CHAPTER 8:

ASSESSMENT OF ENVIRONMENTAL RISKS AND IMPACTS

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8. ASSESSMENT OF ENVIRONMENTAL RISKS AND IMPACTS

The issues and impacts presented in this chapter have been identified via the environmental *status quo* of the receiving environment (environmental, social and heritage features present on site - as discussed in Chapter 5 of this Scoping Report), a review of environmental impacts from other similar solar projects and input from specialists that form part of the project team. Potential environmental risks/impacts will be confirmed during the EIA.

The main potential risks/impacts that the proposed PV development may pose to the receiving environmental and socio-economic environment is summarised in Figure 8.1.

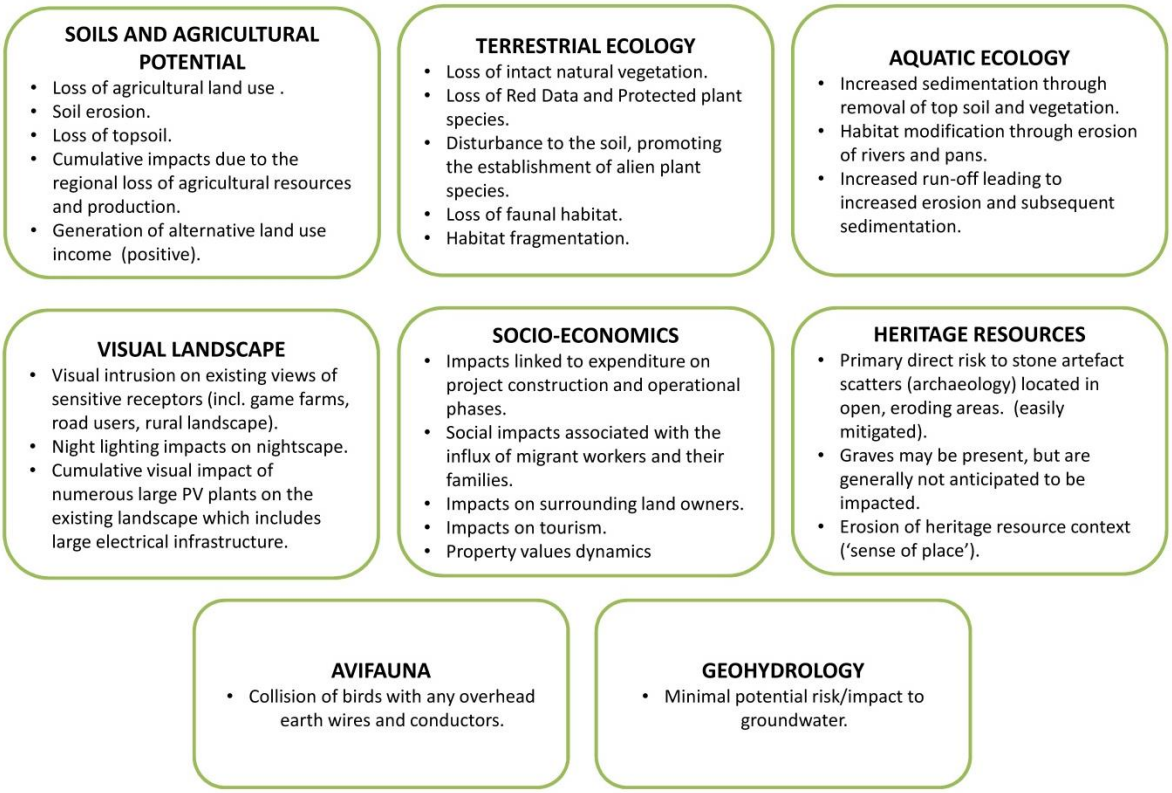

Figure 8.1: Main potential risks/impacts the proposed PV development may pose to the receiving environment, based on Scoping Phase evaluation of existing information.

8.1 Geohydrology[1]

8.1.1 Findings of the Geohydrological Study

An initial site visit was completed by J Conrad (GEOSS) on the 26 December 2015. This was to assess the site and also to prepare for the hydrocensus. Charles Peek (GEOSS) completed the field work and hydrocensus on 16 January 2016. Mr. Peek assessed the sites listed on the NGA and also obtained additional borehole information. According to the NGA search there were four boreholes close to the study site, however these could not be located in the field. The borehole information collected during the hydrocensus in listed in Table 8.1 and Table 8.2. Regarding the borehole naming, "HBH" refers to hydrocensus boreholes. Only two boreholes could be sampled, HBH1 and HBH10. The chemical results are included the Geohydrology Report (Conrad & Peek, 2016) – see Specialist Report Volume. The groundwater from HBH10 is ideal quality whilst the water from HBH1 is of marginal quality.

[1] Conrad & Peek, 2015.

Table 8.1: Hydrocensus results – features and type.

ID	Date	Farm owner	X	Y	Equiped
HBH1	**16/01/2016**	**Fred Euvrard**	**-28.654577**	**25.657494**	**Windpump***
HBH2	16/01/2016	Fred Euvrard	-28.668985	25.649018	Windpump
HBH3	16/01/2016	Fred Euvrard	-28.681997	25.650176	Windpump
HBH4	16/01/2016	Fred Euvrard	-28.669078	25.638569	Windpump
HBH5	16/01/2016	Louis Badenhorst	-28.659372	25.666778	Windpump
HBH6	16/01/2016	Louis Badenhorst	-28.664719	25.698878	Windpump
HBH7	16/01/2016	Louis Badenhorst	-28.664719	25.698878	Diesel pump
HBH8	16/01/2016	Louis Badenhorst	-28.677739	25.695253	Windpump
HBH9	16/01/2016	Louis Badenhorst	-28.677739	25.695253	Diesel pump
HBH10	**16/01/2016**	**Louis Badenhorst**	**-28.680997**	**25.681285**	**Windpump***
HBH11	16/01/2016	Louis Badenhorst	-28.68179	25.677518	Mono-pump (not in use)
HBH12	16/01/2016	Louis Badenhorst	-28.671835	25.688448	Sealed casing
HBH13	16/01/2016	Abrie Deacon	-28.655737	25.697399	Windpump
HBH14	16/01/2016	Abrie Deacon	-	-	Windpump

*Boreholes sampled for the geohydrological study.

Table 8.2: Hydrocensus results – comments.

ID	Total Depth	EC (mS/m)	pH	Use	Comment
HBH1*	**30m**	**-**	**-**	**Sheep**	**Reportedly high yielding used to supply the main farm house. Sample collected.**
HBH2	20m	61.3	8.1	Sheep	No yield data available, owner bought farm after the borehole was drilled. Sample taken.
HBH3	15m	171	7.9	Sheep	No yield data available, owner bought farm after the borehole was drilled.
HBH4	20m	540	7.9	Sheep	No yield data available, owner bought farm after the borehole was drilled.
HBH5	6m	97	8	Wild game	Pumps in to water reservoir. Field chem test.
HBH6	~30m	55	8	Wild game	Pumps in to water reservoir. Field chem test.
HBH7	~30m	-	-	Wild game	2.5 L/s yield, only used when the wind pump is not working to supply animals.
HBH8	20m	-	-	Wild game	Pumps in to water trough. Trough was empty.
HBH9	30m	-	-	Wild game	7.5 L/s yield, only used when the wind pump is not working to supply animals.
HBH10*	**20m**	**60**	**8.6**	**Wild game**	**Pumps in to water reservoir. Field chem test. Sample taken. Yield = 2.5 L/s.**
HBH11	30m	-	-	None	Mono-pump is installed but has no motor. Yield = 6.25 L/s.
HBH12	~30m	-	-	None	The borehole was drilled by the town for water supply. It was too low yielding. Has a reported yield of 2.5 L/s.
HBH13	30m	60	8.1	Cattle	According to the land owner the boreholes have an estimated yield of between 1.5 - 2.0 L/s. they are used to supply water to roughly 50 cattle.
HBH14	30m	-	-	Cattle	According to the land owner the boreholes have an estimated yield of between 1.5 - 2.0 L/s. they are used to supply water to roughly 50 cattle.

*Boreholes sampled for the geohydrological study.

Anecdotal information was also obtained from the land owners and this information assisted with the geohydrological characterisation. The land owners who were consulted were Louis Badenhorst (Palmietfontein 140, Modderpan 750), Fred Euvrard (Brakfontein 2/636, Brakfontein 3/636, Doornhoek RE/ 37, Sterkfontein 4/639) and Abrie Deacon (Cornelia RE/ 1550, Mooihoek RE/ 1551).

Based on the data obtained, groundwater is shallow in places, some boreholes have yield yields and in places the groundwater quality is good. The borehole yields obtained from the field work are included in Figure 8.2**.** Please note these yields are estimates only. These yields are not based on any scientific pumping tests nor do they indicate any sustainability of the indicated yield. The yields are essentially semi-quantitative estimates. The groundwater quality of the boreholes that could be sampled, using EC as an indicator, has been included on Figure 8.3.

8.1.2 Issues, risks and impacts

8.1.2.1 Summary of issues identified during the Scoping Phase

The potential geohydrological issues identified during the scoping phase of this EIA process include:

- The groundwater is relatively shallow in certain parts of the study area
- The boreholes yields are relatively high in places
- The groundwater quality is also good in places.
- The groundwater has a “medium” rating of groundwater vulnerability.

The relevance of the above points is that groundwater is currently used and it is a potential source of water for the project (construction; operation and decommissioning). For these reasons it will require reasonable measures of protection.

The findings above were confirmed by the field work carried out in January 2016. During the site visit consultation was held with Louis Badenhorst; Fred Euvrard and Abrie Deacon. Table 8.3 lists the comments received from the public that pertain to the geohydrology of the site.

Table 8.3: Groundwater-related comments and responses trail. Comments responded to by the appointed specialist, GEOSS.

Comment	Commenter	Response
Are the potential impacts on groundwater going to be addressed?	Jan Louis Badenhorst (Landowner)	This geohydrological study assessed the potential impacts on groundwater. The risk to groundwater is anticipated to be very low if the mitigation measures proposed in this study is implemented“
The scoping report indicates that the proposed project will abstract water from the borehole, therefore the applicant is advised to apply for water authorisation in terms of section 21 of the National Water Act 36 of 1998 (a) taking water from a water source; (b) storing water;	DWS	The applicant is considering the following water sources: • Drilling new boreholes for water abstraction, subject to obtaining a WUL • Existing boreholes to source groundwater • Municipal water • Importing water from other viable sources in the vicinity with trucks If abstraction from existing boreholes is the most feasible option, the application will apply for water authorisation in terms of section 21 of the National Water Act 36 of 1998
Provide proof of agreement that the municipality will supply water to the proposed development and there will be availability of the service to accommodate the proposed project.	DWS	The applicant is considering the following water sources: • Drilling new boreholes for water abstraction, subject to obtaining a WUL • Existing boreholes to source groundwater • Municipal water • Importing water from other viable sources in the vicinity with trucks If abstraction from existing boreholes is the most feasible option, the applicant will receive

Comment	Commenter	Response
		confirmation from the Tokologo Municipality which will be included Environmental Impact Assessment Report
Ensure that ground water use should not cause over abstraction of the aquifers e.g. groundwater level and decrease flows to surface water bodies.	DWS	A geohydrological specialist study during the EIA Phase will outline measures to avoid impact on groundwater resources and proposed mitigation/management actions will be included. These will also be included in the EMPr.
The applicant shall ensure that during construction the equipment and material are kept and stored on a concrete lined surface with bund walls and in such a manner that any spillages can be contained or reclaimed without causing any impact to the environment, ground and surface water resource that will lead water quality to degrade.	DWS	A geohydrological specialist study during the EIA Phase will outline measures to avoid impact on groundwater resources and proposed mitigation/management actions will be included. These will also be included in the EMPr.

8.1.2.2 Sensitivity of the site in relation to proposed activity

There are no geohydrologically sensitive areas and no groundwater dependent ecosystems or springs were located. There are no specific geohydrological areas the proposed structures and infrastructure needs to avoid. If an existing wind pump or borehole is in the way of the planned infrastructure discussions between the client and land owner must be held regarding the replace of the wind pump or borehole that is to be decommissioned.

8.1.2.3 Identification of potential impacts/risks

The following potential impacts (stated in no particular order) of the proposed project activities on groundwater and geohydrological resources are predicted and assessed:

- Potential impact on the groundwater as a result of the construction of storage facilities and temporary labour accommodation during the construction phase
- Potential impact of increased storm water outflows during the construction and operational phase
- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages during the construction, operational and decommissioning phases.

Any construction activities such as the excavation and installation of foundations and piling (narrow diameter holes for foundation purposes) will have no impact on the groundwater of the site or region.

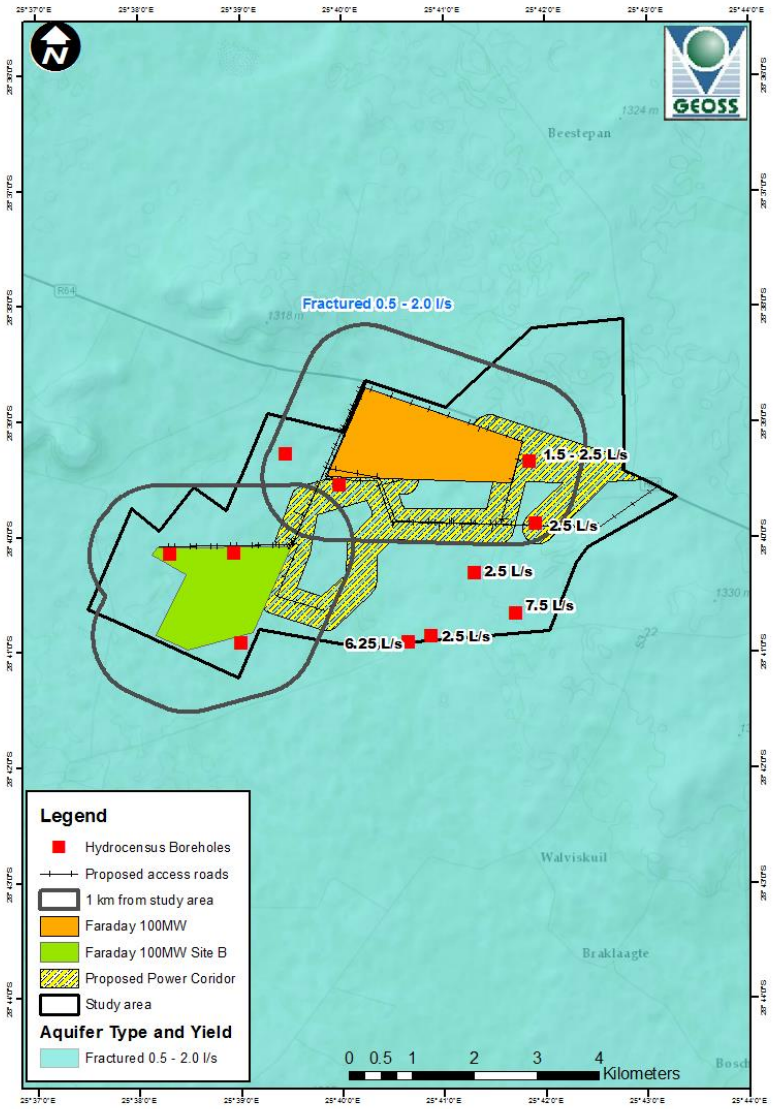

Figure 8.2: Aquifer type and yield (Department of Water Affairs and Forestry groundwater map: 1:500 000 scale 2920 - Prieska)

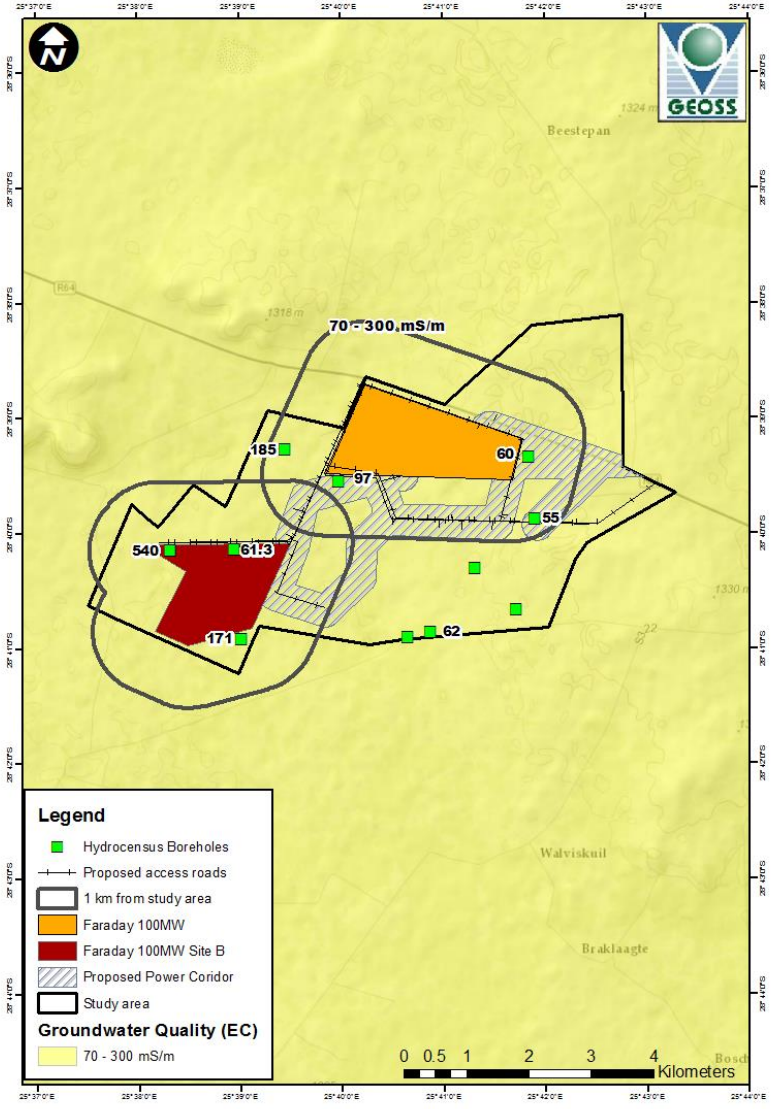

Figure 8.3: Regional groundwater quality (Department of Water Affairs and Forestry groundwater map: 1:500 000 scale 2920 - Prieska)

The potential impacts identified during the EIA Phase are:

Construction Phase

- Potential impact on the groundwater as a result of the construction of storage yards and temporary labour accommodation
- Potential impact of increased storm water outflows
- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.

Operational Phase

- Potential impact of increased storm water outflows.
- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.

Decommissioning Phase

- Potential impact on groundwater quality as a result of accidental oil spillages and fuel leakages.

Cumulative impacts

- If additional groundwater is abstracted for this proposed development there may be a cumulative impact on groundwater.

8.1.3 Impact Assessment

This section describes the potential impacts on the geohydrology of the study area. The project phase (i.e. construction, operation and decommissioning) is associated with each of the impacts. All identified potential impacts to groundwater are direct and no indirect impacts are anticipated.

8.1.3.1 Potential direct impacts during construction phase

Aspect/Activity	**Groundwater/ Construction of storage yards and labour accommodation**
Type of impact	Direct
Potential Impact	Groundwater contamination
Mitigation Required	• During the construction phase all reasonable measures must be taken to prevent soil and groundwater contamination. • The main source of contamination will be from construction vehicles leaking oil or fuel, fuel storage and whilst filling vehicles and machinery. Vehicles must be regularly serviced and maintained to check and ensure there are no leakages. • Any engines that stand in one place for an excessive length of time must have drip trays. • Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. • Construction vehicles and equipment should also be refuelled on an impermeable surface. • A designated area should be established at the construction site camp for this purpose.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Groundwater/ Storm water outflows**
Type of impact	Direct
Potential Impact	Groundwater contamination
Mitigation Required	• Contamination of stormwater must be avoided. This can be done through keeping drainage channels clear of debris and litter. • If any potentially contamination liquids are spilled in the stormwater channels they must be cleaned up.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

8.1.3.2 Potential direct impacts during operation phase

Aspect/Activity	**Groundwater/ Storm water outflows**
Type of impact	Direct
Potential Impact	Groundwater contamination
Mitigation Required	• Contamination of stormwater must be avoided. This can be done through keeping drainage channels clear of debris and litter. • If any potentially contamination liquids are spilled in the stormwater channels they must be cleaned up.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

8.1.3.3 Potential direct impacts during operation phase

Aspect/Activity	**Groundwater/ Storm water outflows**
Type of impact	Direct
Potential Impact	Groundwater contamination
Mitigation Required	• Contamination of stormwater must be avoided. This can be done through keeping drainage channels clear of debris and litter. • If any potentially contamination liquids are spilled in the stormwater channels they must be cleaned up.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

8.1.3.4 Potential direct impacts during all phases

Aspect/Activity	**Groundwater/ Accidental oil spillages or fuel leakages**
Type of impact	Direct
Potential Impact	Groundwater contamination

Mitigation Required	• A precautionary approach must be implemented to prevent oil spillages and fuel leakages from occurring. • During the construction phase, vehicles must be regularly serviced and maintained to check and ensure there are no leakages. • Any engines that stand in one place for an excessive length of time must have drip trays. • Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. • Construction vehicles and equipment should also be refuelled on an impermeable surface. • A designated area should be established at the construction site camp for this purpose. • If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material. • Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

8.1.2.4 Cumulative impacts

Aspect/Activity	**Groundwater/ Over-abstraction**
Type of impact	Direct
Potential Impact	Over-abstraction leading to permanent lowering of groundwater level.
Mitigation Required	• Once the suitability of the groundwater and safe yields of the boreholes are known, water use authorisation will have to be addressed. • Monitoring and management of the boreholes will be required. • The monitoring measures include production and background groundwater level and quality monitoring in conjunction with rainfall measurements and the measurement of the volumes of groundwater abstracted.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	Yes

8.1.4 Legislative and permit requirements

If the project applicant wants to pursue the option of using groundwater a separate study will be required into securing groundwater resources. The abstraction will have to be management on a sustainable basis. Depending on the volume of groundwater that is to be used authorisation will have to be obtained from the Department of Water and Sanitation according to Section 21 (a) and possibly Section 21 (b) of the National Water Act (Act 36 of 1998).

