills and leaks from maintenance vehicles and equipment as well as waste generation on site, can result in soil pollution. Also, any failure of the fuel storage containers or equipment can be a source of soil pollution.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	Improbable (2)
Significance	Medium (36)	Low (14)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	N/A

Mitigation:

- Maintenance must be undertaken regularly on all vehicles and maintenance machinery to prevent hydrocarbon spills;
- No domestic and other waste must be left at the site and must be transported with the maintenance vehicles to an authorised waste dumping area.
-

Residual Impacts:

The residual impact from the operation of the proposed project will be low to negligible.

Cumulative Impacts:

The operation of any additional infrastructure to strengthen and support the operation of the Harmony Central solar PV facility and where waste is not removed to designated waste sites, will increase the cumulative impacts associated with soil pollution in the area.

2.2. Cumulative Impact Assessment

Assessment of cumulative impact of decrease in areas available for livestock farming

Nature:

Decrease in areas with suitable land capability for cattle farming.

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	Local (1)	Regional (2)
Duration	Short duration - 2-5 years (2)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly likely (4)	Highly likely (4)
Significance	Low (28)	Medium (40)
Status (positive/negative)	Negative	Negative
Reversibility	High	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Confidence in findings:

High.

Mitigation:

The only mitigation measure for this impact is to keep the footprints of all renewable energy facilities as small as possible and to manage the soil quality by avoiding far-reaching soil degradation such as erosion.

Assessment of cumulative impact of areas susceptible to soil erosion

Nature:

Increase in areas susceptible to soil erosion

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	Local (1)	Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	Medium (30)	Medium (33)
Status (positive/negative)	Negative	Negative
Reversibility	Low	Low

Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Confidence in findings: High.		
Mitigation: Each of the projects should adhere to the highest standards for soil erosion prevention and management as defined in Section 11.2.2 above.		
Assessment of cumulative impact of increased risk of soil pollution		
Nature: Increase in areas susceptible to soil pollution		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	Local (1)	Regional (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Medium (30)
Status (positive/negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Confidence in findings: High.		
Mitigation: Each of the projects should adhere to the highest standards for soil pollution prevention and management as defined in Section 11.2.3 above.		

2.3. Conclusion

The soil and agricultural properties and sensitivities of the proposed Harmony Central solar PV facility development was the subject of the Agricultural Agro-Ecosystem Assessment conducted. The study found that the area consists of two different natural soil forms, i.e. Avalon and Bainsvlei, ranging from 0.3m to 0.9m in effective soil depth. The areas with existing soil disturbance, are classified as Technosols.

The largest portion of the development area has land with Moderate (Class 08) land capability that is suitable for dryland crop production. Small areas scattered in between has lower land capability (Class 06 and 07 – Low-Moderate) and higher land capability (Class 09 – High-Moderate). The sensitivity rating of the site was also based on the soil classification of the site as well as the current land use. Approximately 166.3 ha has Medium agricultural sensitivity and 44.4ha has Low sensitivity. The entire development footprint falls on land with Medium sensitivity. The proposed development footprint exceeds the allowable limit with 29.4ha for the areas with Medium sensitivity.

It is anticipated that the construction and operation of the Harmony Central solar PV facility will have impacts that range from medium to low. Through the consistent implementation of the recommendation mitigation measures, most of impacts can all be reduced to low. Since the area around the development footprint will be fenced off, it is not anticipated that the impact on livestock grazing can be mitigated as this area will now be excluded from livestock farming.

Considering that the infrastructure components, including the proposed substation, will be placed in close proximity to each other, all reasonable measures have been taken to avoid or minimize fragmentation and disturbance of agricultural activities, provided that the mitigation measures provided are implemented.

It is the opinion of the specialist that even though the development footprint includes areas with Medium agricultural sensitivity that exceeds the allowable development limits, this application be considered favourably. The area has not been used for crop production since 2014 (according to the land owner) and aerial imagery has confirmed that the area has not been from 2010 onwards. The development is currently used for cattle grazing by the local community and this activity can supplement the income of one to two people's families.

However, the project is considered acceptable permitting that the mitigation measures stipulated in this report are followed to prevent soil erosion and soil pollution and to minimise impacts on the veld quality of the farm portions that will be affected. The project infrastructure should also remain within the proposed footprint boundaries that will be fenced off.

4. HERITAGE IMPACT ASSESSMENT

The development area was thoroughly assessed in the field assessment, as detailed in the Heritage Impact Assessment (refer to **Appendix D3** of the BA Report) (HIA). During the field survey, no heritage and archaeological resources of significance were identified within the development area. Therefore, no impacts to heritage resources are anticipated.

Based on the desktop assessment completed, it was noted that although the area proposed for the development of the Harmony Central Plant Solar PV Facility has been extensively previously disturbed, significant archaeological heritage is known from the broader area and as such, it is possible that the proposed development may negatively impact on similar archaeological heritage.

In terms of palaeontology, the development area is underlain by v e underlain by sediments of moderate fossil sensitivity, consisting of caenozoic regolith. The site visit confirmed that there were no fossils visible on the site and along the route for the grid connection. Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint.

The area proposed for development has been extensively previously disturbed through agriculture and mining infrastructure. The Harmony Central Plant Solar PV Facility is proposed to be located adjacent to the Harmony Central Plant).

The installation of a Solar PV Energy Facility is therefore in keeping with the broader development character of the immediate surroundings which lie on the peri-urban edge of Virginia and the massive Harmony Gold mine nearby to the east. Small nodules of artefact-quality chert rocks, homogenous quartzites as well as high-quality riverine Hornfels and Quartz are present in the project areas in addition to relatively abundant standing water, were likely the resources that attracted groups to the broader region, and resulted in them leaving behavioural traces in the form of stone artefacts. Apart from the isolated Stone Age remains mentioned, there was no evidence of Iron Age archaeology within the footprint. No graves were identified within the survey and visibility was reasonably good for stone structures, although much of the surface sediments were only visible in disturbed contexts. Relevantly, the dense grass cover. was a pertinent constraint to documenting potential graves in the areas that were not disturbed. Agricultural and prospection activities may have removed surficial indicators of sub-surface archaeology such as burials, which needs to be considered in future development implicating excavation.

4.1. Impact Assessment Tables

Nature: It is possible that buried archaeological resources may be impacted by the proposed development in the preferred location		
	Without mitigation	With mitigation
Magnitude	Low (2)	Low (2)
Duration	Permanent (5)	Permanent (5)
Extent	Low (1)	Low (1)
Probability	Very improbable (1)	Very improbable (1)
Significance	Low (16)	Low (8)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	NA	

Mitigation:

- » Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

Residual Impacts:

None

Nature: It is possible that buried palaeontological resources may be impacted by the project in the project area

	Without mitigation	With mitigation
Magnitude	Medium (5)	Medium (5)
Duration	Permanent (5)	Permanent (5)
Extent	Low (1)	Low (1)
Probability	Very improbable (1)	Very improbable (1)
Significance	Low (11)	Low (11)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Yes	

Mitigation:

- » The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities. Should any previously unrecorded palaeontological resources be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

Residual Impacts:

None

4.2. Cumulative Impact Assessment

This application is for the proposed development of a solar energy facility and associated grid connection to facilitate activities at the Central Harmony Gold Plant. The location of the proposed PV facility within an area with existing mining activities may lend itself to cumulative impacts. However, in terms of cumulative impacts to heritage resources, it is preferable that industrial-type infrastructure is clustered within an area in order to prevent the sprawl of industrial development across otherwise sensitive cultural landscapes. As such, it is not anticipated that the proposed development will have a negative cumulative impact on significant heritage resources.

4.3. Conclusion

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. No archaeological resources of scientific cultural value were identified within the area proposed for the Central PV Facility and its grid connection and as such, no impact to significant archaeological heritage resources is anticipated.

Furthermore, no impacts to significant palaeontological heritage is anticipated on condition that the attached. Chance Fossil Finds Process is implemented and no impacts to the cultural landscape are anticipated.

There is no objection to the development of the proposed project, on condition that:

- » The Chance Fossil Finds Procedure must be implemented for the duration of construction activities.

- » Should any previously unrecorded archaeological or palaeontological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward

5. VISUAL IMPACT ASSESSMENT

The proposed development is approximately 11km south-east of central Welkom and 6km north of the town Virginia. The project area is predominately mining development and industrial activities. Other dominant land uses in the project area include the R730 road with predominantly maize and wheat farming in the surrounding area. The area is predominantly characterised as transformed by the Harmony Gold mining activities in the area.

The most prominent (and visible) land use within the region is the mining activities, mining infrastructure and mine dumps. Interspersed with these mining activities are agricultural land uses, ranging from irrigated agriculture to the south-west and broader south and western area. Agricultural activities include the production of maize, wheat and sunflower crops, as well as cattle farming. The farmers working these fields predominantly reside at homesteads or farm residences scattered throughout the study area.

The N1 national road provides access to the region and is the main connecting route in between the Gauteng Province (Pretoria) and Welkom. The proposed PV facility sites is accessible from both the M3 and the R730 via secondary roads.

Besides the large number of mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines. The proposed Harmony One Plant PV facility is located approximately 11.4 km north-west of the Harmony Airfield.