Table 8.4: Geohydrology: Impact Assessment Summary Table – Construction Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Construction of storage and labour accommodation yards	**Groundwater contamination**	Neutral	Site	Short- term	Slight	Extremely unlikely	High	Low	➢ All reasonable measures must be taken to prevent groundwater contamination. ➢ Vehicles must be regularly serviced and maintained. Any engines that stand in one place for an excessive length of time must have drip trays. ➢ Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. ➢ Construction vehicles and equipment should also be refuelled on an impermeable surface.	Low	Very low	5	High
Stormwater outflows	**Groundwater contamination**	Neutral	Site	Short- term	Slight	Extremely unlikely	High	Low	➢ All reasonable measures must be taken to prevent groundwater contamination ➢ Essentially the contamination of stormwater must be avoided. ➢ Keep drainage channels clear of debris and litter. ➢ If any potentially contamination liquids are spilled in the stormwater channels they must be cleaned up.	Low	Very low	5	High
Accidental oil spillage / fuel leakage	**Groundwater contamination**	Neutral	Site	Short -term	Slight	Extremely unlikely	High	Low	➢ Vehicles must be regularly serviced and maintained. ➢ Any engines that stand in one place for an excessive length of time must have drip trays. ➢ Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. ➢ Construction vehicles and equipment should also be refuelled on an impermeable surface.	Low	Very low	5	High

Table 8.5: Geohydrology: Impact Assessment Summary Table – Operation Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATION PHASE DIRECT IMPACTS													
Construction of storage and labour accommodation yards	**Groundwater contamination**	Neutral	Site	Short- term	Slight	Extremely unlikely	High	Low	➢ All reasonable measures must be taken to prevent groundwater contamination. ➢ Vehicles must be regularly serviced and maintained. Any engines that stand in one place for an excessive length of time must have drip trays. ➢ Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. ➢ Construction vehicles and equipment should also be refuelled on an impermeable surface.	Low	Very low	5	High
Stormwater outflows	**Groundwater contamination**	Neutral	Site	Short- term	Slight	Extremely unlikely	High	Low	➢ All reasonable measures must be taken to prevent groundwater contamination ➢ Essentially the contamination of stormwater must be avoided. ➢ Keep drainage channels clear of debris and litter. ➢ If any potentially contamination liquids are spilled in the stormwater channels they must be cleaned up.	Low	Very low	5	High
Accidental oil spillage / fuel leakage	**Groundwater contamination**	Neutral	Site	Short -term	Slight	Extremely unlikely	High	Low	➢ Vehicles must be regularly serviced and maintained. ➢ Any engines that stand in one place for an excessive length of time must have drip trays. ➢ Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. ➢ Construction vehicles and equipment should also be refuelled on an impermeable surface.	Low	Very low	5	High

Table 8.6: Geohydrology: Impact Assessment Summary Table – Decommissioning Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE DIRECT IMPACTS													
Accidental oil spillage / fuel leakage	**Groundwater contamination**	Neutral	Site	Short -term	Slight	Extremely unlikely	High	Low	➢ Vehicles must be regularly serviced and maintained. ➢ Any engines that stand in one place for an excessive length of time must have drip trays. ➢ Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. ➢ Construction vehicles and equipment should also be refuelled on an impermeable surface.	Low	Very low	5	High

Table 8.7: Geohydrology: Impact Assessment Summary Table – Cumulative Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CUMULATIVE IMPACTS													
Groundwater	**Over-abstraction**	Negative	Site	Medium-term	Moderate	Unlikely	Yes	Moderate	➢ Monitoring measures include production and background groundwater level and quality monitoring in conjunction with rainfall measurements and the measurement of the volumes of groundwater abstracted.	Moderate	Low	4	Medium

8.2 Fauna & Flora[2]

8.2.1 Findings of the Fauna and Flora Study

8.2.2.1 Flora

Vegetation associated with the study area was typically karroid and was comprised of a mixed grassland/shrubland. Plant species composition was characteristic of the dryer parts of the country and included hardy dwarf shrubs (chaemophytes) such as *Vahlia capensis* and *Lycium* spp. with leaves arranged as tight clusters along the branches and grasses (hemicryptophtes) on sandy soils and depressions. The substrate was predominantly red sands overlaying calcrete, with occasional calcrete outcrops.

Areas that showed obvious signs of overgrazing, such as the presence of indicator species and exposed substrate, were dominated by shrubs. Overgrazing indicators included *Aristida congesta* and *Stipagrostis uniplumis.* Bushclumps of *Acacia* (*Vachellia*) *karroo* and *Diospyros lycioides* were interspersed across the landscape.

Flora Communities

Vegetation composition showed similarities to the Western Free State Clay Grassland and Vaal-Vet Sandy Grassland described by Mucina and Rutherford (2006). The full list of species recorded on site is presented in Appendix 3 of the Fauna & Flora Report (Digby Wells Environmental, 2016 a) – see Specialist Report Volume.

Much of the Faraday A and B sites was characterised by Calcrete sub-outcrops. There was a distinct change in substrate from calcrete to sandy red soils, however, vegetation composition did not show any obvious changes between these two substrates. This may be attributable to the drought conditions and poor vegetation cover, which hampered accurate delineation of vegetation communities.

Vegetation was relatively monotonous on Faraday B, comprised of a short mixed grassland shrubland. Two ephemeral pans occur on the west and east of the Faraday B site and these ecosystems will be described in detail in the wetland assessment report (Digby Wells, 2016 b). Clumps of monospecific stands of *Diospyros lycioides* subsp*. lycioides* were found in well-drained rocky areas of the site. The mixed grassland/shrubland habitat dominated much of Faraday A, in addition to a *Scirpus dioecious*-dominated seep feeding ephemeral pans, cultivated land and small bushclumps of *Vachellia* (*Acacia) karroo*. Examples of vegetation units associated with the Faraday footprint area are represented in Figure 8.4. Table 8.8 lists the species that were commonly encountered in the dominant habitat on site and examples of plant species recorded are represented in Figure 8.5. Due to disturbance from overgrazing, as well as the timing of field studies in a period of drought, not all plant species that occur on site could be identified.

[2] Digby Wells Environmental, 2016 a

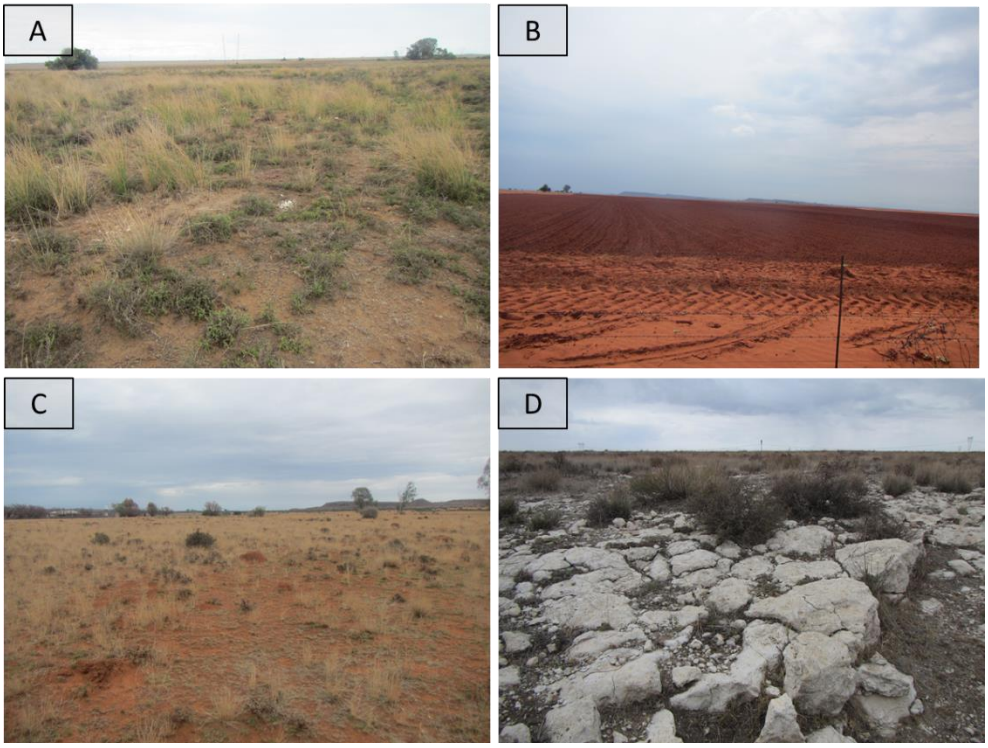

Figure 8.4: Vegetation habitats recorded on the Faraday Solar PV footprint area (A and B)(A: *Scirpus dioecious*-dominated hillslope seep; cultivated land on Faraday A; mixed grassland/shrubland on red soils on Faraday B and calcareous outcrop on the edge of a pan adjacent to a pan)

Table 8.8: Common and characteristic plant species of the *Themeda triandra- Rosenia humilis* mixed shrubland/grassland

Scientific Name	Common Name	Scientific Name	Common Name
Nidorella microcephala	Nidorella	***Eragrostis curvula***	Curved Lovegrass
Pentzia incana	Karoo Bush	***Eragrostis racemosa***	Narrow Heart Lovegrass
Rosenia humilis	Hartbeeskaroo	***Stipagrostis uniplumis***	Blinkbeesgras
Berkheya oppositifolia		***Themeda triandra***	Red Grass
Diospyros lycioides subsp. lycioides	Bluebush	***Trichoneura grandiglumis***	Rolling Grass
Erica thodei	Erica	***Lycium horridum***	Kriedoring
Acacia (Vachellia) karoo	Sweet Thorn	***Prosopis glandulosa***[A]	Honey Mesquite[A]
Acrotome inflata	Tumbleweed	***Zygophyllum lichtensteinianum***	
Aristida stipitata	Buffalo Grass		

Key: [A] denotes alien plant species

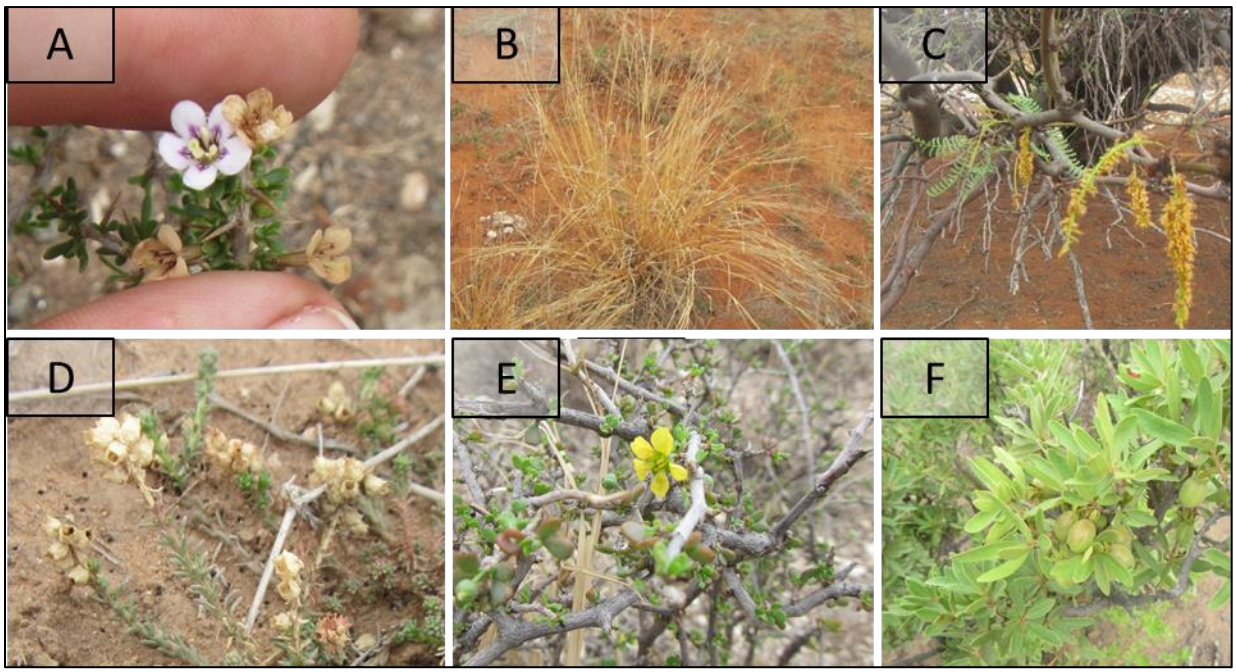

Figure 8.5: Examples of plant species recorded in the mixed shrubland/grassland in the Faraday footprint area (A: *Lycium horridum*; B: *Aristida stipitata*; C: *Prosopis glandulosa*; D: *Erica thodei*; E: *Zygophyllum lichtensteinianum* and *Diospyros lycioides* subsp. *lycioides*)

Species of Special Concern

A single Red Data listed species has been recorded in the QDS 2825AD, namely: *Pentzia oppositifolia* (Rare). Although a *Pentzia* species was recorded on site (*Pentzia incana*), this species was not listed as Red Data. No Red Data species were recorded on the Marconi Solar PV footprint area, however, a provincially protected species, *Brunsvigia radulosa*, was recorded on the boundary of Doornhoek RE 37. This species is listed as protected under the Free State Natura Conservation Ordinance (No. 8 of 1969) and it may occur within the footprint area (Figure 8.6).

Figure 8.6: *Brunsvigia radulosa* (Candelabra Flower), found within the Marconi footprint area.

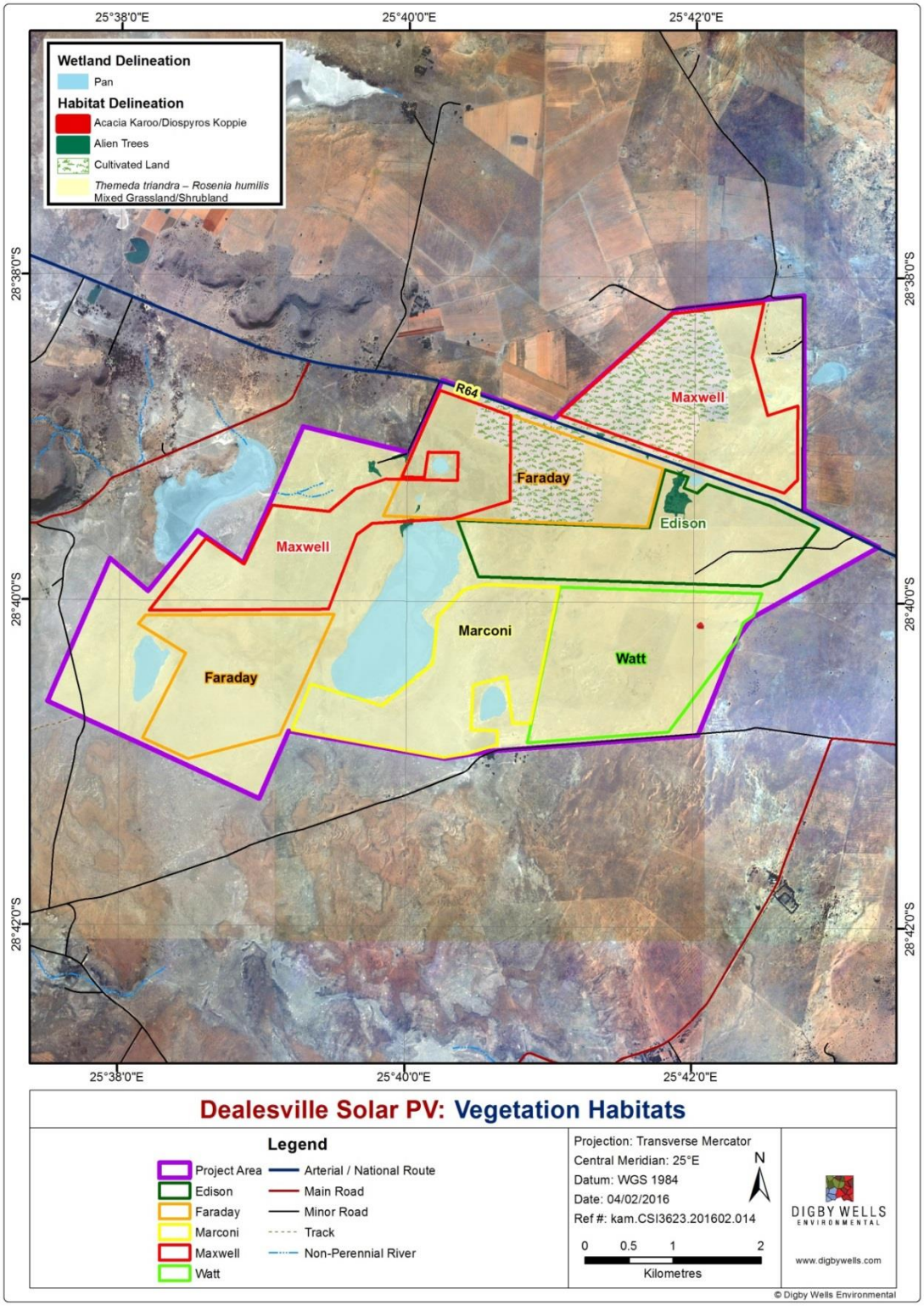

Figure 8.7: Vegetation communities classified for the study area.

Ethnobotanical Species

Ethnobotany is a branch of botany that focuses on the use of plants for medicines and other practical purposes. The use of native plants for ethnobotanical uses can be detrimental to populations that are overexploited.

South Africa has a rich diversity of medicinal plants that not only have a global significance, but also have a cultural and historical role (van Wyk *et al.* 2009). There is a rapidly growing concern for conservation of medicinal plants that are dwindling in number due to illegal harvesting. This is particularly apparent in rural areas where medicinal plants are overexploited by traditional doctors. Two medicinal plant species were recorded in the Faraday Solar PV footprint area, as discussed below:

***Acacia karoo* (Sweet Thorn)**
Bark and leaves used for dysentery and diarrhea. Gum, leaves and bark used as an emolient and astringent for colds, conjunctivitis and hemorrhage. The gum is used for food and taken to treat oral thrush.
Asparagus sp.
Used in traditional medicine to treat tuberculosis, kidney ailments and rheumatism.

Alien Plant Species

Alien plants are considered to be non-native plants that invade formerly pristine environments (Bromilow 2010). Invasions by alien plants cause a change in the composition and functioning of ecosystems and delivery of ecosystem services (Wilgen and de Lange 2011). If alien invasions are not controlled, they exhibit the ability to transform heterogeneous landscapes to homogenous, often dominated by single species or scattered mono-specific clumps, thereby replacing natural vegetation. Further to this, alien bushclumps can alter hydraulic properties, such as infestations of alien trees rendering a water deficit for native plants (Foxcroft 2002). In 2002, the estimated area of alien plant cover in South Africa was 10 million ha, which resulted in an annual water use of 3.3.billion m^3 in excess of natural vegetation (Wilgen and de Lange 2011). Although this is a preliminary estimate, based on desktop studies, it is a good indication of the water losses that incur due to alien plant invasion.

Alien plant species in South Africa have been classified according to NEMBA (No. 10 of 2004), as published in August 2014 (GN R599 in *GG* 37886 of 1 August 2014) into the following categories:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area, and;
- Category 3: Invasive species controlled by activity.

The majority of alien plant species recorded on site were found on the farm Mooihoek RE 1551 (on Faraday A), at the base of a functioning windmill. Further to this, a bushclump of *Eucalyptus camuldulensis* (Red River Gum) was found on the edge of the hillslope seep wetland leading to the ephemeral pans. Roadsides and abandoned farmlands were colonised by alien forbs such as *Conyza* sp. *and Tagetes minuta* (Khakibos). Table 8.9 lists alien plants encountered on site and examples are represented in Figure 8.8.

Table 8.9: Alien plant species recorded in the Faraday PV area.

Family	Species Name	Common Name	Alien Category
Anacardiaceae	*Schinus molle*	Brazilian Pepper Tree	No category
Asteraceae	*Cirsium vulgare*	Scotch Thistle	CARA – 2; NEMBA – 1b
	Conyza sp		No category
	Tagetes minuta	Khakibos	No category
	Xanthium spinosum	Spiny Cocklebur	CARA – 1; NEMBA – 1b
Cactaceae	*Opuntia imbricata*	Imbricate Cactus	No category

Family	Species Name	Common Name	Alien Category
Meliaceae	*Melia azederach*	Syringa	CARA – 3; NEMBA – 1b
Myrtaceae	*Eucalyptus camuldulensis*	Red River Gum	CARA – 2; NEMBA – 1b
Solanaceae	*Datura ferox*	Long-spined Thorn Apple	CARA – 1; NEMBA - 1b
Tamaricaceae	*Tamarix usnioides*	Wild Tamarisk	CARA – 3; NEMBA – 1b

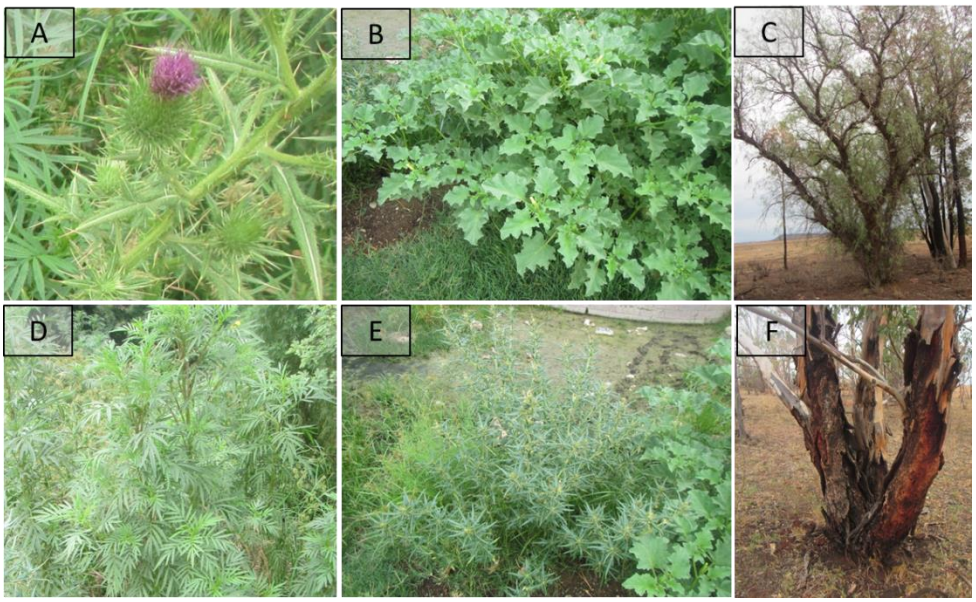

Figure 8.8: Examples of alien plant species recorded in the Faraday footprint area (A: Cirsium vulgare (Scotch Thistle); B: Datura ferox (Long-spined Thorn Apple); C: Schinus molle (Brazilian Pepper Tree); D: Tagetes minuta (Khaibos); E: Xanthium spinosum (Spiny Cocklebur) and F: Eucalyptus camuldulensis (Red River Gum)).

8.2.2.2 Fauna

As described in the flora findings, much of the terrestrial vegetation and habitat within the Faraday Solar PV footprint area has been modified by current and historical land use. It is assumed that these impacts have had a subsequent effect on the fauna species diversity and abundance. The findings of the fauna survey are used as a secondary reflection of the ecosystem health. Low numbers of mammals, reptiles, amphibians and invertebrates were identified within the project area and many of these species are associated with the sensitive habitats described in the following section. Low species counts do not, however, imply that additional species do not occur on site.

Mammals

Actual sightings, spoor, calls, dung and nesting sites, as well as active sampling by means of motion detection cameras and Sherman traps, were used to establish the presence of mammals on the Faraday proposed project site. The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys. The observations of Mr. L. Badenhorst, the owner of the Palmietfontein RE 140 and Modderpan RE 750 properties and Mr Fred Euvrard owner of the Brakfontein 3/ 636 and 2/ 636, Doornhoek RE 37 and Sterkfontein 4/ 639 properties all of which border on or are in close proximity of the proposed Faraday project site, were used to supplement the findings of the mammal survey. Table 8.10 lists mammals that were observed in the Faraday Dealesville solar project area during this survey. The full list of species recorded on site is presented in Appendix 3 of the Fauna & Flora Report (Digby Wells Environmental, 2016 a) – see Specialist Report Volume.

Table 8.10: Mammal species recorded in the study area.

Scientific Name	Common Name	IUCN (2015.4	NEMBA TOPS List (2007)	Transvaal Nature Conservation Ordinance (1983)
Orycteropus afer*	Aardvark	Least concern	Protected	
Proteles cristata*	Aardwolf	Least concern		Protected
Otocyon megalotis*	Bat-eared fox	Least concern	Protected	Protected
Canis mesomelas*	Black-backed jackal	Least concern		
Vulpes chama*	Cape fox	Least concern	Protected	
Lepus capensis*	Cape hare	Least concern		
Hystrix africaeaustralis*	Cape porcupine	Least concern		
Xerus inauris*	Ground Squirrel	Least concern		
Pedetes capensis*	Springhare	Least concern		
Raphicerus campestris*	Steenbok	Least concern	Protected	Protected
Phacochoerus africanus*	Warthog	Least concern		
Cynictis penicillata*	Yellow Mongoose	Least concern		

*-recorded on Faraday PV Be

Of the 124 species of mammals that could possibly be present within the study are, according to desktop information, only 12 species were actually recorded. This is an indication of the effect that the current land use in conjunction with the current drought conditions have.