Figure xx: Center of Saaiploas Located 2KM South West of the proposed development

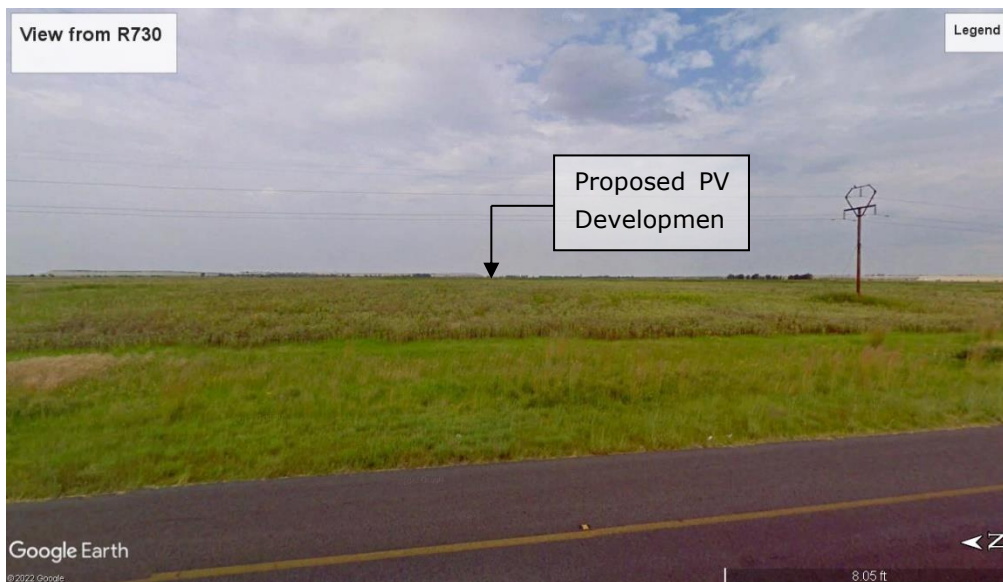


Figure xx: R730 towards Virginia, 4km west of the development



Figure xx: The R730 towards Welkom, 7km North West of the development



Figure 7: The R73 located 2km south of the development



Figure xxx: The R70, 11km north of the development

It is anticipated that visual impacts will result from the activities and infrastructure in all Project phases i.e., construction, operational, and closure. Activities associated with the Project will be visible, to varying degrees from varying distances around the Project site. During the establishment phase, the Project's visibility will be influenced due to the preparatory activities, primarily earthworks and infrastructure establishment. During the operation phase, the visibility of the Project will be the result of the established PV arrays, the substation, and associated powerline infrastructure (grid connections).

Magnitude of the potential visual impact

- » **0 – 1km:** The majority of the exposed areas in this zone fall within the project site, the borders of the adjacent Harmony Central mine and tailings dam, as well as Eskom infrastructure is found within this zone, classified as vacant open space, generally devoid of observers or potential sensitive visual receptors. To the south the boundary properties of the Saaiplaas settlement can also be included in this zone, this section of the town will experience a high visual impact.
- » **1 – 3km:** To the east of the proposed site within the 1 - 3km radius the majority of the exposed area falls within the Harmony Gold mining operations.

The north and majority of the western portion within this radius is characterised by vacant farmland or natural open space, generally devoid of observers or potential sensitive visual receptors. Similarly, the south-western part of the site is a cumulation of Harmony Gold mining operations and vacant farmlands.

It has to be noted that the road and surrounding areas are quite well visually isolated by means of naturally occurring vegetation and previous mining development acting as a shield surrounding the PV facility,

To the south a section of the main road (R73) traverses along the border of the Harmony Gold Central mining operations and travels through the Saaiplaas settlement. Observers travelling along this road will be exposed to the project infrastructure.

Saaiplaas is identified as a potential sensitivity receptor within this zone (to the south-east of the site). The magnitude of the visual impact is expected to be moderate

- » **3 – 6km:** Within a 3 – 6km radius, the visual exposure becomes very scattered and interrupted due to the undulating nature of the topography.

The above-mentioned main road runs completely through this section from west to east. Everything north of this main road within the 3 – 6km radius zone is predominantly vacant farmland or natural open space.

To the south of the R73 the town of Virginia can be identified as a potential sensitivity receptor, the magnitude however is considered to be low in this area.

- » **6 – 10km:** At distances exceeding 6km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer. Sensitive visual receptors are not likely to be visually exposed to the proposed facility, despite lying within the viewshed.

The broader study area is located within the grassland biome characterised by large open grassy plains and wetlands in the lower lying areas. Large tracts of land are utilised for maize production. Depending on the time of the season, or after the harvesting season, these agricultural fields are devoid of any significantly tall or dense vegetation.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is deemed low by virtue of the nature of the vegetation and the low occurrence of urban development. In addition, the scale and form of the structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form, and light / shade characteristics.

Closer to the proposed development site, the occurrence of existing mining is expected to greatly influence the visual exposure of the proposed PV structures and ancillary infrastructure. The existing mining infrastructure is expected to be especially effective in reducing visual exposure to the east and south of the proposed development's location (i.e., along roads and at residence settlements).

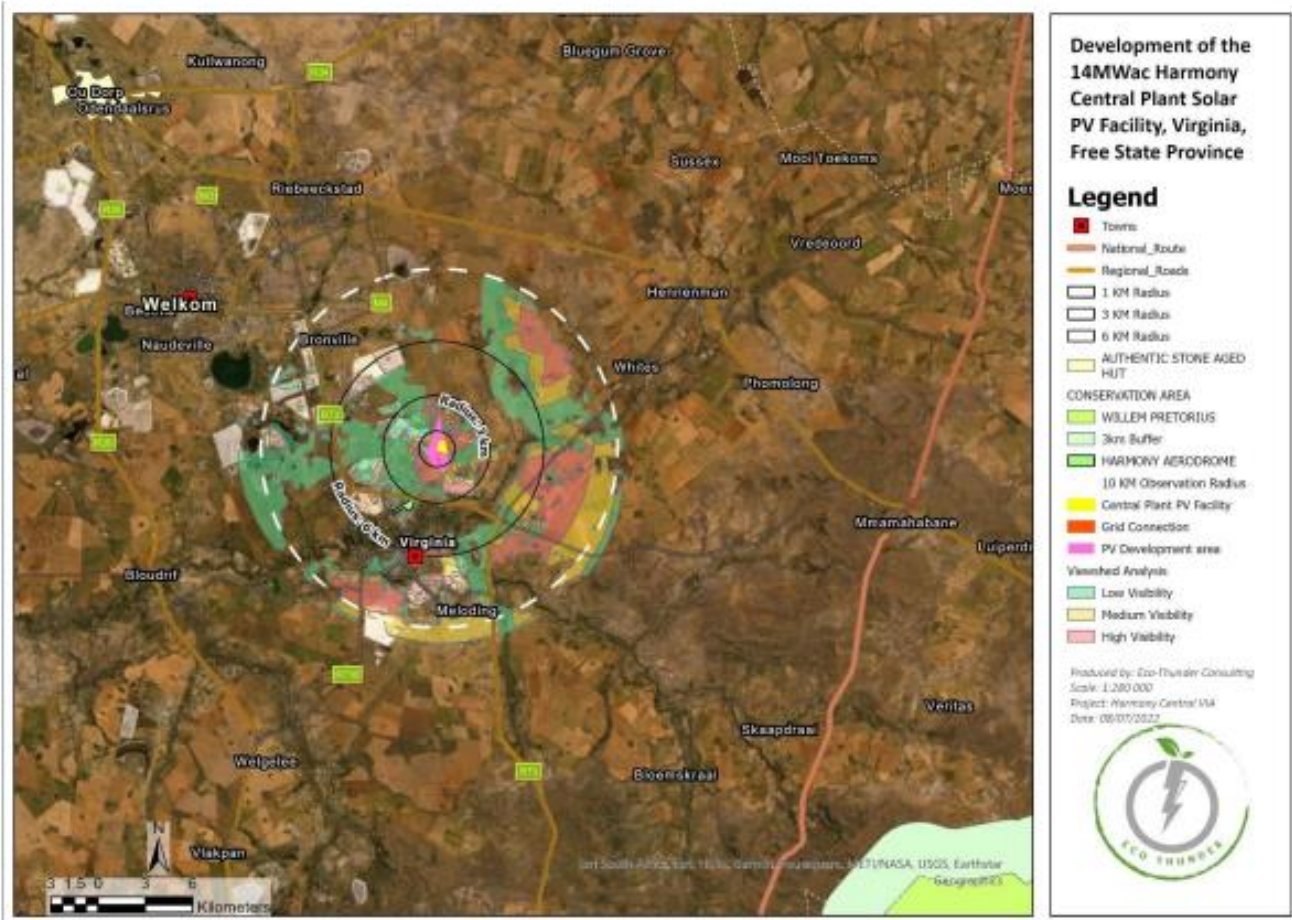


Figure xxx: Viewshed analysis of the proposed Harmony Central Plant Solar PV Facility

5.1. Impact Assessment Tables

Nature: It is possible that buried archaeological resources may be impacted by the proposed development in the preferred location