None of the 17 mammal species are regarded as species of special concern according to the IUCN (IUCN 2015.4), however, five species are protected according to the NEMBA TOPS list (2007), and these are Aardvark (*Orycteropus afer*), Bat-eared Fox (*Otocyon megalotis)*, Blesbuck *(Damaliscus pygargus phillipsi)*, Cape fox *(Vulpes chama*) and Steenbok (*Raphicerus campestris*). In addition the Transvaal ordinance identifies three species as protected, the Bat-eared fox (*Otocyon megalotis*) the Aardwolf (*Proteles cristata*) and the Steenbok (*Raphicerus campestris*).

Aardvarks are found in sub-Saharan Africa, where suitable habitat (savannas, grasslands, woodlands and bushland) and food (i.e., ants and termites) is available. The Bat-eared fox is predominantly an insectivore that uses its large ears to locate its prey. Eight (80) to 90% of their diet is harvester termites (*Hodotermes mossambicus).* Blesbok can be found in open veld or plains of South Africa. Their preferred habitat is open grassland with water. They often occupy relatively small territories of 1 to 2 ha in size. The Cape Fox inhabits mainly open country, from open grassland plains with scattered thickets to arid to semi desert scrub. The Cape fox is nocturnal and most active just before dawn or after dusk; it can be spotted during the early mornings and early evenings (Smithers, 1983). They are solitary creatures, and although they form mated pairs, the males and females are often found alone, as they tend to forage separately (Skinner & Chimimba, 2005). Steenbok live in a variety of habitats from semi-desert, such as the edge of the Kalahari Desert and Etosha National Park, to open woodland and thickets, including open plains, stony savannah, and Acacia–grassland mosaics (Smithers, 1983). They are said to favour unstable or transitional habitats. Steenbok typically browse on low-level vegetation (they cannot reach above 0.9 m), but are also adept at scraping up roots and tubers.

Of the 124 species of mammals that could possibly be present within the study area, according to desktop information, only 17 species were actually recorded. This is an indication of the effect that the current land use in conjunction with the current drought conditions have.

Mammal species identified are depicted in Figure 8.9, many of these species are cryptic and nocturnal and could only be recorded by means of motion sensitive cameras.

Figure 8.9: A: Aardvark (*Orycteropus afer*), B: Aardwolf (*Proteles cristata*), C: Bat-eared fox (*Otocyon megalotis*) and D: Steenbok (*Raphicerus campestris*), Cape fox (*Vulpes chama), F: (*Cape hare *Lepus capensis),* G: Cape porcupine (*Hystrix africaeaustralis)* and Yellow Mongoose (*Cynictis penicillata*). Photos courtesy of Trevor Hardaker (2009)

Herpetofauna

The full list of species recorded on site is presented in Appendix 6 of the Fauna & Flora Report (Digby Wells Environmental, 2016 a) – see Specialist Report Volume. According to Du Preez and Carruthers (2009), frogs occur throughout every habitat within Southern Africa. A number of factors influence their distribution, and they are generally restricted to the habitat type they prefer, especially in their choice of breeding site. The choices available of these habitats coincide with different biomes, these biomes in turn, are distinguished by means of biotic and abiotic features prevalent within them. Therefore a collection of amphibians associated with the Grassland Biome will all choose to breed under the prevailing biotic and abiotic features present. Further niche differentiation is encountered by means of geographic location within the biome, this differentiation includes, banks of pans, open

water, inundated grasses, reed beds, trees, rivers and open ground, all of which are present within the area of interest.

No amphibians were encountered during this field survey even though active searching and pitfall traps, were deployed. The expected amphibian species for the area are listed in the Fauna & Flora Report (Digby Wells Environmental, 2016 a) – see Specialist Report Volume and totalled eight species. The absence of amphibian species is thought to be because of the current drought.

Of the 28 reptile species that could occur in the area of interest only four species were recorded. These species are listed below in Table 8. 11. None of the recorded species are protected according to the IUCN (2015.4), similarly no species are protected according to TOPS list (2007), however all four species are protected according to the Transvaal ordinance (1983). The implication of this is that if these species are encountered they should be removed by qualified personnel and not killed.

Table 8. 11: Reptile species recorded in the study area

Scientific Name	Common Name	IUCN (2015.4)	NEMBA TOPS List (2007)	Transvaal Nature Conservation Ordinance (1983)
Bitis arietans	Puffadder	Least concern	-	Protected
Naja nivea	The Cape Cobra	Least concern	-	Protected
Masticophis taeniatus	Striped Whipsnake	Least concern	-	Protected
Stigmochelys pardalis	Mountain/Leopard Tortoise	Least concern	-	Protected

The reptile species encountered are depicted in Figure 8.10, two of these species pose a danger to humans and livestock, the Puffadder and Cape Cobra, these species were however not reported as being problamatic by the landowner. The Leopard tortoise was found to be specifically affected by the electrical fencing around the farms, the electrical fencing is designed to deter predators from entering the properties, but it has the dualeffect of elctricuting slow moving species such as the Leopard Tortoise.

Figure 8.10: A: Striped whip snake (*Masticophis taeniatus),* B: The Cape cobra (*Naja nivea),* C: Puffadder (*Bitis arietans),* D: Mountain/Leopard Tortoise (*Stigmochelys pardalis)* Photos courtesy of Trevor Hardaker (2009)

Invertebrates

During the wet season survey, invertebrates were recorded using butterfly nets and opportunistic observations and photographed where possible. In support of this, transects were walked along the roads, vegetation types, and grassland areas in order to identify any scorpion or spider nests. Butterflies are a good indication of the habitats available in a specific area (Woodhall, 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall, 2005).

Dung beetles play an important role in agriculture. By burying and consuming dung, they improve nutrient recycling and soil structure. They also protect livestock, such as cattle, by removing the dung which, if left, could provide habitat for pests such as flies. Therefore, many countries have introduced the creatures for the benefit of animal husbandry. Dung beetles *(Scarabeus sp)* were located throughout the property and wherever cattle faeces were evident. These beetles eat dung excreted by herbivores and omnivores, and prefer that produced by the former. Many of them also feed on mushrooms and decaying leaves and fruits. All the species belong to the superfamily *Scarabaeoidea*, most of them to the subfamilies Scarabaeinae and Aphodiinae of the family Scarabaeidae (scarab beetles).

The diversity and density of the invertebrates was relatively low for the proposed Faraday footprint area and surroundings, however this in general could assist in providing an indication of the health of the regional ecology. Although agriculture and livestock has modified the immediate area, there is sufficient habitat that still remains to sustain moderate populations of the typical karroid grassland species of fauna. The invertebrates recorded are listed in Table 8. 12. As expected the prevalence of dung beetles indicated a steady supply of food and shelter to them, largely because of the livestock farming practices that produce much of the dung, essential for their survival.

On the Faraday PV project are a substantial number of Harvester Termites were encountered. The diet of *Hodotermes mossambicus* consists primarily of ripe and/or frost- or drought-killed grass, though tree and shrub material is consumed to a lesser degree. Harvester termites in general, form the main component in the diet of the diurnal Bat-eared fox, Aardvark and the Aardwolf. The large number of these invertebrates creates a stable food source the Aardwolf, Aardvark and Bat eared fox and these animals were recorded during the field survey.

Table 8. 12: Invertebrates recorded in the study area.

Scientific Name/Family	Common Name	IUCN (2015.4	NEMBA TOPS List (2007)	Transvaal Ordinance
Carabidae	Ground Beetles	None	None	None
Scarabaeinae	Dung Beetles	None	None	None
Termitidae/ Hodotermes *mossambicus*	Harvester Termites	None	None	None
Cerambycidae	Long Horn Beetles	None	None	None
Lycosidae	Wolf Spider	None	None	None

The invertebrates recorded are depicted in Figure 8.11, the termites and Dung beetles performing an especially important ecological function of nutrient cycling, and at least the termites being an important food source for certain mammal species.

Figure 8.11: A: Ground Beetle, B: Wolf Spider, C: Dung Beetle, D: Termites

8.2.2 Issues, risks and impacts

8.2.1.1 Summary of issues identified during the Scoping Phase

The potential impacts of the proposed Solar PV facility were assessed for the scoping phase, prior to field investigations and the details of potential impacts are highlighted in this section. The establishment of solar PV facilities results in the rapid alteration of large areas of habitat. For the proposed Faraday Solar PV footprint area, 240 - 300 ha of vegetation will have to be cleared. Further to this, additional area will be disturbed for the establishment of the onsite buildings and electrical infrastructure. The following impacts were listed in the Scoping Flora and Fauna Report (Digby Wells, 2015 a):

- Loss of intact natural vegetation;
- Loss of Red Data and Protected plant and animal species;
- Disturbance to the soil, promoting the establishment of alien plant species;
- Loss of faunal habitat, and
- Habitat fragmentation.

No formal consultation was carried out specifically for the purposes of the fauna and flora impact assessment as all studies were covered by the integrated PPP. The CSIR conducted a joint PPP for all five proposed PV developments. The comments received that are of relevance to ecology (incl. faun & flora, aquatic ecology, wetlands, and avifauna) are indicated in Table 8.13

Table 8.13: Ecology-related comments and responses trail. Comments responded to by the appointed specialist, Digby Wells Environmental.

Comment	Commenter	Response
Violation of the environment/nature.	Anna Jacobs (Neighbouring landowner)	Thank you for your comment, the classification of the environment in to sensitive areas/species have taken place during the specialist study, this resulted in no plant species of special concern (protected) being encountered, protected bird species were encountered and sensitive landscapes were encountered. Appropriate mitigation measures have been suggested to minimise any effect on the sensitive/protected areas and species.
Vegetation	Jan Louis Badenhorst (Landowner)	Thank you for your comment, the classification of the environment in to sensitive areas/species have taken place during the specialist study, this resulted in no plant species of special concern (protected) being encountered, protected bird species were encountered and sensitive landscapes were encountered. Appropriate mitigation measures have been suggested to minimise any effect on the sensitive/protected areas and species.
Cumulative effect on ecology	Jack Amour (Freestate Agri)	Thank you for your comment. The cumulative effect of the Dealesville developments and surrounds have been taken into account and the most important impacts are loss of vegetation and habitat types, currently there are no mitigation measures to alleviate this impact, as it is a definite if the project goes ahead.
What are the impacts on biodiversity in the Dealesville environment?	Gerhard v Rhun (Neighbouring landowner)	Thank you for your comment, the classification of the environment in to sensitive areas/species have taken place during the specialist study, this resulted in no plant species of special concern (protected) being encountered, protected bird species were encountered and sensitive landscapes were encountered. Appropriate mitigation measures have been suggested to minimise any effect on the sensitive/protected areas and species.

8.2.2.2 Sensitivity of the site in relation to proposed activity

Following features are assessed to determine how sensitive the habitat identified within the site is:

- Presence or absence of Red Data or protected plant and animal species;
- Presence or absence of exceptional species diversity;
- Extent of intact habitat in good ecological condition in the absence of disturbance;
- Presence or absence of important ecosystems such as Important Bird Areas (IBA's), Protected Areas, areas demarcated for future protected area status (NPAES) and wetlands.

The Faraday Solar PV footprint area has undergone a moderate degree of disturbance due to overstocking of livestock and disturbance to the soil. Much of Faraday A has been cultivated. Since the site does not fall within any areas of regional ecological importance, any protected areas or areas earmarked for future protected areas status, it does not represent significant high conservation value. Further to this, no Red Data or protected plant or animal species were recorded in the Faraday Solar PV area. The ephemeral pans located on site, however, are very sensitive and the buffer specific buffer requirements to avoid these features have been prescribed in the wetland assessment report (Digby Wells, 2016 b).

The sensitivity map is represented in Figure 8.12 and shows that ephemeral pans have been assigned a high ecological sensitivity. Low sensitivity was assigned to cultivated (or formerly cultivated) areas and the remainder of the site was assigned a moderate sensitivity. No buffer zones have been indicated on this map, please refer to the Digby Wells Wetlands Specialist assessment 2016 for this information.

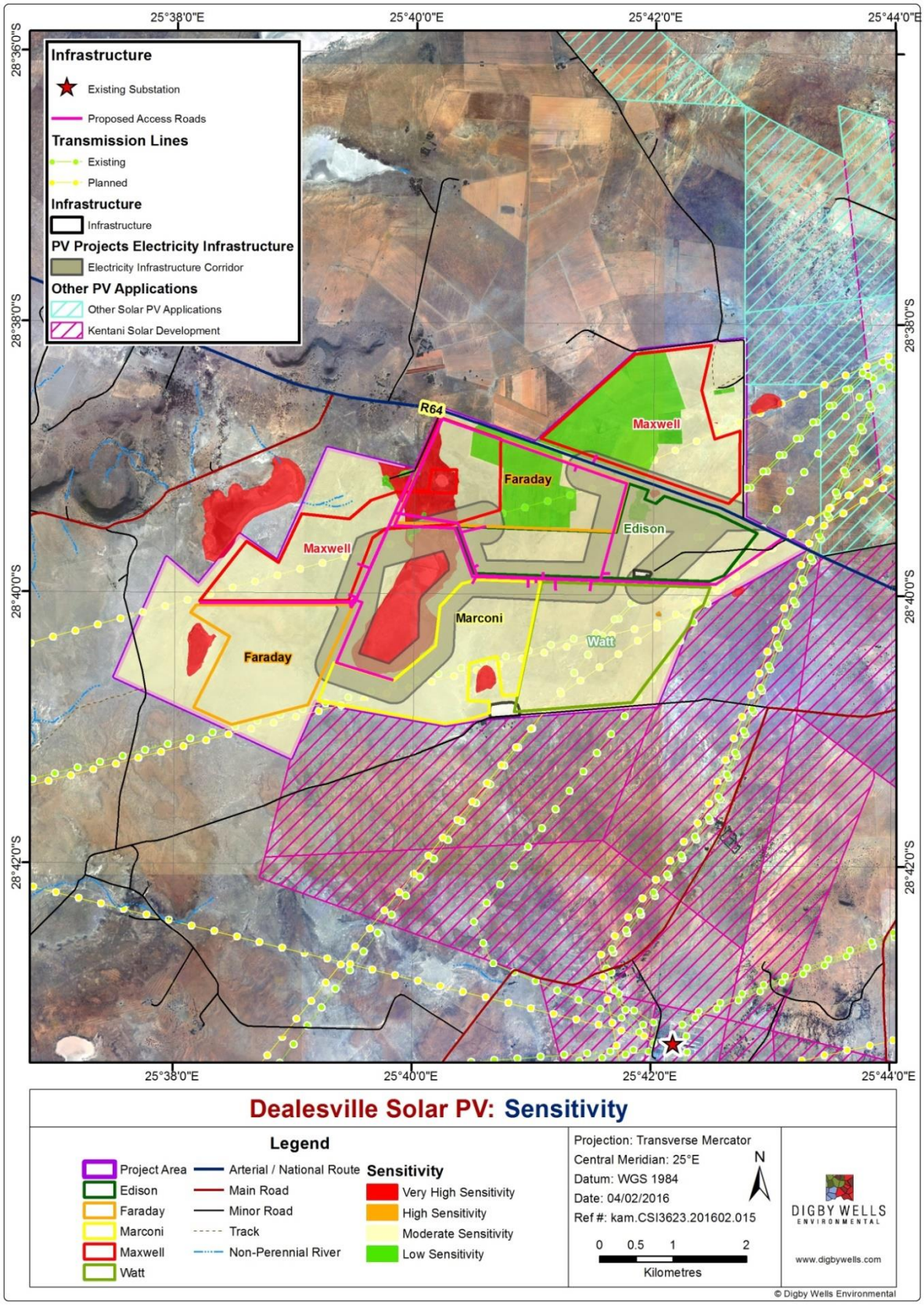

Figure 8.12: Ecological sensitivity of the area proposed for the 29 Solar Dealesville Development.

8.2.2.3 Identification of potential impacts/risks

The aim of the Impact Assessment is to strive to avoid damage or loss of ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate these impacts. Offsets to compensate for loss of habitat are regarded as a last resort, after all efforts have been made to avoid, reduce and mitigate.

The potential development will result in the loss of 240 - 290 ha of natural habitat and 10 ha of disturbed habitat. Since the ephemeral pan is located outside of the footprint area, no direct habitat loss of this very sensitive area will be lost.

Construction Phase

- Loss of plant species associated with the mixed grassland/shrubland; and
- Loss of fauna diversity due to habitat destruction.

Operational Phase

The operational phase will result in the following impact:

- Habitat Fragmentation

Ecosystem function is the measure of the combined functioning of the vegetation and associated species, faunal habitats and wetlands, all of which result in the ecosystem health. The construction of the Solar PV facility will affect the ecosystem function in two main ways. The first is the fragmentation of the ecosystem, which will occur with large land surface changes. Fragmentation occurs conjointly with edge-effects, which change the composition of the ecosystem on the edge of structures such as buildings and roads. The consequence of this is a loss of cohesiveness between larger fragments of habitat which limits the exchange of genes and resources across them. The habitat associated with the footprint area is linked to the regional vegetation types: Vaal-vet Sandy Grassland and Western Free State Clay Grassland and the loss of this habitat will add to the cumulative loss of these units.

- Soil Disturbance Resulting in the Spread of Alien Plant Species on Site

Alien plant species erode the natural biodiversity of habitat by outcompeting native species. *Eucalyptus camuldulensis* and *Opuntia ficus-indica* are invasive species and further disturbance may result in the establishment of dense monospecific stands of these species surrounding the site.

This can be avoided by applying proper management practices such as monitoring for alien plants after development/construction for between five and seven years on an annual basis. Initially, monitoring should take place every three months for one year after closure and rehabilitation has been completed.

Decommissioning Phase

- Invasion by Alien Plant Species

Alien plant species are prone to invade impacted or disturbed areas where natural vegetation has been removed by construction activities. These plant species outcompete indigenous species by making better use of available resources such as water and space and nutrients, thereby eliminating the indigenous species as completion.

Cumulative Impacts

- Cumulative Loss of Ephemeral Pans, taking into account the Proposed Kentani Development

If the Dealesville development goes ahead, in addition to the adjacent Kentani development, this will result in the cumulative loss of ephemeral pans in the area. Further to this, the project area occurs in an Endangered vegetation type and will contribute to the cumulative loss of the Vaal-vet Sandy Grassland.

8.2.2 Impact Assessment

The following tables describe the various activities associated with the phases of Solar PV development proposed for the project area. Associated with these activities are several impacts, which are described in the section below.

8.2.2.4 Potential direct impacts during construction phase

The construction of various surface infrastructure components will mean the removal, partial or complete of vegetation/habitat types present, mainly resulting in the loss of natural habitat.

Aspect/Activity	**Fauna and Flora/Internal access roads and vehicular activities on site**
Type of impact	Direct
Potential Impact	Internal access roads will be required to access the individual components within the Solar PV Power Plant and electrical infrastructure during the construction and operational phases. Use of existing farm tracks will be maximised, however, in some areas this might require the stripping of existing vegetation. This will entail the partial destruction of moderately sensitive habitat. The impact to ephemeral pans is detailed in the Wetlands Assessment Report (Digby Wells, 2016 b).
Mitigation Required	• Keep the footprint of the disturbed area to the minimum and designated areas only, completely avoid the Very High ecologically sensitive areas depicted in Figure 8.12. Vegetate and irrigate open areas to limit erosion, but take care not to promote erosion by irrigating. • Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines. • Preconstruction walk through of the facility in order to locate species of conservation concern that can be translocated as well as comply with permitting conditions. • Preconstruction environmental induction should be done for all construction staff and visitors on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions and remaining within demarcated construction areas.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation within 3 months of disturbance. Native species should be used for rehabilitation e.g. *Cynodon dactylon, Digitaria eriantha, E. plana, Heteropogon contortus and Themeda triandra.*

Aspect/Activity	**Fauna and Flora/Site preparation**
Type of impact	Direct
Potential Impact	•Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled. •Laydown yards must be situated in previously disturbed areas. •From a fauna perspective five species are protected according to the NEMBA TOPS list (2007), and these are Aardvark (*Orycteropus afer*), Bat-eared fox (*Otocyon megalotis*), Blesbuck (*Damaliscus pygargus phillipsi*), Cape fox (*Vulpes chama*) and Steenbok (*Raphicerus campestris*). In addition the Transvaal ordinance identifies

Aspect/Activity	Fauna and Flora/Site preparation
	three species as protected, the Bat-eared fox (*Otocyon megalotis*) the Aardwolf (*Proteles cristata*) and the Steenbok (*Raphicerus campestris*). Special care must be taken during construction not to harm these animals, if afforded the opportunity these animals will move away.
Mitigation Required	•Keep the footprint of the disturbed area to the minimum and designated areas only and completely avoid no-go and sensitive areas as stipulated by the sensitivity maps. Vegetate and irrigate open areas to limit erosion and dust. •Removal of vegetation during construction and operation must be minimised to reduce the risk of excessive open areas occurring. •Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines and completely avoid no go and sensitive areas as stipulated by the sensitivity maps. •Removal of vegetation must be followed closely by rehabilitation by specialists qualified in this vegetation type's remediation. •The general condition of the veld is currently in a pioneer/sub-climax stage, these are the first stages in succession. Pioneer stage facilitates the emergence of the sub-climax stage by improving growth conditions through decreasing run-off, increasing infiltration and increasing the build-up of organic material. The removal of the vegetation will have a negative impact on the amount of ground cover, biodiversity and soil binding (by plants roots). This will increase the risk and occurrence of soil erosion. The positive impact will be that alien invasive plant species will be removed during the same process. This, however, should be done with caution to prevent the spread of seeds and therefore the plants. •During construction the risk of soil contamination by spills of hazardous materials increases dramatically. Increased water runoff due to removal of vegetation could contaminate water sources with sediment. The contamination of water by hazardous materials is also a real possibility and all possible precautions must be taken to avoid this. •Construction phase activities will increase the local dust levels and noise level, which includes noise and dust from heavy machinery and trucks. The increased traffic of heavy duty vehicles and machinery will pose a threat to animals in the area. Once construction starts these animals will move out of the area, if given the chance, and settle in a more sheltered area. With the removal of the vegetation during construction phase less food items will be available to animals in the area, and the risk of erosion will make the area even less desirable for animals especially the browsing/grazing species. If protected animals, as discussed in this report, are encountered, the environmental manager must be alerted.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	All alien plant species recorded on site should be removed. Control methods are listed in Volume B:EMPr An Alien Vegetation Management Plan must be implemented. And alien plants should be monitored biannually after construction for 5-7 years.

8.2.2.5 Potential indirect impacts during construction phase

Aspect/Activity	Fauna and Flora/Construction of surface infrastructure and preparation
Type of impact	Indirect
Potential Impact	•Fragmentation of the vegetation and habitat types occurs conjointly with edge-effects, which change the composition of the ecosystem on the edge of structures such as buildings and roads. The consequence of this is a loss of cohesiveness between larger fragments of habitat which limits the exchange of genes and resources across them. •The habitat associated with the footprint area is linked to the regional vegetation

Aspect/Activity	Fauna and Flora/Construction of surface infrastructure and preparation
	types: Vaal-vet Sandy Grassland and Western Free State Clay Grassland and the loss of this habitat will add to the cumulative loss of these units.
Mitigation Required	•Site preparation will include the removal of vegetation at the footprint of each mounting structure. Where the terrain is undulating the site will be levelled. Rocks may be removed, as well as tall shrubs and bushes that may be obstacles. Due to the nature of the soil on site and inherently low agricultural capabilities, it is not envisioned that topsoil will be stripped and stockpiled. •From a fauna perspective five species are protected according to the NEMBA TOPS list (2007), and these are Aardvark (*Orycteropus afer*), Bat-eared fox (*Otocyon megalotis*), Blesbuck (*Damaliscus pygargus phillipsi*), Cape fox (*Vulpes chama*) and Steenbok (*Raphicerus campestris*). In addition the Transvaal ordinance identifies three species as protected, the Bat-eared fox (*Otocyon megalotis*) the Aardwolf (*Proteles cristata*) and the Steenbok (*Raphicerus campestris*). Special care must be taken during construction not to harm these animals, if afforded the opportunity these animals will move away.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation.