	Without mitigation	With mitigation
Magnitude	Low (2)	Low (2)
Duration	Permanent (5)	Permanent (5)
Extent	Low (1)	Low (1)
Probability	Very improbable (1)	Very improbable (1)
Significance	Low (16)	Low (8)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	NA	

Mitigation:

- » Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

Residual Impacts:

None

Nature: It is possible that buried palaeontological resources may be impacted by the project in the project area

	Without mitigation	With mitigation
Magnitude	Medium (5)	Medium (5)
Duration	Permanent (5)	Permanent (5)
Extent	Low (1)	Low (1)
Probability	Very improbable (1)	Very improbable (1)
Significance	Low (11)	Low (11)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Not likely	Not likely
Can impacts be mitigated?	Yes	
Mitigation:		
» The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities. Should any previously unrecorded palaeontological resources be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.		
Residual Impacts:		
None		

5.2. Cumulative Impact Assessment

This application is for the proposed development of a solar energy facility and associated grid connection to facilitate activities at the Central Harmony Gold Plant. The location of the proposed PV facility within an area with existing mining activities may lend itself to cumulative impacts. However, in terms of cumulative impacts to heritage resources, it is preferable that industrial-type infrastructure is clustered within an area in order to prevent the sprawl of industrial development across otherwise sensitive cultural landscapes. As such, it is not anticipated that the proposed development will have a negative cumulative impact on significant heritage resources.

5.3. Conclusion

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. No archaeological resources of scientific cultural value were identified within the area proposed for the Central PV Facility and its grid connection and as such, no impact to significant archaeological heritage resources is anticipated.

Furthermore, no impacts to significant palaeontological heritage is anticipated on condition that the attached Chance Fossil Finds Process is implemented and no impacts to the cultural landscape are anticipated.

There is no objection to the development of the proposed project, on condition that:

- » The Chance Fossil Finds Procedure must be implemented for the duration of construction activities.
- » Should any previously unrecorded archaeological or palaeontological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward

6. SOCIAL IMPACT ASSESSMENT

Impacts are expected to occur with the development of the Harmony Central Plant Solar PV Facility during the construction, operation and decommissioning phases. Both positive and negative impacts are identified and assessed.

Positive and negative impacts during construction include:

- » Direct employment and skills development.
- » Economic multiplier effects.
- » Safety and security risks.
- » Impacts on daily living and movement patterns.
- » Nuisance impact (noise and dust).

Positive and negative impacts during operation include:

- » Direct employment and skills development.
- » Development of clean, renewable energy infrastructure.
- » Visual and sense of place impacts.

6.1. Impact Assessment Tables

Construction Phase

<i>Nature:</i>			
Employment opportunities and skills development			
Impact description: The creation of employment opportunities and skills development opportunities during the construction phase for the country and local economy			
	Rating	Motivation	Significance
<i>Prior to Enhancement</i>			
Duration	Short-term (1)	The construction period will last for less than one year	Low Positive (30)
Extent	Local – Regional (5)	The impact will occur at a local, regional and national level	
Magnitude	Low (4)	The creation of employment opportunities will assist to an extent in alleviating unemployment levels within the area	
Probability	Probable (3)	Construction of the project will result in the creation of a number of direct and indirect employment opportunities, which will assist in addressing unemployment levels within the area and aid in skills development of communities in the area	

Enhancement measures:

To enhance the local employment, skills development and business opportunities associated with the construction phase, the following measures should be implemented:

- » It is recommended that a local employment policy be adopted to maximise the opportunities made available to the local labour force. Harmony Central Solar PV Facility should make it a requirement for contractors to implement a 'locals first' policy, especially for semi and low skilled job categories.
- » Enhance employment opportunities for the immediate local area, i.e., Metsimaholo Local Municipality. If this is not possible, then the broader focus areas should be considered for sourcing workers.
- » Consideration must be given to women during the recruitment process.
- » It is recommended that realistic local recruitment targets be set for the construction phase.
- » Training and skills development programmes should be initiated prior to the commencement of the construction phase.

Post Enhancement

Duration	Short-term (1)	The construction period will last for less than one year	Medium Positive (55)
Extent	Regional (4)	The impact will occur at a local, regional and national level	
Magnitude	Moderate(6)	The creation of employment opportunities will assist to an extent in alleviating unemployment levels within the area	
Probability	Definite (5)	Construction of the project will result in the creation of a number of direct and indirect employment opportunities, which will assist in addressing unemployment levels within the area and aid in the skills development of communities in the area	

Residual Risks:

Improved pool of skills and experience in the local area

Nature:

Multiplier effects on the local economy

Impact description: **Significance of the impact from the economic multiplier effects from the use of local goods and services**

	Rating	Motivation	Significance
<i>Prior to Enhancement</i>			
Duration	Long-term (4)	Will continue for the duration of the project due to legal obligation to pay taxes.	Medium Positive (36)
Extent	Local – Regional (4)	Will include mostly local and some regional impacts	
Magnitude	Low (4)	Will derive from increased cash flow from wages, local procurement, economic growth, taxes and LED and HRD initiatives.	
Probability	Probable (3)	Will depend on; proportion of local spending by employees, capacity of local enterprises to supply; effectiveness of LED and HRD initiatives, contributions to local government.	

Enhancement measures:

- » **It is recommended that a local procurement policy be adopted by the developer to maximise the benefit to the local economy, where feasible (Metsimaholo Local Municipality).**
- » **Harmony One Plant Solar Pv should develop a database of local companies, specifically Historically Disadvantaged (HD) companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work where applicable.**
- » **Engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers, where feasible.**

Post Enhancement

Duration	Long-term (4)	As for pre-enhancement	Medium Positive (60)
Extent	Local – Regional (4)	SMME capacity building will limit procurement from outside the local municipality	
Magnitude	Low (4)	Mitigation will likely increase intensity of multiplier effects as it will concentrate impact to local area, sustainability of initiatives will also be increased if aligned with other those of other institutions	
Probability	Definite (5)	Increased local employment and procurement as well as skilled SMME's skill enhance likelihood of benefits to local economy	

Residual Risks:

Improved local service sector, growth in local business.

Nature:

Safety and security

Impact description: **Temporary increase in safety and security concerns associated with the influx of people during the construction phase**

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	Short-term (2)	Will be limited to the construction phase which is less than one year.	Low Negative (27)
Extent	Local – Regional (3)	Safety concerns will affect nearby communities.	
Magnitude	Low (4)	Could place the lives of neighboring community members at risk.	
Probability	Probable (3)	Traffic would need to be considered in the area	

Mitigation:

- » Access in and out of the construction area should be strictly controlled by a security company.
- » The appointed EPC contractor must appoint a security company and appropriate security procedures are to be implemented to limit access to the site and surrounding areas.
- » The contractor must ensure that open fires on the site for heating, smoking or cooking are not allowed except in designated areas.
- » The contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff.
- » Have clear rules and regulations for access to the proposed site to control loitering.
- » A comprehensive employee induction programme would cover land access protocols, fire management and road safety must be prepared. A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process

Post Mitigation

Duration	Short-term (2)	As for pre-mitigation	Low Negative (16)
Extent	Local (2)	Safety measures will likely restrict impacts on nearby communities	
Magnitude	Low (4)	Appropriate mitigation will reduce the risk of this project	
Probability	Improbable (2)	As for pre-mitigation	

Residual Risks:

None anticipated.

Nature:

Disruption of daily living and movement patterns

Impact description: **Temporary increase in traffic disruptions and movement patterns during the construction phase**

	Rating	Motivation	Significance
Prior to Mitigation			
Duration	Short-term (2)	Will be limited to the construction phase which is less than one year	Medium Negative (40)
Extent	Local (2)	Will affect road users from nearby communities	
Magnitude	Moderate (6)	Will affect the quality of life of neighboring communities	
Probability	Highly probable (4)	Traffic would need to be considered in the area	

Mitigation:

- » **All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues.**
- » **Heavy vehicles should be inspected regularly to ensure their road safety worthiness.**
- » **Implement penalties for reckless driving for the drivers of heavy vehicles as a way to enforce compliance to traffic rules.**
- » **Avoid heavy vehicle activity during 'peak' hours (when people are driving to and from work).**
- » **The developer and engineering, procurement and construction (EPC) contractors must ensure that any damage / wear and tear caused by construction related traffic to the roads is repaired.**
- » **A comprehensive employee induction programme which covers land access protocols and road safety must be prepared.**

- » **A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.**

Post Mitigation

Duration	Short-term (2)	As for pre-mitigation	Low Negative (16)
Extent	Local (2)	Safety measures will likely restrict impacts on road users	
Magnitude	Low (4)	Appropriate mitigation will reduce the risk of this project	
Probability	Improbable (2)	As for pre-mitigation	

Residual Risks:

None anticipated.

Nature:

Increased pressure on local services/resources

Impact description: **Added pressure on economic and social infrastructure during construction as a result of in-migration of people**

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	Short-term (2)	Influx related pressure on services will start during construction and continue during the operational phase	Medium Negative (30)
Extent	Local (2)	May affect resource management on local district municipal level	
Magnitude	Moderate (6)	Intensify existing service delivery and resource problems and backlogs, especially sewerage and road networks	
Probability	Probable (3)	Population influx will affect the ability of the local municipality to meet increased demand	

Mitigation:

- » **A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.**
- » **Harmony Solar PV Facility should liaise with the MLM to address potential impacts on local services.**

Post Mitigation

Duration	Short-term (2)	As for pre-mitigation	Low Negative (16)
Extent	Local (2)	Safety measures will likely restrict impacts on road users	
Magnitude	Low (4)	Appropriate mitigation will reduce the risk of this project	

Probability	Improbable (2)	As for pre-mitigation	
Residual Risks:			
Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure.			