Aspect/Activity	Fauna and Flora/Soil disturbance resulting in the spread of alien plant species on site
Type of impact	Indirect
Potential Impact	Alien plant species erode the natural biodiversity of habitat by outcompeting native species. *Eucalyptus camuldulensis* and *Opuntia ficus-indica* are invasive species and further disturbance may result in the establishment of dense monospecific stands of these species surrounding the site.
Mitigation Required	• Keep the footprint of the disturbed area to the minimum and designated areas only, completely avoid no-go and sensitive areas as stipulated by the sensitivity maps. • Vegetate and irrigate open areas to limit erosion, but take care not to cause erosion by irrigating. Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. • Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the ridges or drainage lines. This can be avoided by applying proper management practices such as monitoring for alien plants after development for between 5-7 years on an annual basis. Initially, monitoring should take place every three months for one year after closure and rehabilitation.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation. An Alien Vegetation Management Plan must be implemented. And alien plants should be monitored biannually after construction for 5-7 years.

8.2.2.6 Potential direct impacts during operation phase

Aspect/Activity	Fauna and Flora/Access control and fencing
Type of impact	Direct
Potential Impact	•The construction of fences around the property will have a dual effect on the flora and fauna frequenting the area, it will exclude grazing animals (mostly livestock, possibly wild animals) from the property negatively affecting the available graze for these animals, but also allowing vegetation to recover from overgrazing.

Mitigation Required	•Veld management measures will have to be employed. This can be achieved by allowing gaps in fencing for animal species to move between grazing areas, during prescribed times of the year. •Any electric fencing must have a bottom strand not lower that 30 cm to the ground, in order for tortoises and snakes to pass safely.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	An Alien Vegetation Management Plan must be implemented. And alien plants should be monitored biannually after construction for 5-7 years.

Aspect/Activity	**Fauna and Flora/Undertake site remediation**
Type of impact	Direct
Potential Impact	On completion of construction and after all construction equipment has been removed from the site, the site will be rehabilitate where practical.
Mitigation Required	Ensure the use of indigenous, local plant species, and remediation is completed by qualified personnel with the correct equipment in the correct season (wet season).
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	No

8.2.2.7 Potential direct impacts during decommissioning phase

Aspect/Activity	**Fauna and Flora/Disassemble components** The components of the plant will be disassembled and removed. Components will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.
Type of impact	Direct
Potential Impact	Habitat loss
Mitigation Required	•The disassembly of infrastructure may result in impacts to vegetation, as large machinery is needed for removal of the infrastructure components. Of concern here is the destruction of vegetation, creation of favourable habitat for fast growing invasive species and ground compaction. •Also of concern are the possible spillages from construction vehicles. In the event that spillages and leaks do occur, these would impact negatively on vegetation and soil quality. •The demolition of infrastructure may require vehicles making use of non-designated areas; special care must be taken not to destroy rehabilitated areas. All hard surfaces must be removed from site. •All disturbed areas must be rehabilitated. •This activity is considered to be medium in duration as well as site specific in extent with impacts being on site. The severity of the impact was determined to be minor.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	Alien plant monitoring should take place for 2-3 years. All alien plant species should be removed, preferably as juveniles, before they become established and bear seed and flowers.

8.2.2.8 Cumulative impacts

The greater study area has been impacted due to historical livestock and game farming, with much of the site overgrazed. The cumulative effects of the planned Faraday power facility infrastructure and its maintenance, in addition to the effect of other planned and approved solar facilities, will affect the available graze and browse that wild herbivores need for survival. The ecosystem functioning and services that are currently produced in the area could be impaired or reduced in small areas; these include food and shelter for the animals.

The footprint of the proposed Solar PV panels will impact on the ecosystem services and vulnerable habitats such as drainage lines, rocky outcrops and plains. This will be through reduced flow in drainage lines, reduced viability in plant communities due to reduction in area and compromising of habitats due to fencing and keeping out of fauna and pollinators.

The adjacent Kentani development will also result in a large area of habitat loss. This will add to the cumulative loss of Highveld Salt Pan vegetation, unless mitigation and management measures are adhered to. Further to this, the Vaal-vet Sandy Grassland is an Endangered ecosystem and further loss of this habitat will add to the cumulative negative impacts.

8.2.2.9 Legislative and permit requirements

No permits will be required for flora and fauna associated with the study site.

Table 8.14: Fauna and Flora: Impact Assessment Summary Table – Construction Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Internal access roads and vehicular activities on site	**Habitat and species loss**	Negative	Site	Long-term	Moderate	Very likely	Yes (rehabilitation after Construction)	Moderate (endangered vegetation)	Plant and Animal search and rescue (EMPr)	Moderate	Low	4	High
	Exposed soil susceptible to erosion	Negative	Site	Medium-term	Moderate	Likely	Yes (rehabilitation after Construction)	Moderate	Erosion Management Plan (EMPr)	Low	Very low	5	High
Site Preparation	**Habitat and species loss**	Negative	Site	Long-term	Substantial	Very likely	Yes (rehabilitation after Construction)	Moderate (endangered vegetation)	Plant and Animals search and rescue (EMPr)	Moderate	Low	4	High
	Exposed soil susceptible to erosion	Negative	Site	Medium-term	Moderate	Likely	Yes (rehabilitation after Construction)	Moderate	Erosion Management Plan (EMPr)	Low	Very low	5	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONTRUCTION PHASE INDIRECT IMPACTS													
Construction of surface infrastructure and preparation	**Habitat and species loss**	Negative	Site and surroundings	Long-term	Substantial	Very likely	Yes (rehabilitation after Construction)	Moderate (endangered vegetation)	Plant and Animal search and rescue (EMPr)	Moderate	Low	4	High
	Exposed soil susceptible to erosion	Negative	Site and surroundings	Medium-term	Moderate	Likely	Yes (rehabilitation after Construction)	Moderate	Erosion Management Plan (EMPr)	Low	Very low	5	High
Soil disturbance resulting in the spread of alien plant species on site	**Spread of Alien plant species**	Negative	Site and surroundings	Long-term	Moderate	Likely	Yes (rehabilitation after Construction)	Moderate	Alien plant Management Plan (EMPr)	Low	Very low	5	High
	Exposed soil susceptible to erosion	Negative	Site and surroundings	Medium-term	Moderate	Likely	Yes (rehabilitation after Construction)	Moderate	Erosion Management Plan (EMPr)	Low	Very low	5	High

Table 8.15: Fauna and Flora: Impact Assessment Summary Table – Operational Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATIONAL PHASE DIRECT IMPACTS													
Access control and fencing	**Fencing in, or out certain grazers**	Negative	Site	Long-term	Substantial	Very likely	Yes (with mitigation measures)	Moderate (endangered vegetation)	Plant search and rescue (EMPr)	Moderate	Low	4	Medium
	Over or under grazed veld	Negative	Site	Medium-term	Moderate	Likely	Yes (rehabilitation after decommissioning)	Moderate	Erosion Management Plan (EMPr)	Low	Very low	5	High
Undertake site remediation	**Rehabilitation of disturbed areas**	Positive	Site	Medium-term	Moderate	Likely	Yes (rehabilitation after decommissioning)	Moderate	Erosion Management Plan (EMPr)	Low	Very low	5	High

Table 8.16: Fauna and Flora: Impact Assessment Summary Table – Decommissioning Phase Impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE DIRECT IMPACTS													
Disassemble components	**Damage of vegetation and habitat types**	Negative	Site	Short-term	Moderate	Very likely	Yes (with mitigation measures)	Moderate (endangered vegetation)	Plant search and rescue (EMPr)	Moderate	Low	4	Medium

Table 8.17: Fauna and Flora: Impact Assessment Summary Table – Cumulative Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE													
Clearing of vegetation, including Kentani, and the remaining Dealesville projects.	**Habitat and species loss**	Negative	Site	Long-term	Substantial	Very likely	Yes (with mitigation measures)	Moderate (endangered vegetation)	Plant search and rescue (EMPr)	Moderate	Low	4	Medium
	Exposed soil susceptible to erosion	Negative	Site	Medium-term	Moderate	Likely	Yes (with mitigation measures)	Moderate	Erosion Management Plan (EMPr)	Low	Very low	5	High

8.3 Avifauna[3]

8.2.3 Findings of the Avifauna study

The Free State Province has a number of restricted-range species associated with its predominant grassland habitat, these include species such as Southern Bald Ibis (*Geronticus calvus*), Rudd's Lark (*Heteromirafra ruddi*), Botha's Lark (*Spizocorys fringillaris*) and Lesser Kestrel (*Falco naumanni*) and Cape Vulture (*Gyps coprotheres*), all found in high altitude grasslands. Pristine upland wetlands are host to small numbers of Wattled Crane (*Bugeranus carunculatus*), Blue Crane (*Anthropoides paradiseus*), as well as the critically endangered White-winged Flufftail (*Sarothrura ayresi*). The pan systems could harbour the Lesser Flamingo (*Phoenicopterus minor*), Black-winged Pratincole (*Glareola nordmanni*), and the Maccoa Duck (*Oxyura maccoa*) all of which are regarded as Near Threatened according to the IUCN and have been recorded within the project area according to SABAP2. A number of these species could be found to occur within the vicinity of the project area either as a vagrant or permanent breeding species.

The protected species recorded during the field work survey were, the Lanner Falcon (*Falco biarmicus*) VU, Cape Vulture (*Gyps coprotheres*) EN and Secretary Bird (*Sagittarius serpentarius*) VU. The endemic species recorded were Cape Sparrow (*Passer melanurus*), and Near Endemic were, Lark like Bunting (*Emberiza impetuani*) and Eastern Clapper Lark (*Mirafra fasciolata*) (Table 8.18).

Table 8.18: Bird species recorded on the Faraday PV site.

Scientific Name	Common Name	IUCN (2015.4	NEMBA (2007)	Transvaal Nature Conservation Ordinance 1983
Afrotis afraoides	Northern Black Korhaan			Protected
Anthus cinnamomeus	African Pipit			Protected
Bostrychia hagedash	Hadeda Ibis			Protected
Bubo africanus	Spotted Eagle Owl			Protected
Bubulcus ibis	Cattle Egret	Least concern		Protected
Burhinus capensis	Spotted Thicknee			Protected
Buteo buteo	Steppe Buzzard			Protected
Calandrella cinerea	Red Capped Lark			Protected
Cercotrichas coryphaeus	Karoo Scrub Robin	Least concern		Protected
Chrysococcyx caprius	Deidrick Cuckoo			Protected
Circaetus pectoralis	Black-chested Snake Eagle			Protected
Colius striatus	Speckled Mousebird			Protected
Corvus albus	Pied Crow			Protected
Crithagra atrogularis	Black-throated Canary			Protected
Dicrurus adsimilis	Fork-tailed Drongo			Protected
Elanus axillaris	Black-shouldered Kite			Protected
Emberiza impetuani	Lark like Bunting		Near Endemic	Protected
Euplectes progne	Long tailed Widow Bird			Protected
Falco biarmicus	Lanner Falcon	Vulnerable		Protected
Falco naumanni	Lesser Kestrel		Vulnerable	Protected
Falco rupicolus	Rock Kestrel			Protected
Gyps coprotheres	Cape Vulture	Endangered		Protected

[3] Digby Wells Environmental, 2016 d

Scientific Name	Common Name	IUCN (2015.4	NEMBA (2007)	Transvaal Nature Conservation Ordinance 1983
Hirundo rustica	Barn Swallow			Protected
Lanius collaris	Common Fiscal			Protected
Lanius collurio	Red Backed Shrike			Protected
Macronyx capensis	Cape Long Claw			Protected
Melierax canorus	Southern Pale Chanting Goshawk			Protected
Merops apiaster	European Bee-eater			Protected
Mirafra fasciolata	Eastern Clapper Lark		Near Endemic	Protected
Myrmecocichla formicivora	Ant Eating Chat			Protected
Numida meleagris	Helmeted Guineafowl			Protected
Oena capensis	Namaqua Dove			Protected
Ortygospiza fuscocrissa	African Qualfinch			Protected
Passer melanurus	Cape Sparrow		Endemic	Protected
Plegadis falcinellus	Glossy Ibis			Protected
Plocepasser mahali	White Browed Sparrow Weaver			Protected
Pternistis swainsonii	Swainson's Spurfowl			Protected
Sagittarius serpentarius	Secretary Bird	Vulnerable		Protected
Streptopelia capicola	Cape Turtle Dove			Protected
Streptopelia semitorquata	Red-eyed Dove			Protected
Tyto alba	Barn Owl			Protected
Upupa epops	African Hoopoe			Protected
Vanellus armatus	Blacksmith Lapwing			Protected
Vanellus coronatus	Crowned Lapwing			Protected

8.2.4 Issues, risks and impacts

8.3.2.1 Summary of issues identified during the Scoping Phase

The potential impacts of the proposed Faraday Solar PV facility were assessed for the scoping phase, prior to field investigations and the details of potential impacts are highlighted in this section. The establishment of solar PV facilities results in the rapid alteration of large areas of habitat. For the proposed Faraday Solar PV footprint area, 240 - 300 ha of vegetation will have to be cleared. Further to this, additional area will be disturbed for the establishment of the onsite buildings and electrical infrastructure. The following impacts were listed in the Scoping Flora and Fauna Report (Digby Wells, 2016):

- Loss of intact habitat (including micro habitat);
- Loss of Red Data and Protected bird species;
- Collision of birds with electricity infrastructure; and
- Electrocution of birds by electricity infrastructure.

One of the most significant impacts of solar PV facilities is the impact on avifauna. The displacement or exclusion from important habitats of nationally and/or globally threatened, rare, endemic or range-restricted bird species may occur (Birdlife, 2012). The 'lake effect' is a well-documented impact of the Concentrated Solar Power facilities, where birds are attracted to the reflective surfaces of panels and this results in collisions (in a similar way to the windows of buildings).

3.1.1.1 Sensitivity of the site in relation to proposed activity

In terms of ecological sensitivity, the following features are assessed to determine how sensitive the habitat identified within the site is:

- Presence or absence of Red Data or protected bird species;
- Presence or absence of exceptional bird species diversity;
- Extent of intact habitat in good ecological condition in the absence of disturbance;
- Presence or absence of important ecosystems such as Important Bird Areas (IBA's), Protected Areas, areas demarcated for future protected area status (NPAES) and wetlands.

The Faraday PV site does not provide a wide variety of habitats for bird species, the site is uniform and impacted on by farming activities, such as cattle farming. The site does not occur within an IBA, but one does occur approximately 30 km away. The site is therefore deemed not sensitive for avifauna, however due to the close proximity of the IBA and the fact that some larger species have extremely large ranges one cannot discount the possibility of certain species occurring on the site.

Locally the site is not sensitive for avifauna. The only sensitive feature of the environment is the salt pans and wetlands that are found around the greater site. These are seen as sensitive to avifauna due to them being an attractant to many species of birds. In particular waterbirds and the both species of flamingo would be attracted to these pans and wetlands following good rain. The rest of the site is fairly uniform grassland with the occasional small farm dam.

The Faraday Solar PV footprint area has undergone a moderate degree of disturbance due to overstocking of livestock and disturbance to the soil, resulting in the establishment of a large bushclump of alien trees (covering 10 ha). Since the site does not fall within any areas of regional ecological importance, any protected areas or areas earmarked for future protected areas status, it does not represent significant high conservation value. Further to this, four Red Data (IUCN 2015) bird species (Transvaal Nature Conservation Act) were recorded in the Faraday Solar PV area.

The sensitivity map is represented in Figure 8.13 and shows that ephemeral pans have been assigned a high ecological sensitivity. Low sensitivity was assigned to cultivated (or formerly cultivated) areas and the remainder of the site was assigned a moderate sensitivity.

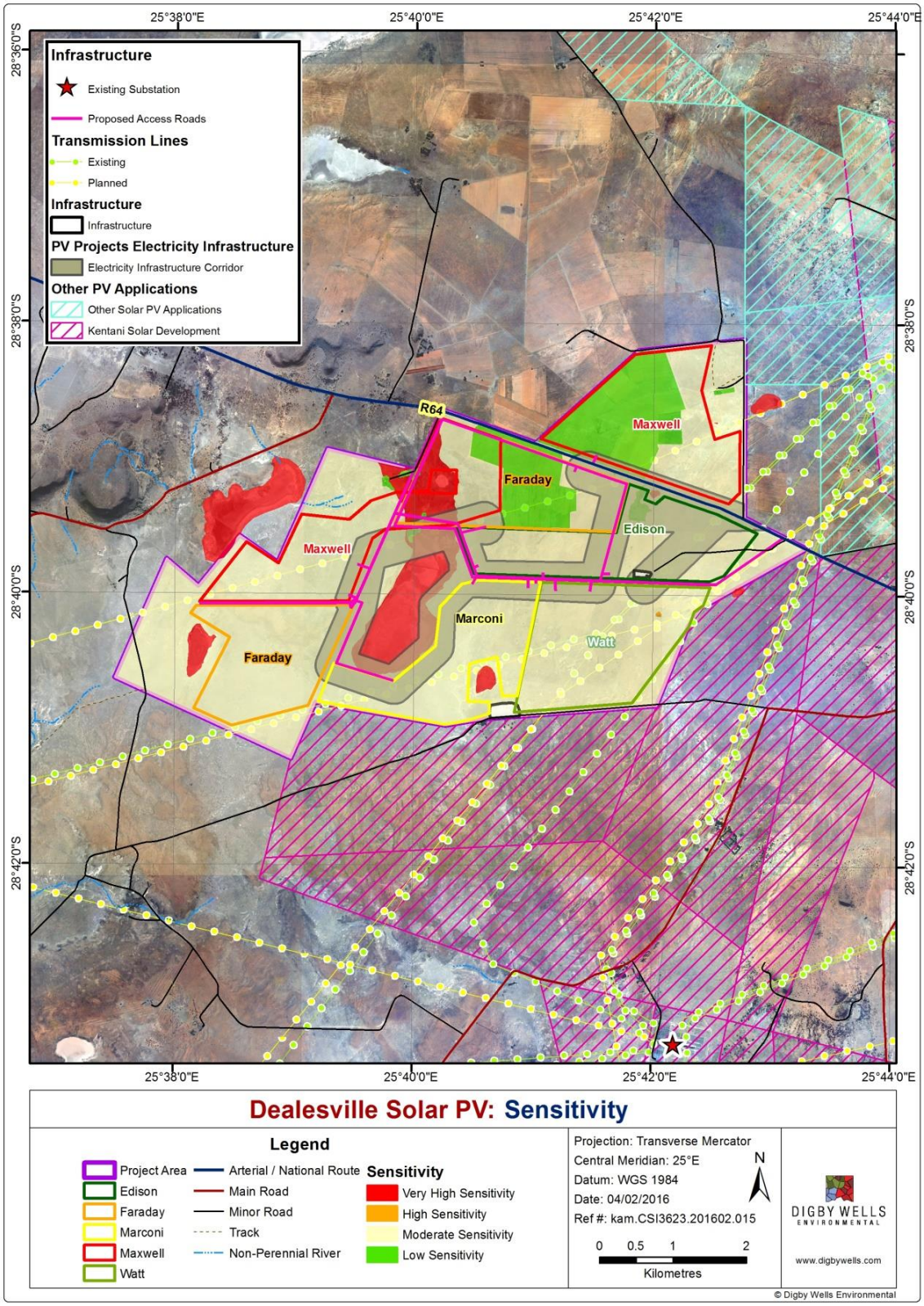

Figure 8.13: Ecological sensitive areas identified for avifauna.

8.3.3.1 Identification of potential impacts/risks

The development may potentially result in the loss of 240 - 290 ha of natural habitat and 10 ha of disturbed habitat. Since the ephemeral pan is located outside of the footprint area, no direct habitat loss of this sensitive area will be lost.

Construction Phase

- Loss of Avifauna diversity due to habitat destruction.

This impact is listed by Birdlife SA as a serious negative factor, it states the impact as "loss of habitat for resident bird species caused by construction, operation and maintenance of PV". Certain preferred habitats found on site will be of more importance to bird species such as drainage lines, wetlands, pans and bushclumps, these areas are therefore designated as sensitive habitats.

As species of conservation concern were recorded during the field survey, mitigation measures are essential to mitigate this impact.

- Loss of avifauna diversity due to disturbance and barrier effects

The disturbance of avifauna during the construction (and thereafter during operation and maintenance) of the facility and associated infrastructure is likely to occur. Disturbance could also contribute to a habitat fragmentation effect during the operational phase of this project, since certain bird species will be displaced from the site, and forced to find alternative territories. This could be particularly relevant for small species whose entire territory may be taken up by the development.

Operational Phase

- Habitat Fragmentation

Ecosystem function is the measure of the combined functioning of the vegetation and associated species, faunal habitats and wetlands, all of which result in the ecosystem health. The construction of the Solar PV facility will affect the ecosystem function in two main ways. The first is the fragmentation of the ecosystem, which will occur with large land surface changes. Fragmentation occurs conjointly with edge-effects, which change the composition of the ecosystem on the edge of structures such as buildings and roads. The consequence of this is a loss of cohesiveness between larger fragments of habitat which limits the exchange of genes and resources across them.

- Collision and electrocution of birds on overhead power line.

Collision and electrocution of birds on the proposed power lines are likely. In the case of electrocution this is relatively easily avoided by designing the power line with a bird friendly structure. All line structures must be used in tandem with the standard Eskom Bird Perch to provide safe perching substrate high above the dangerous hardware. This is particularly important given the recorded occurrence of Cape Vultures *(Gyps coprotheres) and* Spotted Eagle (*Bubo africanus*) owls in the area.

In terms of avifauna colliding with the power lines, this is a significant impact with very likely probability of occurrence. In this receiving environment it is less important at this stage of the project where the proposed power lines run. In general it would be better for them to run adjacent to existing power lines to minimize the impact of collisions. Due to the high number of existing powerlines already in the general area the impact already exists and an additional line will not be of great significance. An option for the developer is to use underground cabling to connect the facility to the grid, this will furthermore mitigate impacts such as collisions or electrocutions. An important mitigation measure for avifauna conservation will be an Avifauna walkthrough which must be performed regardless of the type of construction that will be used. A walk through will inform the exact areas where reflective bird diverters must be installed.

- Electrocution of birds in substations/switching stations

The impact of electrocution of birds at substation and switching stations is of high probability, but is likely to be of low significance, as threatened species are less likely to frequent these areas. It is recommended that mitigation be applied reactively once the site is operational, only if a problem is detected.

- Collision of birds with panels and other infrastructure

Through experience there is a real possibility that birds will collide with the PV panels. This could be during the normal course of their daily activities or when they are attracted to the panels, perhaps mistaking them for water sources, the so called "lake effect". It is important to stress that this impact will probably only become significant when large numbers of birds are in the vicinity of the facility. For this reason, the more sensitive species in terms of this impact are likely to be the gregarious, flocking species which are mostly not threatened species in this study area.

It is recommended that a monitoring program be implemented to collect data on all species deaths. In addition the "lake effect" is cause for concern and would potentially impact water birds and other species attracted to water, such as the two flamingo species that do occur in this area (although fairly far off in the identified IBA). This group of species must be monitored as part of the onsite bird monitoring program when this is implemented.

- Nesting and other use of infrastructure by birds

Nesting, perching and roosting of certain species, such as small raptors and crows on electricity infrastructure poses a threat to maintenance and could be responsible for starting fires. To avoid this, management of these areas must include the clearing of the nests.

Decommissioning Phase
No impacts are expected during this phase.

Cumulative Impacts

- Cumulative Loss of Ephemeral Pans, taking into account the Proposed Kentani Development

If the Dealesville development goes ahead, in addition to the adjacent Kentani development, this will result in the cumulative loss of ephemeral pans and subsequent bird habitat in the area.

8.2.5 Impact Assessment

8.3.3.1 Potential direct impacts during construction phase

Aspect/Activity	**Loss of Avifauna diversity/habitat destruction for site clearing**
Type of impact	Direct
Potential Impact	This impact is listed by Birdlife SA as a serious negative factor, it states the impact as "loss of habitat for resident bird species caused by construction, operation and maintenance of PV". Certain preferred habitats found on site will be of more importance to bird species such as drainage lines, wetlands, pans and bushclumps, these areas are therefore designated as sensitive habitats. As species of conservation concern were recorded during the field survey, mitigation measures are essential to mitigate this impact.

Aspect/Activity	**Loss of Avifauna diversity/habitat destruction for site clearing**
Mitigation Required	• Keep the footprint of the disturbed area to the minimum and designated areas only; • Completely avoid the Very High ecologically sensitive areas. • Vegetate and irrigate open areas to limit erosion, but take care not to promote erosion by irrigating. • Removal of vegetation during construction and operation will be minimised to reduce the risk of excessive open areas occurring. • Adhere to existing roads, and if new roads are constructed, these must not cross sensitive areas such as the pans or drainage lines. • Preconstruction walk through of the facility in order to locate species of conservation concern that can be translocated as well as comply with permitting conditions. • Preconstruction environmental induction should be done for all construction staff and visitors on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions and remaining within demarcated construction areas.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	Removal of vegetation must be followed closely by rehabilitation within 3 months of disturbance. Native species should be used for rehabilitation e.g. *Cynodon dactylon, Digitaria eriantha, Eragrostis plana, Heteropogon contortus and Themeda triandra.*

Aspect/Activity	**Loss of avifauna diversity/disturbance and barrier effects due to establishment of facility**
Type of impact	Direct
Potential Impact	The disturbance of avifauna during the construction (and thereafter during operation and maintenance) of the facility and associated infrastructure is likely to occur. Disturbance could also contribute to a habitat fragmentation effect during the operational phase of this project, since certain bird species will be displaced from the site, and forced to find alternative territories. This could be particularly relevant for small species whose entire territory may be taken up by the development.
Mitigation Required	• Bird fatalities due to this impact will have to be monitored, such a monitoring plan will indicate what species are affected and at what time/season these occur. • The footprint of the construction phase, including laydown yards, roads and buildings must be kept to a minimum. So as to not disturb birds or destroy available habitat.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	Implement an Avifauna monitoring program as per Bird life SA recommendations. All alien plant species recorded on site should be removed. An Alien Vegetation Management Plan must be implemented. And alien plants should be monitored biannually after construction for 5-7 years.

Aspect/Activity	**Fragmentation of avifaunal habitat/Establishment of facility**
Type of impact	Direct
Potential Impact	Ecosystem function is the measure of the combined functioning of the vegetation and associated species, faunal habitats and wetlands, all of which result in the ecosystem health. The construction of the Solar PV facility will affect the ecosystem function in

Aspect/Activity	**Fragmentation of avifaunal habitat/Establishment of facility**
	two main ways. The first is the fragmentation of the ecosystem, which will occur with large land surface changes. Fragmentation occurs conjointly with edge-effects, which change the composition of the ecosystem on the edge of structures such as buildings and roads. The consequence of this is a loss of cohesiveness between larger fragments of habitat which limits the exchange of genes and resources across them.
Mitigation Required	The footprint of the construction phase, including laydown yards, roads and buildings must be kept to a minimum. So as to not disturb birds or destroy available habitat.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	none

8.3.3.2 Potential direct impacts during operation phase

Aspect/Activity	**Bird collisions with powerlines/Established electricity infrastructure**
Type of impact	Direct
Potential Impact	Collision and electrocution of birds on the proposed power lines are likely. In terms of avifauna colliding with the power lines, this is a significant impact with very likely probability of occurrence. In this receiving environment it is less important at this stage of the project where the proposed power lines run. In general it would be better for them to run adjacent to existing power lines to minimise the impact of collisions. Due to the high number of existing powerlines already in the general area the impact already exists and an additional line will not be of great significance. An option for the developer is to use underground cabling to connect the facility to the grid, this will furthermore mitigate impacts such as collisions or electrocutions. An important mitigation measure for avifauna conservation will be an Avifauna walkthrough which must be performed regardless of the type of construction that will be used. A walk through will inform the exact areas where reflective bird diverters must be installed.
Mitigation Required	• In the case of electrocution this is relatively easily avoided by designing the power line with a bird friendly structure. All line structures must be used in tandem with the standard Eskom Bird Perch to provide safe perching substrate high above the dangerous hardware. This is particularly important given the recorded occurrence of Vultures in the area. • Utilize underground cabling as far as possible. • Conduct an Avifauna walkthrough before construction starts. • Install bird reflectors/deflectors
Impact Significance (Pre-Mitigation)	2 (high negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	No

Aspect/Activity	**Electrocution of birds in substations/Established electricity infrastructure**
Type of impact	Direct
Potential Impact	The impact of electrocution of birds at substation and switching stations is of high probability, but is likely to be of low significance, as threatened species are less likely to frequent these areas. It is recommended that mitigation be applied reactively once the site is operational, only if a problem is detected.

Mitigation Required	• Regular maintenance of these facilities to remove nesting sites
Impact Significance (Pre-Mitigation)	2 (high negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	No

Aspect/Activity	**Bird collisions with PV panels and other infrastructure/Established solar facility**
Type of impact	Direct
Potential Impact	Through experience there is a real possibility that birds will collide with the PV panels. This could be during the normal course of their daily activities or when they are attracted to the panels, perhaps mistaking them for water sources, the so called "lake effect". It is important to stress that this impact will probably only become significant when large numbers of birds are in the vicinity of the facility. For this reason, the more sensitive species in terms of this impact are likely to be the gregarious, flocking species which are mostly not threatened species in this study area.
Mitigation Required	• Implement monitoring program
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	No
Conditional Authorisation	No

8.3.3.3 Cumulative impacts

The impacts listed above for this PV project are the exact same impacts for any other PV facility. Therefore the addition of any more will multiply the effect on avifauna.

8.3.4 Legislative and permit requirements

No permits will be required for Avifauna associated with the study site.

Table 8.19: Avifauna: Impact Assessment Summary Table – Construction Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Loss of Avifauna Diversity due to habitat destruction	**Habitat and species loss**	Negative	Local	Long-term	Substantial	Certain	Yes with strict mitigation	Moderate	➢ Keep Disturbance footprint to a minimum. ➢ Practice continual rehabilitation	Moderate	Low	1	High
Loss of Avifauna Diversity due to disturbance and barrier effect	**Species loss**	Negative	Site	Long-term	Substantial	Very likely	Yes with strict mitigation	Moderate	➢ Monitor Bird fatalities. ➢ Keep Disturbance footprint to a minimum	Moderate	Low	2	High
Avifauna habitat fragmentation	**Habitat and species loss**	Negative	Site	Long-term	Substantial	Very likely	Yes with strict mitigation	Moderate	➢ Keep Disturbance footprint to a minimum	Moderate	Low	4	High

Table 8.20: Avifauna: Impact Assessment Summary Table – Operational Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATIONAL PHASE DIRECT IMPACTS													
Collision and electrocution on powerlines	**Species loss**	Negative	Site	Long-term	Moderate	Likely	Yes with strict mitigation	Moderate	➢ Use bird friendly towers ➢ Utilize underground cabling as far as possible. ➢ Conduct an Avifauna walkthrough before construction starts. ➢ Install bird reflectors/deflectors	High	Low	2	High
Electrocutions on substations and switching stations	**Species loss**	Negative	Site	Long-term	Substantial	Very likely	Yes with strict mitigation	Moderate	➢ Regular maintenance	High	Low	3	High
Collision of birds with panels and other infrastructure	**Species loss**	Negative	Site	Long-term	Substantial	Likely	Yes with strict mitigation	Moderate	➢ Implement monitoring program	Moderate	Low	5	High

Table 8.21: Avifauna: Impact Assessment Summary Table – Cumulative Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CUMULATIVE IMPACTS													
Cumulative impact of PV infrastructure	Avifauna habitat and Species loss	Negative	Regional	Long-term	Substantial	Very likely	Yes (rehabilitation after decommissioning)	Low reversibility	➢ Keep Disturbance to designated areas	High	Moderate	4	Medium

8.4 Wetlands[4]

8.4.2 Findings of the Wetlands Study

8.4.4.1 Wetland Delineation

Two HGM units were delineated in associated with the site, namely: pan/depressions and a hillslope seep. Pans are shallow ephemeral systems that are a common feature of the landscape of the general region and generally occur over shales and unconsolidated surficial sandstones in South Africa (Allan *et al.* 1995) (although pans associated with the site were underlain by calcrete). Their formation is dependent on a number of factors, including climate, geological susceptibility, disturbance to the surface via animals, salt-weathering, a lack of integrated drainage systems and deflation processes (Goudie and Thomas 1985). They are inward draining systems and as a result, their catchment is regarded as sensitive.

In South Africa, a belt of pans occur in the dry Northern Cape, the North West, Free State, Gauteng and in the Mpumalanga Provinces. These wetlands are more common in areas of low rainfall (less than 500mm). Pans are important ecological features and play an important role in the maintenance of biodiversity, particularly for avifauna. Wetland bird species often find ephemeral pans directly after first rain events (Simmons *et al.* 1999).

Two ephemeral pans were delineated within Faraday A and these were hydrologically linked to one another, as well as the large oblong pan to the south (Palmietfontein Pan), by a hillslope seep, as represented in Figure 8.14. No wetlands were identified within the Faraday B footprint area, however, this area is bound by an ephemeral pan to the west, referred to as Brakfontein Pan in this report, and the southern portion of Palmietfontein Pan to the east. Palmietfontein Pan covers an approximate area of 155 ha.

The hillslope seep wetland that was delineated that links the three pans is likely to be linked to the watercourse to the north of the site (although the boundaries of wetlands outside of the site were not delineated). The hillslope seep was dominated by sedges *Scirpus dioecious* and *Juncus krausii*, as well as grasses (not all identified due to drought conditions).

8.4.4.2 Terrain Indicator

The landscape of the study area is studied on a desktop level prior to field investigation in order to determine potential wetlands on site. Aspects of elevation and slope are identified and later ground-truthed in the field. Wetlands identified are classified into HGM units based on geomorphology and hydrology.

8.4.2.3 Soil Form Indicator

Two aspects are considered when using soils as wetland indicators, namely, soil form and characteristic hydric soil features. The pans were characterised by hardpan carbonates with shallow to no topsoil. Prieska soils were indicative showing strong calcareous structure and showing prismacutanic features. Typical soil hydric features such as soil mottling and gleyed horizon were absent, which is attributable to the ephemeral nature of the pans. Examples of calcrete outcrops are represented in Figure 8.15.

[4] Digby Wells Environmental, 2016 b

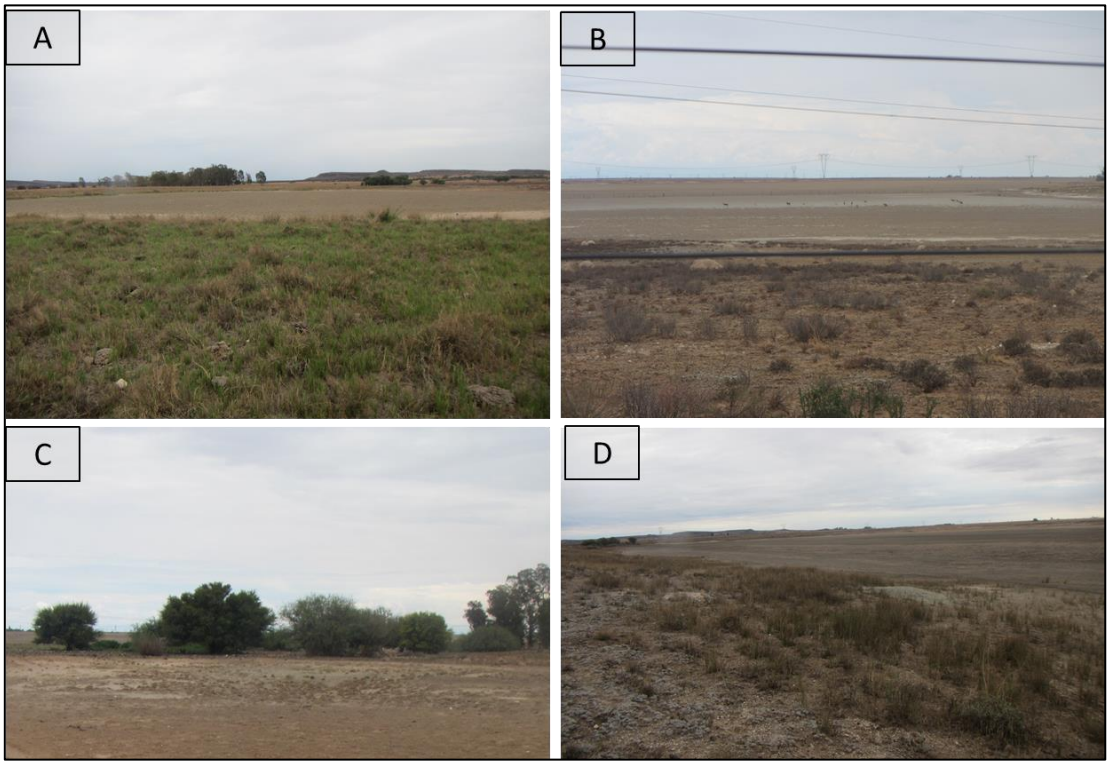

Figure 8.14: Examples of pans associated with the Faraday A and B project area (A: northern Mooihoek Pan; B: Palmietfontein Pan; C: southern Mooihoek Pan and Brakfontien Pan).

Figure 8.15: Examples of the calcrete-dominated substrate associated with pans on site.

8.4.2.4 Vegetation Indicator

A hydrophytic plant community is a vegetation community that is dominated by species that have colonised the wetland areas and have been distributed as a result of hydrological factors such as flow rates, water depth, timing and duration of flooding, sediment accumulation, and underground water exchange. These species have adapted to an inundated environment and are used as indicators of the presence of wetlands according to the specifications of the DWS.

Due to the arid climate of the area and the temporary nature of the pans, not all of the plant species that were used as wetland indicators have been listed as wetland indicators by the DWS and are not all necessarily strictly hydrophytic plants. Hydrophytes can be subdivided into the following:

- Obligate plants – dependant on saturated soil and found in permanent zone of wetlands;
- Facultative plants – adapted to either wet or dry conditions.

Table 8.22 lists the plant species occurring in wetland areas and Figure 8.16 reflects examples of some of these. These species were found primarily on the edges of pans and the pans themselves were largely bare (with exception to some *Selaginella* sp. mats and sparse grasses). *Scirpus dioecious* dominated the hillslope seep, as well as unidentified grasses (due to lack of identifying features at the time of sampling).

Table 8.22: Wetland plant species identified on site.

Species	Common Name	Type of adaptation to inundation
Vachellia (Acacia) karoo	Sweet Thorn	t
Cynodon dactylon	Couch Grass	fw
Deverra aphylla	Wildeseldery	t
Diospyros lycioides subsp. lycioides	Bluebush	t
Gnidia polcephala	Karoo Broom	t
Juncus krausii	Matting Rush	o
Ruschia hamata	Beesvygie	t
Scirpus dioecious		o
Themeda triandra	Red Grass	fw
Ziziphus mucronata	Buffalo Thorn	fw

Key: 'fw' denotes facultative wetland plants; 't' denotes terrestrial plants and 'o' denotes obligate wetland plants

The distribution of the wetlands associated with the Faraday Solar PV area is represented in Figure 8.17. Wetland buffer zones are a requirement to facilitate the protection of delineated wetlands within the project area. The purpose of the establishment of buffer zones is to minimise the anthropogenic impacts associated with the proposed development on the receiving water resources. A buffer zone is defined according to the NWA as: "A strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another." (Macfarlane *et al*. 2014).

A number of explanations have been provided for the establishment of buffer zones, such as:

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

A buffer of 100 m has been placed around the smaller pans, and a buffer of 200 m around the Palmietfontein and Brakfontein Pans associated with the Faraday A and B Solar PV area, which includes the immediate catchment of the pans (Figure 8.17). Although the northern Mooihoek pan has been excluded from Faraday A, the buffers of this wetland and the hillslope seep that contributes flow to this wetland fall within the Faraday A footprint area. The southern pan will be completely removed and the northern boundary of the Palmietfontein Pan impacted on. Although the Brakfontein Pan does not fall within the footprint area for Faraday B, a small area of the buffer will lost.

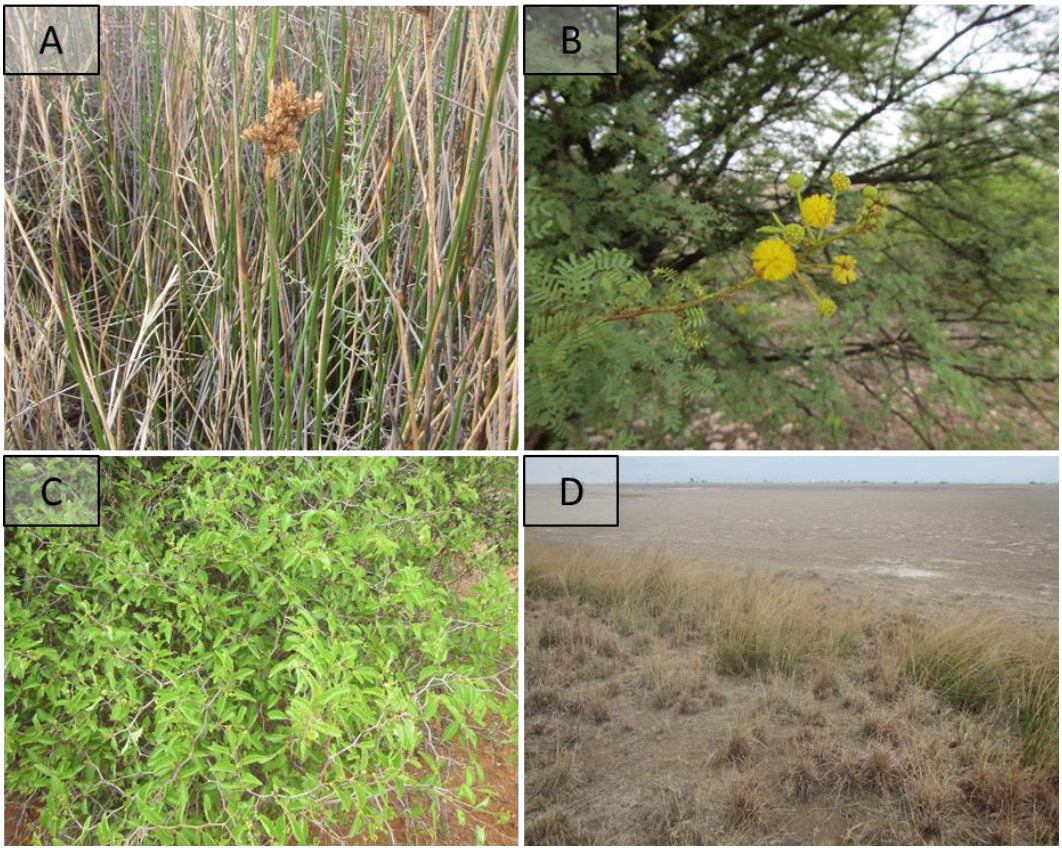

Figure 8.16: Vegetation indicators and plant species found on the edges of ephemeral pans and the hillslope seep associated with Faraday A and B (A: Juncus krausii sedge; B: Vachellia (Acacia) karoo (Sweet Thorn) found common in clay-rich soils of pans; C: Ziziphus mucronata (Buffalo Thorn) and mixed Juncus kraussii and Scirpus dioecious).

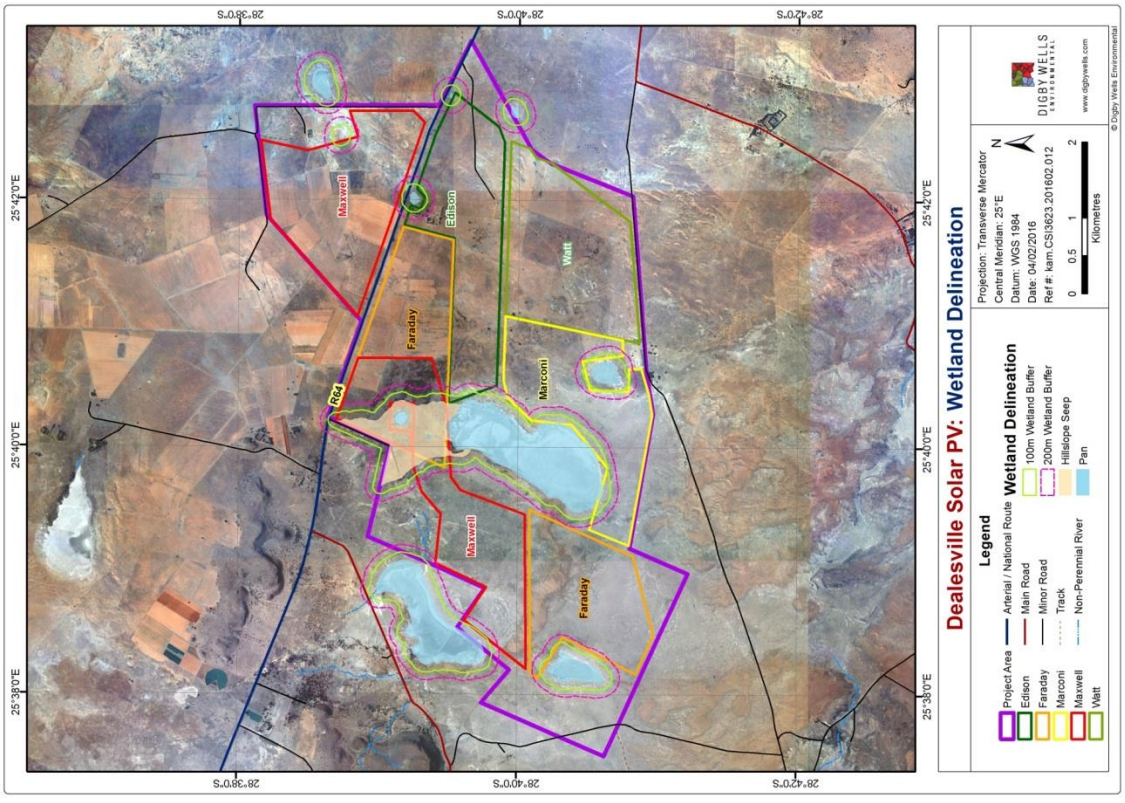

Figure 8.17: Wetland delineation and distribution.