Nature:
Nuisance impacts (noise & dust)

Impact description: Nuisance impacts in terms of temporary increase in noise and dust, and the wear and tear on private farm roads for access to the site

	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	Short-term (2)	Nuisance impacts will only be limited to the construction phase.	Medium Negative (44)
Extent	Local (1)	This will remain within the project extent from construction activities.	
Magnitude	High (8)	Dust impacts and noise nuisance from construction activities.	
Probability	Highly Probable (4)	Movement of heavy construction vehicles during the construction phase has a potential to create noise, damage to roads and dust.	

Mitigation:

- » **The movement of construction vehicles on the site should be confined to agreed access road/s.**
- » **The movement of heavy vehicles associated with the construction phase should be timed (where possible) to avoid times days of the week, such as weekends, when the volume of traffic travelling along the access roads may be higher.**
- » **Dust suppression measures should be implemented, such as wetting on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.**
- » **All vehicles must be roadworthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.**
- » **A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process**

<i>Post Mitigation</i>			
Duration	Short-term (2)	As for pre-mitigation	Low Negative (18)
Extent	Local (1)	Mitigation measures will assist with increasing the impact.	
Magnitude	Moderate (6)	Appropriate mitigation will reduce the risk of this project	
Probability	Improbable (2)	As for pre-mitigation	

Residual Risks:
None anticipated

Operation Phase

Nature:
Job creation during operation

Impact description: The creation of employment opportunities and skills development opportunities

during the operation phase for the country and local economy			
	Rating	Motivation	Significance
<i>Prior to Enhancement</i>			
Duration	Long term (4)	Project will be operational up to 30years	Medium Positive (33)
Extent	Regional (3)	Any new positions are likely to be filled by persons living in the local municipal area	
Magnitude	Low (4)	It is anticipated that ~10 jobs will be generated during the operation phase. A number of highly skilled personnel may need to be recruited from outside the local municipal area	
Probability	Probable (3)	Employment opportunities will be created during the operation phase	
<i>Enhancement measures:</i>			
<ul style="list-style-type: none"> » It is recommended that a local employment policy is adopted by the developer to maximise the project opportunities being made available to the local community. Enhance employment opportunities for the immediate local area, Metsimaholo Local Municipality, if this is not possible, then the broader focus areas should be considered for sourcing employees. » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible » The developer should establish vocational training programs for the local employees to promote the development of skills 			
<i>Post Enhancement</i>			
Duration	Long-term (4)	As for pre-enhancement	Medium Positive (44)
Extent	Local - regional (3)	As for pre-enhancement	
Magnitude	Low (4)	Mitigation will maximise local job creation	
Probability	High Probable (4)	Mitigation will maximise probability that any local recruitment targets are achieved and local benefits optimised	
<i>Residual Risks:</i>			
Improved pool of skills and experience in the local area			
<i>Nature:</i>			
Development of clean, renewable energy infrastructure			
Impact description: Development of clean, renewable energy infrastructure			
	Rating	Motivation	Significance
<i>Prior to Enhancement</i>			
Duration	Long term (4)	Adding a renewable energy sector to the Fezile Dabi economy may contribute to the diversification of the local economy and provide greater economic stability.	Medium Positive (48)
Extent	Local – Regional - National (4)	The generation of renewable energy will contribute to South Africa's electricity market. Since the off-taker of the power generated by the facility will be Sasol limited (which is currently dependent on Eskom for electricity supply), the proposed development will indirectly relieve the national grid	

Magnitude	Low (4)	The proposed facility will only generate up to 10MW _{ac}	
Probability	Highly Probable (4)	Facility will help contribute to the total carbon emissions associated with non-renewable energy generation	
<i>Enhancement measures:</i>			
None anticipated			
<i>Post Enhancement</i>			
Duration	Long term (4)	As for pre-enhancement	Medium Positive (48)
Extent	National (4)	As for pre-enhancement	
Magnitude	Low (4)	As for pre-enhancement	
Probability	Highly Probable (4)	As for pre-enhancement	
<i>Residual Risks:</i>			
Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming			