8.4.2.5 Wetland Health Assessment

Vegetation associated with the study site showed signs of overgrazing and pans in particular were largely affected. Cattle paths had formed, which contributed to the formation of erosion gulleys. Alien plant species included large trees of *Eucalyptus camuldulensis* (Red River Gum) clumps that had established within the catchment of Palmietfontein Pan, as well as a small stand of alien forbs in the hillslope seep wetland associated with disturbance from the establishment of a windmill. Alien forbs are listed in the Flora and Fauna Report (Digby Wells Environmental, 2016 a). Large clumps of *E. camuldulensis* trees can reduce subsurface flow due to their high water consumption and are not favourably placed in arid environments. The most significant impacts include the following and examples are represented in Figure 8.18:

- Alien plant invasion;
- Gulley erosion;
- Farm roads traversing wetland area and
- Overgrazing in wetlands.

Figure 8.18: Examples of current impacts to the wetland health (A: erosion; B and C: Eucalyptus camuldulensis invasion in the catchment of the northern pan and Palmietfontein pan respectively and D: a road crossing the Palmietfontein pan).

The results of the wetland health assessment are represented in Table 8.23 and shown on the map in Figure 8.19.

Table 8.23: Results of the Present Ecological State Assessment.

Wetland Unit	Health Score	PES Category
Northern Mooihoek Pan	3	C
Southern Mooihoek Pan	2	D
Palmietfontein Pan	3	C
Brakfontein Pan	3	C
Hillslope Seep linked to pan	2	D

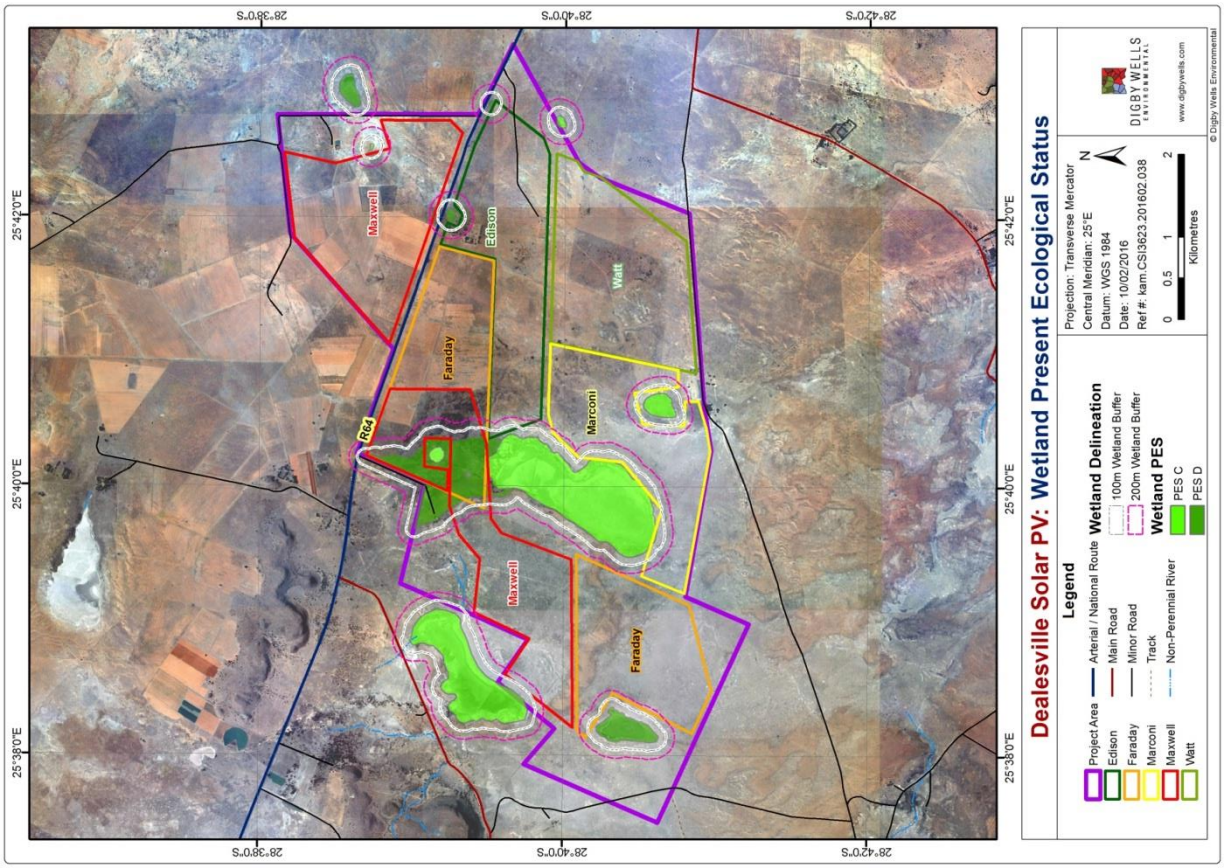

Figure 8.19: Present Ecological State of the wetlands in the study area.

8.4.2.6 Wetland Functionality Assessment

The EIS assessment was completed for each of the ephemeral pans different HGM units and the results are given in Table 8.24 below. Although ephemeral pans are important for the maintenance of biodiversity, no Red Data or unique animal species were recorded for the pans associated with the site (Digby Wells Environmental, 2016 a). Although game species make use of the pans, they were not assigned high ecological importance or sensitivity. Further to this, ephemeral pans are common across the regional landscape.

Table 8.24: Overall Ecological Importance and Sensitivity scores for the wetland HGM units.

Wetland Unit	EIS Category
Northern Mooihoek Pan	D
Southern Mooihoek Pan	D
Palmietfontein Pan	C
Brakfontein Pan	C
Hillslope Seep linked to pan	D

8.4.3 Issues, risks and impacts

8.4.2.1 Summary of issues identified during the Scoping Phase

The potential issues identified in the Scoping Phase included the following:

- Loss of wetland habitat;
- Loss of Red Data and Protected plant species;
- Disturbance to the soil, promoting the establishment of alien plant species in wetlands;
- Loss of faunal habitat, and
- Habitat fragmentation.

8.4.2.2 Sensitivity of the site in relation to proposed activity

Wetlands are sensitive ecosystems that perform many complex functions including the maintenance of water quality, carbon storage, stream-flow regulation, flood attenuation, various social benefits as well as the maintenance of biodiversity (Kotze *et al*., 2007). Further to this the NWA protects wetlands in South Africa and as a consequence, all wetlands within the site should be excluded from the development. A buffer of 100 m has been placed around each wetland and this should be regarded as a 'no-go' zone. A buffer of 200 m is recommended for the Brakfontein and Palmietfontein Pans (larger pans) to conserve more of its catchment. The infrastructure layout is represented in Figure 8.20 and shows that Faraday Solar PV footprint area infringes on the wetland buffers of three pans and will result in the loss of one small pan (southern Mooihoek Pan). In addition, the electrical infrastructure footprint coincides with the boundaries of the Palmietfontein Pan and associated hillslope seep, as well as a small pan to the north-east of the Dealesville project

8.4.2.3 Identification of potential impacts/risks

Three wetland pans and one hillslope seep linked to a pan were delineated as part of this wetland assessment. Due to a history of livestock and game farming in the area, as well as cultivation, the wetlands in question, as well as the vegetation throughout the study area, had been considerably overgrazed. No Red Data or Protected plant species were recorded during the site visit in the wetland areas and this impact (identified in the Scoping Phase, is no longer relevant.

The potential impacts identified during the EIA assessment are:

Construction Phase

- Loss of wetland buffers;
- Increased sedimentation;
- Increased incidence of erosion.

Operational Phase

- No impacts are anticipated as part of the operational phase.

Decommissioning Phase

- No impacts are anticipated as part of the operational phase.

Cumulative Impacts

- Cumulative loss of wetland pans.

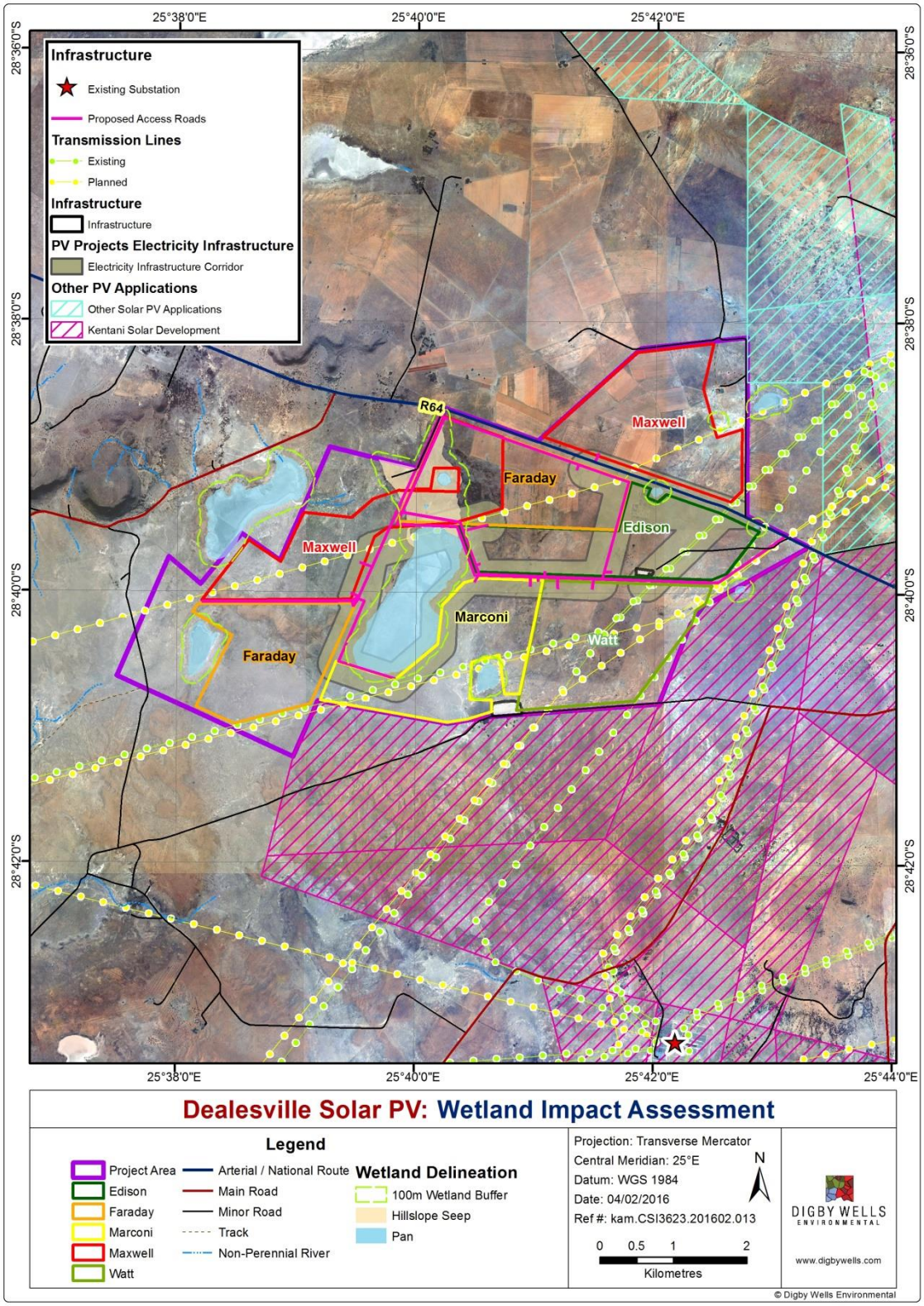

Figure 8.20: Sensitive wetland features within the study area.

8.4.4 Impact Assessment

The proposed Faraday A Solar PV development will result in the loss of a hillslope seep (51 ha) and a small pan (southern Mooihoek Pan covering 0.37 ha). In addition, the buffers of the northern Mooihoek Pan and Palmietfontein Pan will be infringed upon.

No direct loss of wetland is anticipated due to the Faraday B development. This section assesses the expected impacts of the Faraday A and B Solar PV developments, as well as the impacts of the electrical infrastructure footprint area for the entire Dealesville Solar PV development.

8.4.3.1 Potential direct impacts during construction phase

Activity	**Loss of pans and hillslope seep /Vegetation clearing for the Faraday PV Solar PV**
Type of impact	Indirect
Potential Impact	During the construction phase, vegetation associated with the Faraday Solar PV area will be cleared. The southern Mooihoek Pan and the wetland buffers for three pans and a hillslope seep (51 ha) will be lost. Buffers are important for maintaining the integrity of these pans since they act as natural filters of sediment and also serve to prevent the onset of erosional processes that readily occur in arid landscapes. Further to this, the natural buffer strips are comprised of native vegetation, though sparsely distributed. Disturbance to this area would invariably result in the establishment of alien forbs such as *Cirsium vulgare* (Scotch Thistle), *Conyza* spp., *Tagetes minuta* and *Datura* spp.
Mitigation Required	There is no mitigation for the loss of wetlands and buffers. The footprint area of the Faraday B Solar PV should be amended to exclude the wetlands and the associated buffer of 100 m (smaller pans) and 200 m (larger pans). Recommendations for the management of alien and invasive plant species is provided in the Flora and Fauna Report (Digby Wells Environmental, 2016 a).
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	None - there will be no impact if the buffers are excluded from the infrastructure plan.
I&AP Concern	No
Conditional Authorisation	All wetlands and buffers should be excluded from the footprint.

Activity	**Loss of pans and hillslope seep /Vegetation clearing for electricity infrastructure**
Type of impact	Direct
Potential Impact	Clearing of vegetation for the proposed infrastructure for the electrical infrastructure will result in the loss of approximately 35.22 ha of pan and 3ha of hillslope seep habitat, as well as a small pan to the north-east of the Dealesville project boundary. This will reduce the overall integrity of the Palmietfontein pan, potentially resulting in a drop of PES from a category C to D (largely modified).
Mitigation Required	The buffer of 100 - 200 m should be left intact around smaller pans and 200 m around Palmietfontein pan. In the case where it is not possible to avoid wetlands, the Palmietfontein pan and buffer should be considered as a priority for preservation. If the Cornelia pan is lost, a wetland offset strategy should be considered to compensate for the loss of this habitat, regardless of its relative small size. If any wetlands are impacted, disturbed areas should be revegetated immediately. An environmental control officer should monitor the wetlands during construction to ensure that unnecessary impacts are avoided.
Impact Significance (Pre-Mitigation)	3 (moderate negative)

Activity	**Loss of pans and hillslope seep /Vegetation clearing for electricity infrastructure**
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	No
Conditional Authorisation	All wetlands and buffers should be excluded from the footprint.

8.4.3.2 Cumulative impacts

If each of the five proposed projects for the 29 Solar Dealesville Development go ahead, one small pan and a hillslope seep will be lost and the buffers of numerous pans will be infringed upon. At least two ephemeral pans may be lost to the adjacent proposed Kentani development. Whilst pans are a common feature of the landscape in the area, they are protected by the NWA and should be conserved. All pans and buffers should be excluded from development.

8.4.4 Legislative and permit requirements

8.4.4.1 Water Use License Application

In the case where an ephemeral pan or buffer zone cannot be avoided, a Water Use Licence Application will be required. Note that the activities pertain to watercourses and all wetlands (including pans). In terms of the NWA, Section 21, the following activities will be triggered:

- (c) impeding or diverting flow of a watercourse;
- (i) altering the beds, banks, course or characteristics of a watercourse.

8.4.4.2 Wetland Offsets

SANBI, in collaboration with the DWS, has developed a guideline for wetland offsets in South Africa (DWS 2014). The guideline was produced to provide guidance on wetland offsetting, with particular reference to loss of wetlands due to mining-related activities. The guideline for wetlands offsets in South Africa defines 'biodiversity offsets' as "measurable conservation outcomes resulting from actions to compensate for residual negative impacts on biodiversity". If the mitigation hierarchy is applied and all efforts to avoid wetlands and buffers are exhausted, a wetland offset strategy should be employed.

Table 8.25: Wetlands: Impact Assessment Summary Table – Construction Phase Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Clearing of vegetation for the Faraday Solar PV	**Loss of wetland buffers**	Negative	Site	Long-term	Substantial	Definite	Rehabilitation with native species	High (overgrazed vegetation)	Avoid wetland buffers	Moderate	No impact	3	High
Clearing of vegetation for electrical infrastructure	**Loss of pan area, pan habitat and buffers**	Negative	Site	Long-term	Moderate	Definite	Rehabilitation with native species	Moderate	Avoid wetlands and buffers	Moderate	Low	3	High

Table 8.26: Wetlands: Impact Assessment Summary Table – Cumulative Impacts

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CUMULATIVE IMPACTS													
Vegetation clearing	Cumulative loss of ephemeral pans	Negative	Site	Long-term	Moderate	Definite	Rehabilitation with native species	Moderate	Avoid wetlands and buffers	Moderate	No impact	4	High

8.5 Aquatic ecology[5]

8.5.2 Findings of the Aquatic Ecology Study

No rivers intersect the site, however the project area presents five freshwater pans. At the time of sampling all four pans assessed were dry. The site falls within the quaternary catchment of C52K, which is within the Highveld ecoregion. The nearest major drainage system within the quaternary catchment is the Modder River Located approximately 22 km away from the site. The proposed project area falls within the Upper Orange Water Management Area (WMA). The Modder River flows into the Riet River which then enters the Vaal shortly before the Vaal drains into the Orange River which empties into the Atlantic Ocean on the West Coast of South Africa.

Figure 8.21 demonstrates the conditions within the pans at the time of the assessment, and Figure 8.22 below indicates the locations and names of the pans in relation to the proposed project areas. It is noted that Pan 2 was not considered for the assessment due to its small size and temporary nature. Pan 3 (Palmietfontein Pan) is the largest of the pans associated with the proposed 100 MW solar panel project, covering an area of 155 ha.

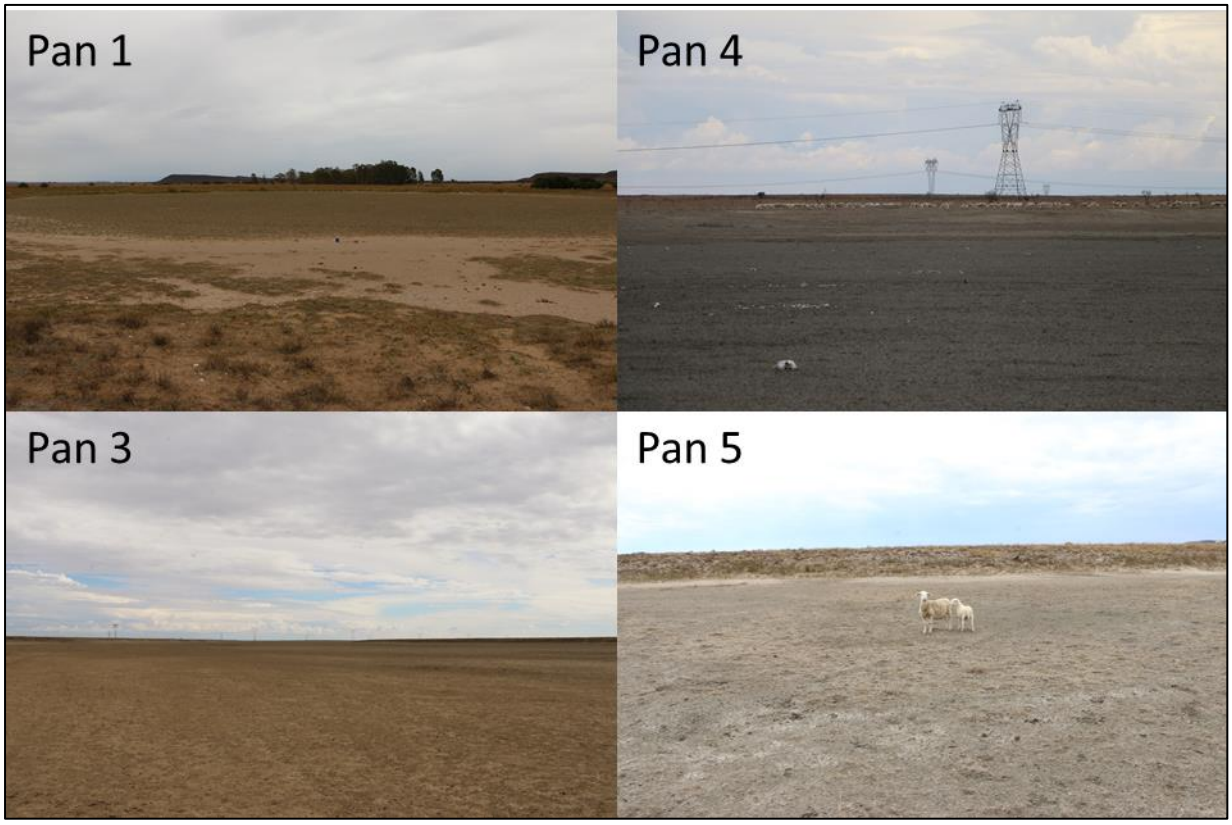

Figure 8.21: Images depicting conditions within the pans assessed during the aquatic ecology survey.

During the survey (January 2016) all pans within the project boundary were dry. As such, no *in situ* water quality data or live sampling of invertebrates could take place.

[5] Digby Wells Environmental, 2016 c

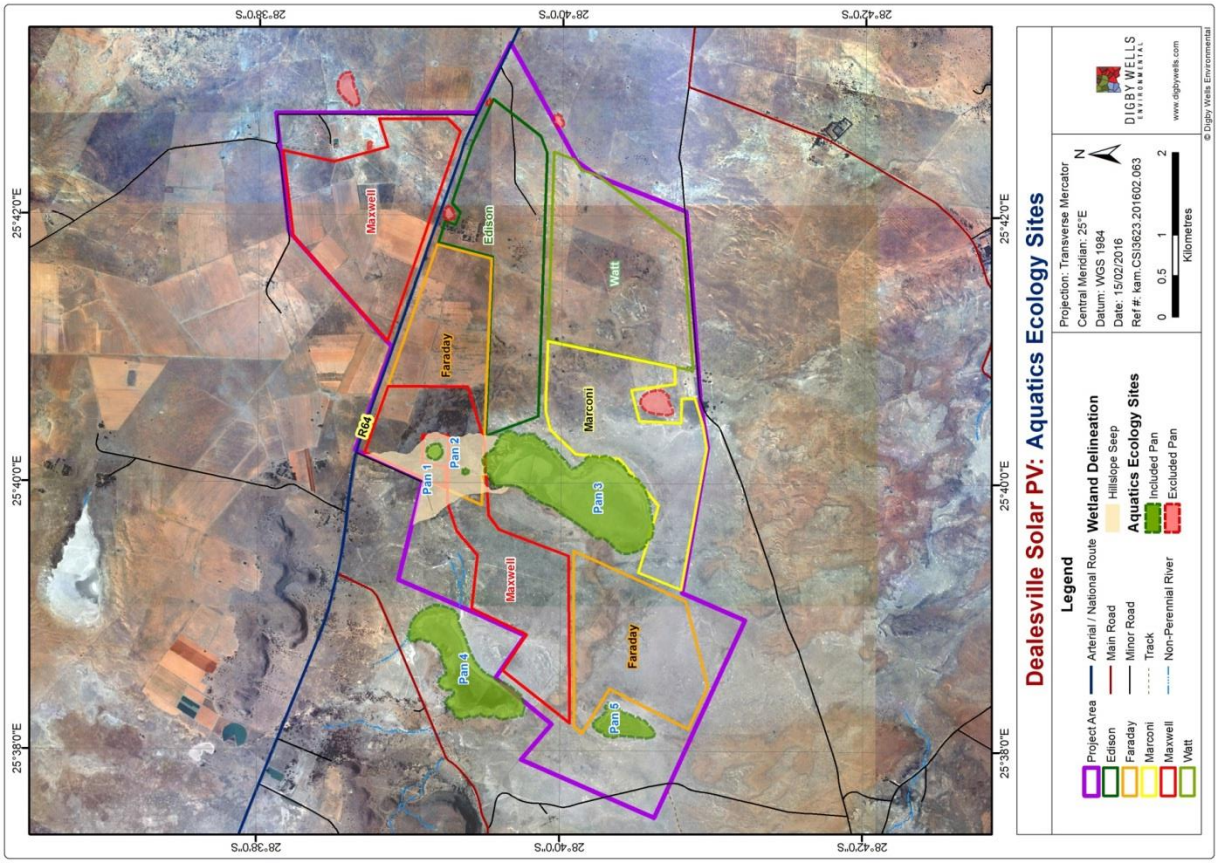

Figure 8.22: Aquatic ecology sites.

8.5.1.1 Habitat Quality

Pan 1

Table 8.27 displays the results from the habitat quality assessment for Pan 1.

Table 8.27: Habitat quality index for Pan 1.

	Score	Weight	Max score	Actual
Flow modification	7	20	10	14
Water Quality Modification	8	25	10	20
Sediment Load Modification	8	15	10	12
Indigenous Vegetation Removal	8	20	10	16
Invasive Vegetation Encroachment	6	10	10	6
Alien Fauna	7	10	10	7
Total				**75**
Category				**Limited modification**

Based on the outcomes of the habitat assessment there is limited modification within Pan 1 catchment.

Pan 5

Table 8.28 displays the results from the habitat quality assessment for Pan 5.

Table 8.28: Habitat quality index for Pan 5.

	Score	Weight	Max score	Actual
Flow modification	7	20	10	14
Water Quality Modification	7.5	25	10	18.75
Sediment Load Modification	8	15	10	12
Indigenous Vegetation Removal	7	20	10	14
Invasive Vegetation Encroachment	7	10	10	7
Alien Fauna	4	10	10	4
Total				**69.75**
Category				**Moderate modification**

The results of the habitat assessment show that the catchment area of Pan 4 is currently moderately modified.

8.5.1.2 Invertebrates

Due to the time required to hatch the pan invertebrates the results for the invertebrate's assessment are not yet complete. However, the samples have been hatched for the previous 12 days and thus some preliminary results are available,

Preliminary Results

To date only Pan 1 and 4 have hatched any invertebrates. The taxa identified so far are illustrated in Table 8.29.

Table 8.29: Invertebrates identified as of the submission date.

Orders	Pan 1	Pan 3	Pan 4	Pan 5	IUCN
Anostraca	X	X	X	X	Many species listed as vulnerable to critically endangered (Henri et al. 2014)
Cladocera			X		Not yet assessed
Conchostraca			X		Not yet assessed
Podocopida			X		All species listed as vulnerable to critically endangered
Total Diversity	**1**	**1**	**4**	**1**	

A total of 4 orders of invertebrate taxa were hatched from Pan 4, whereas, only a single taxon was hatched from the other pans.

Discussion

- **Pan 1**

The habitat quality assessment revealed that the catchment and supporting habitat of Pan 1 is in a largely natural state, however certain small scale impacts were evident.

Alien fauna in this instance, the grazing of sheep, has led to some degree of trampling and degradation of the sediment structures surrounding the immediate pan area. It is also probable that when the pan does contain water livestock obtain water from it.

Alien vegetation was also recorded within the pan catchment. This has the effect of reducing surface runoff into the pan and thus reducing the amount of water entering the pan.

These two impacts are the cause of the small to no discernible impact rating within Table 8.27. The alien vegetation has resulted in modified flows entering the pan while livestock are believed to be the cause of increased sediment loads, created when animal paths are worn into the catchment slope (Figure 8.23). Livestock are also believed to be the cause of the indigenous vegetation removal by grazing pressure and an overall increase in nutrients within the pan catchment which may impact on water quality.

Figure 8.23: Livestock paths leading to sediment mobilisation into Pan 1. Also present is the local invasive *Vachellia karroo*.

- **Pan 5**

Pan 5 was found to be moderately modified. Again, the primary cause for this is the livestock that graze and water themselves within the pan catchment. Constant use creates paths that when rainfalls become preferential flow paths and eventually lead to incised erosion channels. Where previously the pan would have been fed by diffuse surface water inflow, now small drainage lines collect water and with the increased energy erode soil and transport sediment into the pan interior altering the state of the habitat.

Invertebrate Assessment

The invertebrate assessment is still running and the final results will be added to the report when the hatchling results are finalised. Anostraca hatchlings as recorded in the study provide some indication of sensitivity and the presences of vulnerable aquatic species.

8.5.2 Issues, risks and impacts

8.5.2.1 Summary of issues identified during the Scoping Phase

The potential aquatic ecology issues identified during the scoping phase of this EIA process include:

- Grazing and trampling of the pan catchment by stock animals;
- Threat of alien vegetation to water quantity; and
- Potential of water abstraction from ground water sources feeding the pan.

It is further stated that no comments or responses were received during the process of this study.

8.5.2.2 Sensitivity of the site in relation to proposed activity

Figure 8.24 below indicates the sensitive areas to be avoided by the proposed project.

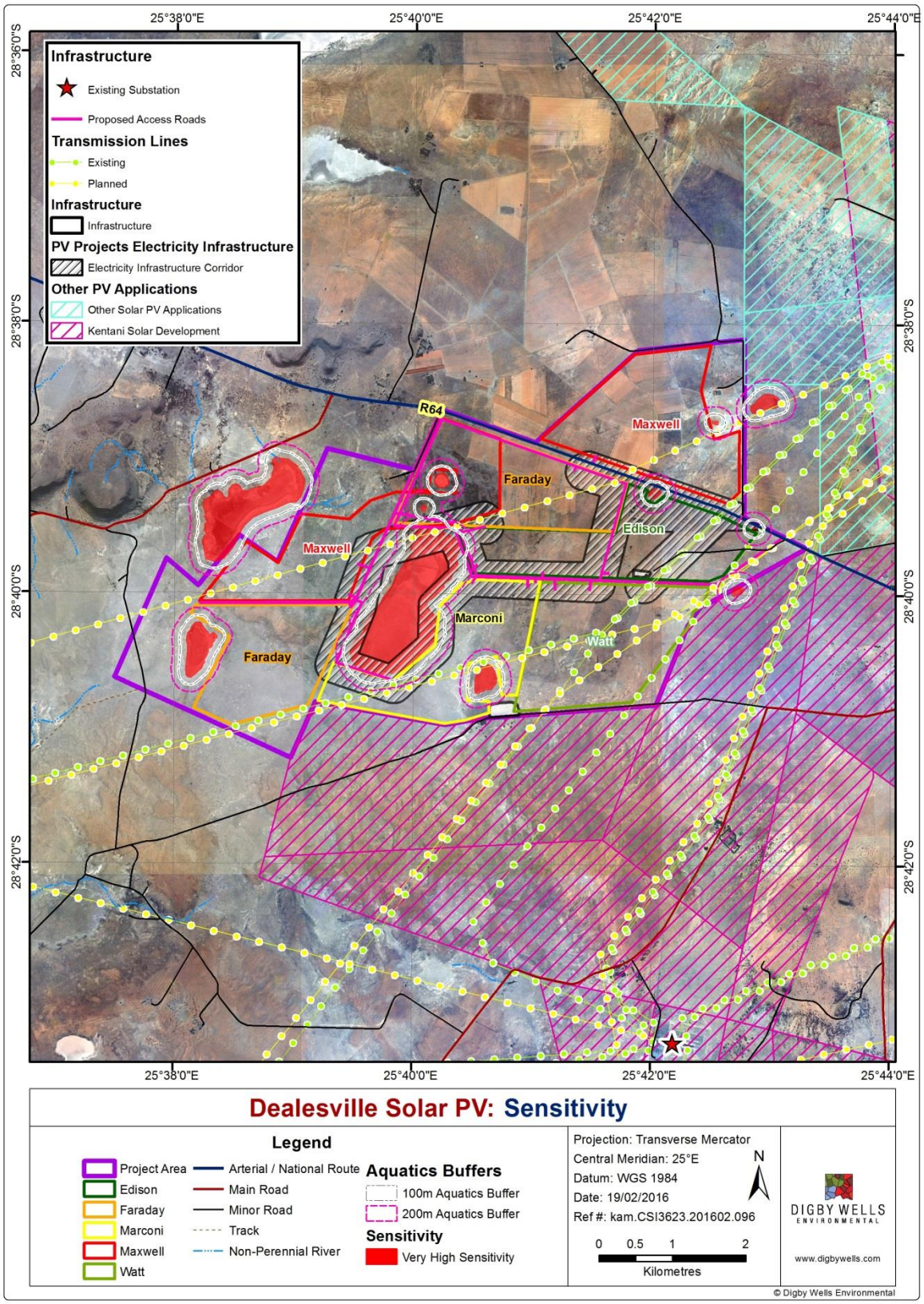

Figure 8.24: Sensitive aquatic ecology features.

8.5.2.3 Identification of potential impacts/risks

Based on the field investigation which took place in January of 2016 the following impacts were identified per project phase:

Construction

- Erosion as a result of site clearing and vehicular activities; and
- Sedimentation of the pans due to mobilisation of the eroded material

Operation

- Increased run off from the hardened surface of the solar panels and related infrastructure leading to erosion;
- Sedimentation of the pan due to mobilisation of the eroded material.

Decommissioning

- Erosion from the area cleared of infrastructure; and
- Sedimentation of the pan due to mobilisation of the eroded material

8.5.3 Impact Assessment

8.5.3.1 Potential direct impacts during construction phase

Aspect/Activity	**Aquatic ecology/ erosion and sedimentation**
Type of impact	Direct
Potential Impact	Construction phase impacts such as erosion from vegetation removal and destabilisation of soils could lead to the sedimentation of the pan as soils migrate down slope.
Mitigation Required	• Site clearing should only take place before a section is due to be constructed; • Only the footprint necessary should be cleared; • Removal of alien vegetation from the pan catchment; • Implementation of a 200m wide buffer around the pans within the project area. ○ No vehicles, waste material or infrastructure to be placed in the catchment of the pans
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low positive)
I&AP Concern	No

8.5.3.2 Potential direct impacts during operation phase

Aspect/Activity	**Aquatic ecology/ erosion and sedimentation**
Type of impact	Direct
Potential Impact	Operation phase impacts could accrue from the increased hardness of the solar panels and infrastructure. The increased speed of runoff would impart greater energy to the water and make erosion of soils more likely.

Aspect/Activity	**Aquatic ecology/ erosion and sedimentation**
Mitigation Required	• Maintenance of alien vegetation, keeping it out of the pan catchment; • Implementation and maintenance of a storm water management system that prevents heavy rainfalls outside the pan catchment being diverted into the pan system; and • Implementation of a 200m wide buffer around the pans within the project area. ○ No vehicles, waste material or infrastructure to be placed in the catchment of the pans
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low positive)
I&AP Concern	No

8.5.3.3 Potential direct impacts during decommissioning phase

Aspect/Activity	**Aquatic ecology, erosion and sedimentation**
Type of impact	Direct
Potential Impact	The removal of infrastructure could expose soil and increase the possibility of surface runoff mobilising soils into the pan interior.
Mitigation Required	• Rehabilitation of roads on site to prevent the creation of preferential flow paths; • Maintenance of alien vegetation, keeping it out of the pan catchment; • Maintenance of a storm water management system that prevents heavy rainfalls outside the pan catchment being diverted into the pan system; and • Implementation of a 200m wide buffer around the pans within the project area. ○ No vehicles, waste material or infrastructure to be placed in the catchment of the pans
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low positive)
I&AP Concern	No

8.5.3.4 Cumulative impacts

No cumulative impacts are foreseen, due to the nature of pans, being largely self-contained systems, if other impacts mentioned above are removed such as stock farming no other industry is present within the respective catchment to contribute to cumulative impacts

8.5.3.5 Legislative and permit requirements

No permits will be required for aquatic ecology associated with the study site.

Table 8.30: Aquatic Ecology: Impact assessment summary table – Construction Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Internal access roads, vehicular activities on site and site preparation	**Erosion and Sedimentation**	Negative	Pan catchment	Long-term	Substantial	Very likely	Yes (rehabilitation after Construction)	Moderate (endangered vegetation)	➢ 200 m buffer around pan; ➢ Remove stock animals	Moderate	Low positive	4	High

Table 8.31: Aquatic Ecology: Impact assessment summary table – Operation Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATION PHASE DIRECT IMPACTS													
Increased runoff from hardened surfaces and vehicular incursions into the pan	**Erosion and Sedimentation**	Negative	Pan catchment	Long-term	Substantial	Very likely	Yes (rehabilitation after Construction)	Moderate (endangered vegetation)	➢ 200 m buffer around pan; ➢ Maintain absence of stock animals ➢ Use of berms and canals to trap excess runoff	Moderate	Low positive	4	High

Table 8.32: Aquatic Ecology: Impact assessment summary table – Decommissioning Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATION PHASE DIRECT IMPACTS													
Increased threat for loosened topsoil and lack of anchorage	**Erosion and Sedimentation**	Negative	Pan catchment	Long-term	Substantial	Very likely	Yes (rehabilitation after Construction)	Moderate (endangered vegetation)	➢ 200m buffer around pan; ➢ Maintain absence of stock animals; ➢ Use of berms and canals to trap excess runoff	Moderate	Low positive	4	High

8.6 Soils and Agricultural potential[6]

8.6.1 Findings of the Soil and Agricultural Potential study

8.6.1.1 Climate and water availability

Rainfall for the site is given as 438 mm per annum, with a standard deviation of 112 mm according to the South African Rain Atlas (Water Research Commission, undated). One of the most important climate parameters for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. Moisture availability is classified into 6 categories across the country (see Section 6.6, Chapter 6). The proposed development site falls within moisture availability class 5 which is described as a severe limitation to agriculture.

Water for stock is obtained from wind pumps on the farm. There is not water available in sufficient quantities for any form of irrigation on the site and no irrigated lands occur on it.

All the farmers report that low rainfall and particularly variability of rainfall is a major limitation to agriculture in the area, with the result that rainfed crop farming is marginal.

8.6.1.1 Terrain, topography and drainage

The proposed development is located on a terrain unit of level plains with some relief at an altitude of between 1,240 and 1,290 meters. Slopes across the site are an average of less than 2% and a maximum of 3% (Faraday PV A) and less than 1% (Faraday PV B).

The underlying geology is shale and mudstone of the Ecca Group, at times covered by surface limestone. Dolerite intrusions occur.

There are no drainage courses on the site. There are pans on the farm, but these have been excluded from the footprint of the development, with a buffer between them and the edge of the development.

8.6.1.2 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The proposed development is located across two land types, namely Db3 in the west and Ae46 in the east (see Figure 8.25). Ae46 comprises predominantly moderately deep to deep, sands to loamy sands of the Hutton soil form on underlying rock or hard-pan carbonate. These soils fall into the Calcic and Oxidic soil groups according to the classification of Fey (2010). Db3 comprises mostly shallow sandy clay loams of the Valsrivier soil form on underlying clay, and shallow loamy sands of the Mispah soil form on underlying hard-pan carbonate or rock. These soils fall into the Duplex and Calcic soil groups according to the classification of Fey (2010). A summary detailing soil data for the land types is provided in the Soil and Agricultural Potential Report (Lanz, 2016) – see Specialist Report Volume.

The field investigation on site Faraday PV A identified six different soil forms on the site, namely Hutton, Plooysburg, Mispah, Gamoep, Coega and Valsrivier (Figure 8.25 a). Dolerite outcrops occur in the eastern part of the site with shallow Mispah soils in their close vicinity and shallow Hutton soils further from them. Hardpan carbonate occurs in the subsoil across the western part of the site (Coega and Gamoep soil forms), and in smaller patches in the central part of the site amongst otherwise deep Hutton soils. Note that the Gamoep, Coega and Plooysburg soil forms were added to the South African soil classification system since the recording of the land type data. Soils of these

[6] Lanz, 2016

forms would have been classified as Oakleaf, Mispah and Hutton respectively in the land type data. Shallow Valsrivier soils on underlying clay occur in the extreme north west of the site. Data from soil sample points across the site is given in the Soil and Agricultural Potential Report (Lanz, 2016) – see Specialist Report Volume.

The field investigation on site Faraday PV B identified four different soil forms on the site, namely Hutton, Mispah, Coega and Valsrivier (Figure 8.25 b). Shallow Valsrivier soils on underlying clay occur across much of the site. Hardpan carbonate occurs in the subsoil in the central part of the site (Coega soil form). Note that the Coega soil form was added to the South African soil classification system since the recording of the land type data. Soils of this form would have been classified as Mispah in the land type data. Dolerite outcrops occur in a limited patch with shallow Mispah soils in their close vicinity and shallow Hutton soils further from them. Data from soil sample points across the site is given in the Soil and Agricultural Potential Report (Lanz, 2016) – see Specialist Report Volume.

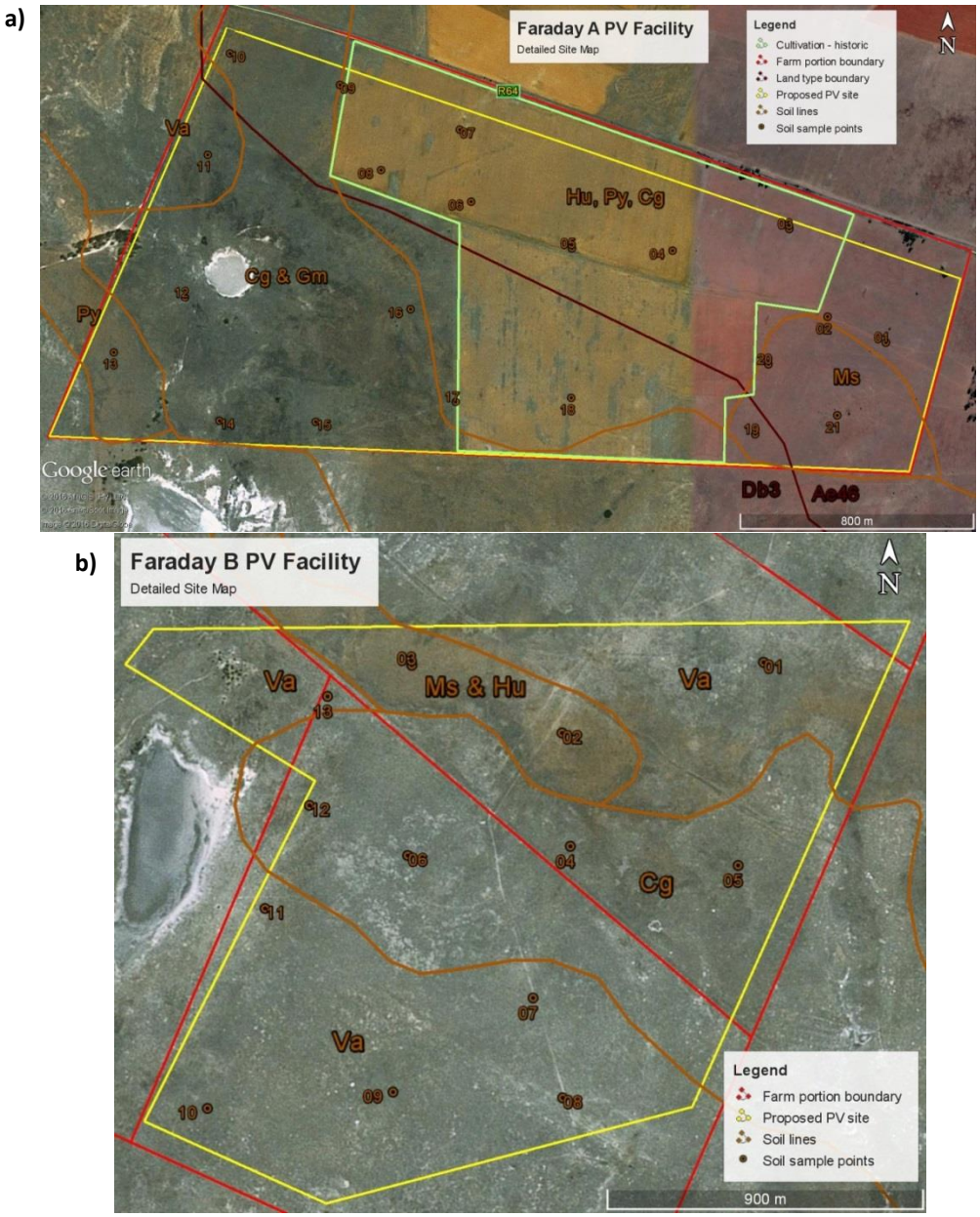

Figure 8.25: Detailed satellite image site map showing investigated soils for a) Faraday PV A; and b) Faraday PV B.

The land has low to moderate water erosion hazard (class 5), mainly due to the low slope. The western parts (land type Db3) is classified as moderately susceptible to wind erosion (class 3d) and the eastern parts (land type Ae46) is classified as susceptible (class 2b).

8.6.1.3 Agricultural capability

Land capability is the combination of soil suitability and climate factors. The area has a land capability classification, on the 8 category scale, of Class 5 - non-arable, moderate potential grazing land. The limitations to agriculture are both climatic low moisture availability with high variability of rainfall as well as limited soil depth. The potential maize yield on AGIS (Schulze) is low at 1.35 tons per hectare. The natural grazing capacity is 11-13 hectares per large stock unit.

8.6.1.4 Land use and development on and surrounding the site

The site is located within a grain farming agricultural region, but none of it is used for cultivation. It is used only for grazing of cattle and sheep. Part of site Faraday PV A has been cultivated historically, but no cultivation has been done within the last 10 years.

There are no buildings on either of the sites. The only agricultural infrastructure on site is fencing into grazing camps.

Proposed road access to the site is via a new road from the R64, over the neighbouring farm portion to the north, that will run along the edge of other proposed solar developments in the area.

8.6.1.5 Status of the land

The biome classification for the western half of the site (land type Db3) is Western Free State Clay Grassland, and the eastern half (land type Ae46) is Vaal-Vet Sandy Grassland. The land has been transformed by agriculture and is grazed, but there is no evidence of significant erosion or other land degradation on the site.

8.6.1.6 Possible land use options for the site

Because of the predominantly shallow soils, lack of access to water for irrigation, and climatic moisture and rainfall variability constraints, the site is not suitable for cultivated crops. Cultivation on a part of site Faraday PV A that has better soils than the rest was found to be economically non-viable and was discontinued more than 10 years ago. Viable agricultural land use is therefore limited to grazing only.

The site is within one of South Africa's eight renewable energy development zones (REDZs), and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. These factors include an assessment of the significance of the loss of agricultural land. Renewable energy development is therefore a very suitable land use option for the site.

Photographs of site conditions are shown in Figure 8.26 to Figure 8.30.

Figure 8.26: Photograph showing general site conditions on site Faraday PV A.

Figure 8.27: Photograph of typically occurring dolerite outcrops. Dolerite occurs at shallow depth below Hutton and Mispah soils on parts of the sites.

Figure 8.28: Photograph from an excavation in the study area of shallow Hutton soil on underlying dolerite.

Figure 8.29: Photograph of Gamoep soil profile from the site showing the excavated hardpan carbonate that is in the subsoil.

Figure 8.30: Photograph of Valsrivier soil profile from the study area, where shallow clay occurs in the subsoil.

8.6.2 Issues, risks and impacts

8.6.2.1 Summary of issues identified during the Scoping Phase

The potential agricultural issues identified during the scoping phase of this EIA process include:

- Loss of agricultural land use;
- Soil erosion;
- Loss of topsoil;
- Generation of alternative / additional land use income; and
- Cumulative impacts due to the regional loss of agricultural land.

Telephonic and personal consultation was done with the current farmers of the land, Mr Abrie Deacon, Mr LeRoy Ebersohn, and Mr Fred Euvrard, to get details of agricultural conditions and farming practices on the farm. In the course of the project, the neighbouring farmers / owners - Louis Badenhorst and Pieter Nel - were also consulted on agricultural conditions and farming practices in the area.