<i>Nature:</i>			
Visual impacts and impacts on sense of place			
Impact description: Visual impacts and sense of place impacts associated with the operation phase of the project			
	Rating	Motivation	Significance
<i>Prior to Mitigation</i>			
Duration	Long term (4)	Impact on sense of place relates to the change in the landscape character and visual impact of the proposed solar energy facility	Low Negative (18)
Extent	Local (1)	Dependent on the demographics of the population that resides in the area and their perceptions	
Magnitude	Low (4)	There are industrial/mining operations and formal residential areas located in proximity to the site	
Probability	Improbable (2)	There are no tourist attractions located adjacent to the property and therefore the anticipated impact on the areas visual quality and sense of place is low.	
<i>Mitigation:</i>			
None anticipated			
<i>Post Mitigation</i>			
Duration	N.A. – Mitigation not possible.		N.A. – Mitigation not possible.
Extent	N.A. – Mitigation not possible.		
Magnitude	N.A. – Mitigation not possible.		
Probability	N.A. – Mitigation not possible.		
<i>Residual Risks:</i>			
None anticipated if the visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status			

6.2. Cumulative Impact Assessment

Cumulative impacts have been considered as part of this energy facility has the potential to result in significant positive cumulative impacts and relatively low cumulative impact; specifically with the

establishment of a number of Solar energy facilities in the vicinity of the Local Municipality will create a number of socio-economic opportunities for the area, which in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore, at municipal level, the cumulative impact could be positive and could incentivize operation and maintenance companies to centralize and expand their activities towards education and training.

Nature:

An increase in employment opportunities, skills development and business opportunities with the establishment of more than one solar energy facility

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
<i>Extent</i>	Local -regional (3)	Local-regional (3)
<i>Duration</i>	Long-term (4)	Long-term (4)
<i>Magnitude</i>	Low (4)	Moderate (6)
<i>Probability</i>	Probable (3)	Probable (3)
<i>Significance</i>	Medium (33)	Medium (52)
<i>Status (positive or negative)</i>	Positive	Positive
<i>Reversibility</i>	N/A	N/A
<i>Irreplaceable loss of resources?</i>	N/A	N/A
<i>Can impacts be mitigated?</i>	Yes	Yes

Confidence in findings: **High.**

Mitigation:

The establishment of a number of solar energy facilities in the area does have the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted and local services providers are utilised by the developers to maximise the project opportunities available to the local community.

Nature:

Negative impacts and change to the local economy with an in-migration of labourers, businesses and jobseekers to the area

	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
<i>Extent</i>	Local (1)	Local-regional (3)
<i>Duration</i>	Long-term (4)	Long-term (4)
<i>Magnitude</i>	Minor (2)	Low (4)
<i>Probability</i>	Very improbable (1)	Improbable (2)
<i>Significance</i>	Low (7)	Low (22)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	Yes	
<i>Irreplaceable loss of resources?</i>	No	
<i>Can impacts be mitigated?</i>	Yes	

Confidence in findings: **High.**

Mitigation:

- » **Develop a recruitment policy / process (to be implemented by contractors), which will ensure the sourcing of labour locally, where available.**
- » **Work together with government agencies to ensure that service provision is in line with the development needs of the local area.**
- » **Form joint ventures with community organisations, through Trusts, which can provide local communities with benefits, such as employment opportunities and services.**
- » **Develop and implement a recruitment protocol in consultation with the municipality and local community leaders. Ensure that the procedures for applications for employment are clearly communicated.**

6.3. Conclusion

From a social perspective, it is concluded that the project is supported, but that mitigation measures should be implemented and adhered to. The assessment of the key issues indicated that there are no negative impacts that can be classified as fatal flaws, and which are of such significance that they cannot be successfully mitigated. Positive impacts could be enhanced by implementing appropriate enhancement measures and through careful planning. Based on the social assessment, the following general conclusions and findings can be made:

- » The potential negative social impacts associated with the construction phase are typical of construction related projects and not just focused on the construction of PV facilities and could be reduced with the implementation of the mitigation measures proposed.
- » Employment opportunities will be created in the construction and operation phases and the impact is rated as positive even if only a small number of individuals will benefit in this regard.
- » The proposed project could assist the local economy in creating entrepreneurial development, especially if local businesses could be involved in the provision of general material and services during the construction and operational phases.
- » Capacity building and skills training amongst employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.
- » The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society.

A site visit was undertaken during the Assessment Phase of the SIA. The site visit include primary interviews with key stakeholders and interested and affected parties, this will further be expanded upon during the public participation phase for the basic assessment. The proposed Central Solar PV facility and associated infrastructure is unlikely to result in permanent damaging social impacts.

From a social perspective, it is concluded that the project could be developed subject to the implementation of the recommended mitigation measures, enhancement measures and management actions.