Comments raised by the public that are relevant to soils and agricultural potential, and this study's response to them are logged in Table 8.33.

Table 8.33: Agriculture-related comments and responses trail. Comments responded to by the appointed specialist, Johann Lanz.

Comment	Commenter	Response
Runoff, soil ecology, dust, reflection/glare, rehabilitation at end of project, access roads?	Jack Amour (Freestate Agri)	All potential impacts on soil have been addressed in this report and mitigation measures have been recommended.
Complete research about the feasibility of this type of development (authority Department of Agriculture);	Gerhard van Rhyn (Neighbouring landowner)	The site is within one of South Africa's eight proposed renewable energy development zones (REDZ), and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. These factors include an assessment of the significance of the loss of agricultural land.
Dealesville is already over-developed with electricity infrastructure, how does this influence agriculture and property values in Dealesville?		The cumulative impact has been discussed and assessed.
The financial benefit drives landowners to agree to the development. If their farms have no or very limited agricultural potential they are very positive about the development as it offers financial compensation, which is understandable, but what about their neighbours?	Gerhard van Rhyn (Neighbouring landowner), with support from Gert Jonker, Annetjie Jacobs, Kobus van Staden, Wouter de Vos, Ivan Stevens & E. Stevens, G.P. Van Straaten	There is no impact of the development on soils or agricultural potential off the immediate development site.
Heaps of stone lying around the place after construction, but is lower than the three-meter height that makes rehabilitation compulsory by law.		Disturbance to agricultural land requires rehabilitate in terms of CARA and burial of topsoil will be mitigated in terms of the EMPr.
That the Department of Agriculture must be approached execute complete and holistic research such projects in the Free State, and specifically its impact on agriculture and possible areas that might be more suitable for such development than just farmland.		The site is within one of South Africa's eight proposed renewable energy development zones (REDZ), and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. These factors include an assessment of the significance of the loss of agricultural land.
Is there a study by Department of Agriculture (or Free State Agriculture) on the effects of solar panels on agriculture (livestock and/or cultivation).		The wind and solar SEA for South Africa has assessed these effects.

8.6.2.2 Sensitivity of the site in relation to proposed activity

Agricultural conditions and potential are generally lower in site Faraday PV B which is therefore preferred. The historical cultivation on Faraday PV A is on better soils than the rest of the site, and so placement of infrastructure should be off the historically cultivated areas where possible. However because the whole site is unsuited to cultivation, none of it is considered to be land that

has a high priority for preservation as agricultural land. Therefore none of the site is considered to be agriculturally sensitive and no part of it therefore needs to be avoided by the development. There are no required buffers.

8.6.2.3 Identification of potential impacts/risks

The potential impacts identified during the EIA assessment are:

Construction phase

- Loss of agricultural land use;
- Soil erosion;
- Loss of topsoil;
- Degradation of veld vegetation;
- Generation of alternative / additional land use income;

Operational phase

- Loss of agricultural land use;
- Soil erosion;
- Generation of alternative / additional land use income;
- Increased security against stock theft and predation.

Decommissioning phase

- Loss of agricultural land use;
- Soil erosion;
- Loss of topsoil;
- Degradation of veld vegetation;
- Generation of alternative / additional land use income.

Cumulative impacts

- Regional loss of agricultural land.

8.6.3 Impact Assessment

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of potentially arable land. The proposed site is on land which is unsuitable for cultivation due to both soil and climate limitations. The low agricultural potential of the site limits the significance of agricultural impacts. The site is not considered to be land that has a high priority for preservation as agricultural land.

The impact assessment of the development includes the associated transmission infrastructure which includes substations. The footprint of the substations are considered as part of the total footprint of the development infrastructure. The impacts of the power lines are negligible because the actual footprint of disturbance is confined to the pylon bases and is very small. All agricultural activity (grazing) can continue undisturbed below the lines themselves.

All identified impacts are considered to be direct impacts. No indirect impacts were identified.

8.6.3.1 Potential direct impacts during construction phase

Aspect/Activity	**Loss of agricultural land use/Establishment of infrastructure**
Type of impact	Direct
Potential Impact	Loss of agricultural land use is due to direct occupation of the land by all development infrastructure. It results in affected portions of land being taken out of agricultural production. During the construction phase the entire site will be excluded from agricultural use.
Mitigation Required	None possible
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	3 (moderate negative)
I&AP Concern	Yes

Aspect/Activity	**Soil erosion/Construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	Erosion may be by wind or water. It can occur as a result of the alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal, the establishment of hard standing areas and roads, and the presence of panel surfaces. Erosion will cause loss and deterioration of soil resources. The land has low susceptibility to erosion by water because of the very low slope and low susceptibility to erosion by wind because of the clay content, and the risk of erosion is therefore low.
Mitigation Required	• Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at points where water accumulation might occur. • The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.
Impact Significance (Pre-Mitigation)	2 (low negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	No

Aspect/Activity	**Loss of topsoil/Construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	Loss of topsoil can result from poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.). It will result in a decrease in the soil's capability for supporting vegetation.
Mitigation Required	• If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. • Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. • During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. • Any subsurface spoils from excavations must be disposed of where they will not bury the topsoil of agricultural land.
Impact Significance (Pre-Mitigation)	2 (low negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	No

Aspect/Activity	**Degradation of veld vegetation/Dust deposition during construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	Degradation of veld vegetation can occur beyond the direct footprint of the development due to dust deposition.
Mitigation Required	• Control dust generation during construction activities by implementing standard construction site dust control measures of damping down with water where dust generation occurs.
Impact Significance (Pre-Mitigation)	1 (very low negative)
Impact Significance (Post-Mitigation)	1 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Generation of alternative and-or additional land use income/Leasing of land**
Type of impact	Direct
Potential Impact	This is a positive impact for agriculture. Alternative / additional land use income will be generated by the farming enterprise through rental of the land to the energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability.
Mitigation Required	None possible
Impact Significance (Pre-Mitigation)	2 (low positive)
Impact Significance (Post-Mitigation)	2 (low positive)
I&AP Concern	Yes

8.6.3.2 Potential direct impacts during operation phase

Aspect/Activity	**Loss of agricultural land use/Establishment of infrastructure**
Type of impact	Direct
Potential Impact	Loss of agricultural land use is due to direct occupation of the land by all development infrastructure. It results in affected portions of land being taken out of agricultural production. During the construction phase the entire site will be excluded from agricultural use.
Mitigation Required	• Set up the facility and the agreements with land owners in such a way that facilitates grazing of small stock within the panel areas during the operational phase.
Impact Significance (Pre-Mitigation)	2 (low negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	Yes

Aspect/Activity	**Soil erosion/Construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	Erosion may be by wind or water. It can occur as a result of the alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal, the establishment of hard standing areas and roads, and the presence of panel surfaces. Erosion will cause loss and deterioration of soil resources. The land has low susceptibility to erosion by water because of the very low slope and low susceptibility to erosion by wind because of the clay content, and the risk of erosion is therefore low.
Mitigation Required	• Implement an effective system of storm water run-off control using bunds and

Aspect/Activity	**Soil erosion/Construction of surface infrastructure and preparation**
	ditches, where it is required - that is at points where water accumulation might occur. • The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.
Impact Significance (Pre-Mitigation)	2 (low negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	No

Aspect/Activity	**Generation of alternative and-or additional land use income/Leasing of land**
Type of impact	Direct
Potential Impact	This is a positive impact for agriculture. Alternative / additional land use income will be generated by the farming enterprise through rental of the land to the energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability.
Mitigation Required	None possible
Impact Significance (Pre-Mitigation)	2 (low positive)
Impact Significance (Post-Mitigation)	2 (low positive)
I&AP Concern	Yes

Aspect/Activity	**Increased security against stock theft and predation/Security measures at solar facility**
Type of impact	Direct
Potential Impact	This is a positive impact for agriculture. Because the energy facility is likely to be fenced with secure fencing that is jackal proof and because it will need to be secured against human entry, it offers grazing land for small stock that has increased security against both stock theft and predation. This has the potential to improve the production of small stock farming on site, particularly because both stock theft and predation are significant limitations to small stock farming on site.
Mitigation Required	• Ensure that the security fencing around the facility is jackal proof.
Impact Significance (Pre-Mitigation)	2 (low positive)
Impact Significance (Post-Mitigation)	2 (low positive)
I&AP Concern	Yes

8.6.3.3 Potential direct impacts during decommissioning phase

Aspect/Activity	**Loss of agricultural land use/Establishment of infrastructure**
Type of impact	Direct
Potential Impact	Loss of agricultural land use is due to direct occupation of the land by all development infrastructure. It results in affected portions of land being taken out of agricultural production. During the construction phase the entire site will be excluded from agricultural use.
Mitigation Required	None possible
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	3 (moderate negative)
I&AP Concern	Yes

Aspect/Activity	**Soil erosion/Construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	Erosion may be by wind or water. It can occur as a result of the alteration of the land surface run-off characteristics. Alteration of run-off characteristics may be caused by construction related land surface disturbance, vegetation removal, the establishment of hard standing areas and roads, and the presence of panel surfaces. Erosion will cause loss and deterioration of soil resources. The land has low susceptibility to erosion by water because of the very low slope and low susceptibility to erosion by wind because of the clay content, and the risk of erosion is therefore low.
Mitigation Required	• Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at points where water accumulation might occur. • The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.
Impact Significance (Pre-Mitigation)	2 (low negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	No

Aspect/Activity	**Loss of topsoil/Construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	Loss of topsoil can result from poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, road surfacing etc.). It will result in a decrease in the soil's capability for supporting vegetation.
Mitigation Required	• If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. • Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them. • During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface. Any subsurface spoils from excavations must be disposed of where they will not bury the topsoil of agricultural land.
Impact Significance (Pre-Mitigation)	2 (low negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	No

Aspect/Activity	**Degradation of veld vegetation/Dust deposition during construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	Degradation of veld vegetation can occur beyond the direct footprint of the development due to dust deposition.
Mitigation Required	• Control dust generation during construction activities by implementing standard construction site dust control measures of damping down with water where dust generation occurs.
Impact Significance (Pre-Mitigation)	1 (very low negative)
Impact Significance (Post-Mitigation)	1 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Generation of alternative and-or additional land use income/Leasing of land**
Type of impact	Direct
Potential Impact	This is a positive impact for agriculture. Alternative / additional land use income will be generated by the farming enterprise through rental of the land to the energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability.
Mitigation Required	None possible
Impact Significance (Pre-Mitigation)	2 (low positive)
Impact Significance (Post-Mitigation)	2 (low positive)
I&AP Concern	Yes

8.6.3.4 Cumulative impacts

Aspect/Activity	**Regional loss of agricultural land and production/Establishment of multiple solar PV facilities**
Type of impact	Direct
Potential Impact	Cumulative impacts are likely to occur as a result of the regional loss of agricultural land and production as a result of other developments on agricultural land in the region. Although the loss of individual project portions of land of low agricultural potential has low significance, as discussed above, the cumulative impacts of land loss regionally become more significant. However, despite this cumulative impact, it is still agriculturally strategic from a national perspective to steer as much of the country's renewable energy development as possible to regions such as this one, with low agricultural potential. It is preferable to incur a higher cumulative loss in such a region, than to lose agricultural land with a higher production potential elsewhere in the country.
Mitigation Required	None possible
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	3 (moderate negative)
I&AP Concern	Yes

8.6.3.5 Legislative and permit requirements

A change of land use (re-zoning) for the development on agricultural land needs to be approved in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). This is required for long term lease, even if no subdivision is required. Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). No application is required in terms of CARA. The EIA process covers the required aspects of this. The Department of Agriculture, Forestry and Fisheries reviews and approves applications in terms of these Acts according to their *Guidelines for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011.

Table 8.34: Agriculture and Soil Potential: Impact assessment summary table – Construction Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Occupation of the land by the project infrastructure	**Loss of agricultural land use**	Negative	Site	Medium term	Substantial	Very Likely	High	Low	None	Moderate	Moderate	3	High
Change in land surface characteristics.	**Erosion**	Negative	Site	Medium term	Moderate	Unlikely	Low	Low	Implement an effective system of storm water run-off control.	Low	Low	4	High
Constructional activities that disturb the soil profile.	**Loss of topsoil**	Negative	Site	Medium term	Moderate	Unlikely	Moderate	Low	Strip, stockpile and re-spread topsoil during rehabilitation.	Low	Low	4	High
Construction dust generation	**Degradation of veld vegetation**	Negative	Site	Medium term	Slight	Likely	High	Low	Control dust	Very Low	Very Low	5	High
Project land rental	**Additional land use income**	Positive	Site	Long term	Moderate	Very Likely	High	Low	None	Low positive	Low positive	4	High

Table 8.35: Agriculture and Soil Potential: Impact assessment summary table – Operation Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATION PHASE DIRECT IMPACTS													
Occupation of the land by the project infrastructure	**Loss of agricultural land use**	Negative	Site	Long term	Moderate	Very Likely	High	Low	Facilitate grazing of small stock within the panel areas.	Low	Low	4	High
Change in land surface characteristics.	**Erosion**	Negative	Site	Long term	Moderate	Unlikely	Low	Low	Implement an effective system of storm water run-off control.	Low	Low	4	High
Project land rental	**Additional land use income**	Positive	Site	Long term	Moderate	Very Likely	High	Low	None	Low positive	Low positive	4	High
Fencing and securing of facility perimeter	**Increased security against stock theft and predation.**	Positive	Site	Long term	Moderate	Very Likely	High	Low	Ensure fencing is jackal proof.	Low positive	Low positive	4	High

Table 8.36: Agriculture and Soil Potential: Impact assessment summary table – Decommissioning Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE DIRECT IMPACTS													
Occupation of the land by the project infrastructure	**Loss of agricultural land use**	Negative	Site	Medium term	Substantial	Very Likely	High	Low	None	Moderate	Moderate	3	High
Change in land surface characteristics.	**Erosion**	Negative	Site	Medium term	Moderate	Unlikely	Low	Low	Implement an effective system of storm water run-off control.	Low	Low	4	High
Decommissioning activities that disturb the soil profile.	**Loss of topsoil**	Negative	Site	Medium term	Moderate	Unlikely	Moderate	Low	Strip, stockpile and re-spread topsoil during rehabilitation.	Low	Low	4	High
Decommissioning dust generation	**Degradation of veld vegetation**	Negative	Site	Medium term	Slight	Likely	High	Low	Control dust	Very Low	Very Low	5	High
Project land rental	**Additional land use income**	Positive	Site	Long term	Moderate	Very Likely	High	Low	None	Low positive	Low positive	4	High

Table 8.37: Agriculture and Soil Potential: Impact assessment summary table – Cumulative impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CUMULATIVE IMPACTS													
Occupation of the land by the project infrastructure of multiple developments	**Regional loss of agricultural land**	Negative	Regional	Long term	Substantial	Very Likely	High	Low	None	Moderate	Moderate	3	High

8.7 Heritage[7]

8.7.2 Findings of the heritage study

The general vicinity is very flat, although rocky outcrops do occur in the area. The PV and EGI study areas are largely flat and grassed (Figure 8.31 and Figure 8.32), although a pan (Figure 8.31) and a low rocky hill do occur in the western and eastern parts of Maxwell PV A. The EGI corridor includes a large cluster of trees and a tree-lined avenue in the north on Cornelia, while another large cluster of trees occurs in association with an old farm complex at the far western end of Modderfontein, just outside the south-western corner of the Maxwell PV A PV site. To the south of Maxwell PV A and east of Maxwell PV B there is a very large pan.

Figure 8.31: View towards the east across Maxwell PV A. The trees in the distance at centre are the avenue on the farm Cornelia. The inset shows a view south over the pan.

Figure 8.32: View towards the west across Maxwell PV B.

This section describes the heritage resources recorded in the study area with palaeontological information sourced from the specialist desktop study by Rossouw (2016). The full list of heritage feautres recorded on site is presented in the HIA Report (Orton, 2016) – see Specialist Report Volume. Heritage resources are plotted on Figure 8.33.

[7] Orton, 2016

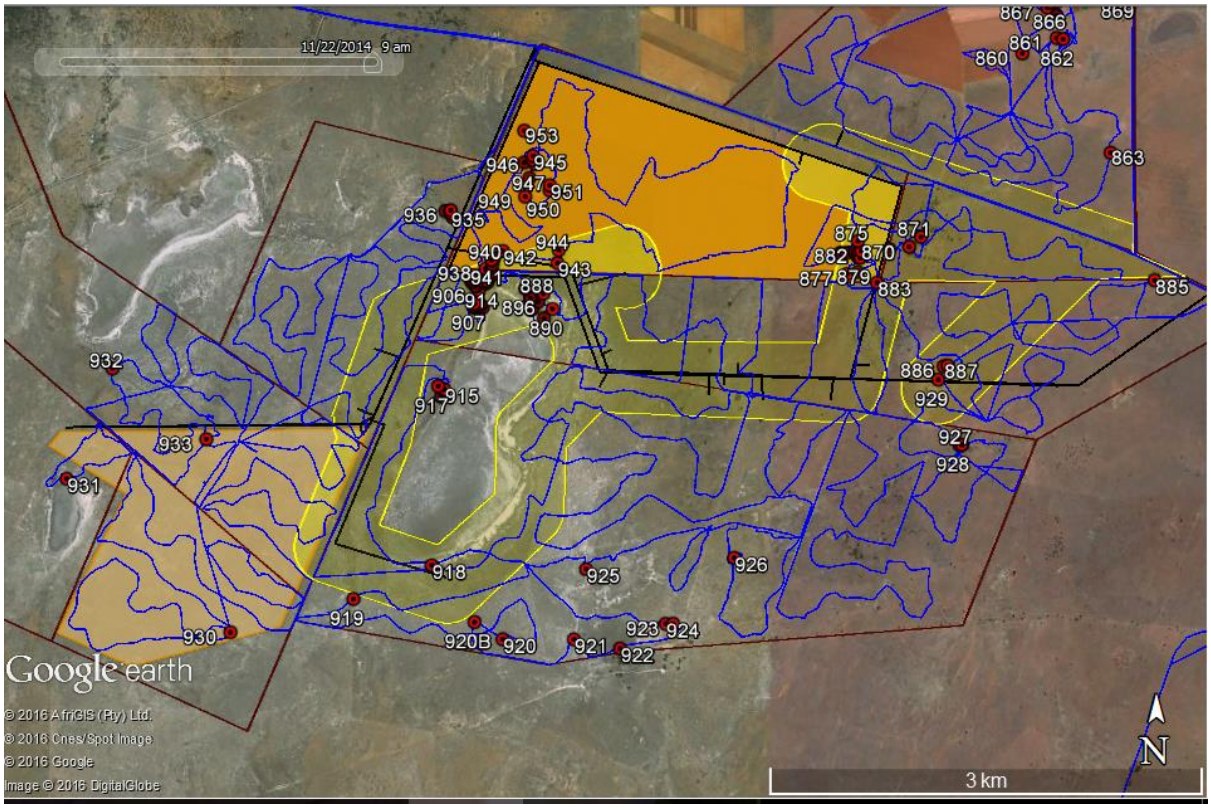

Figure 8.33: Aerial view of the study area showing the survey tracks (blue lines) and finds (numbered red dots). The PV study areas are shaded orange (Faraday PV A) and brown (Faraday PV B) and the EGI corridor in transparent yellow.

8.7.1.1 Palaeontology[8]

The local sediments vary markedly in age. The oldest are the Permian Ecca Shales (Tierberg Formation), Jurassic dolerite intrusions (Karoo Dolerite Suite), well-developed Quaternary calcretes, surface limestones, calcified pandunes and aeolian sands (Kalahari Group). The latter are the most recent geological phase and are comprised of red-brown Kalahari sands (Hutton sands).

The Tierberg Formation contains a variety of sparse trace fossils and burrows, with fossil wood being present in the upper layers of the formation. Rossouw (2016) reviews the various species on record for this formation. The dolerite intrusions are not fossiliferous and are not considered further. Localised spring deposits and calcified pan dunes are potentially sensitive and can occur in the area. Fossilised bone accumulations and sediments (peats) can occur within pan dunes and these dunes may also have houses hyena lairs in the past and also acted as foci for human occupation.

8.7.1.2 Archaeology

As expected because of the sand cover over the site, Stone Age archaeological resources were extremely sparse within the PV study areas. At least half of the surface area of Maxwell PV A was comprised of old agricultural lands which had been thoroughly ploughed and appeared devoid of archaeology – none would be expected in this sand which also lacks gravel. However, in the west of Maxwell PV A there were four scatters of Stone Age artefacts associated with the margins of the small pan and the low sand dune to its south. In the east of Maxwell PV A several LSA bedrock grinding grooves were found on the low rocky hill at waypoints 872 to 874 (Figure 8.35 a & b). These may have been used for grinding seeds. They are not very old because they have yet to develop patina and there were no associated artefacts though. In the area to the south of Maxwell PV A and

[8] Rossouw, 2016

within the EGI corridor, along the edge of the large pan, there were many thousands of stone artefacts dating to the MSA and LSA (Figure 8.34 a & b). Although in poor (eroded) context, they still have scientific value in the technological information they can provide.

a) **b)**

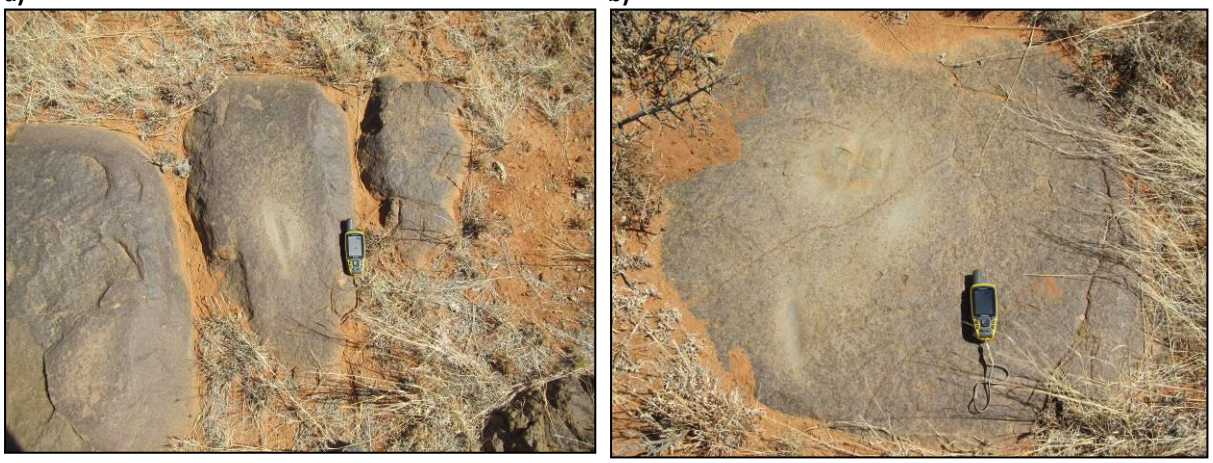

Figure 8.34: a) A grinding groova at Waypoint 872; and b) Grinding grooves at Waypoint 874.

a) **b)**

Figure 8.35: a) Stone artefacts from Waypoint 888 [scale is in cm]; and b) The ground surface at way The ground surface at Waypoint 895 – all the dark spots are stone artefacts.

A very interesting find was made at waypoint 907 to the east of the large pan but within the EGI corridor. It was a small boulder with three 'cupules' ground into it (Figure 8.36). That these are not recent is betrayed by the fact that their inner surfaces are well patinated, having taken on the same colour weathering rind as the rest of the boulder. Such finds are unusual but are known to occur on small, vertical rock faces in the Northern Cape (Orton & Webley 2012). The cupules are clearly older than the grinding grooves described above.

Figure 8.36: Small boulder with three ground cupules in it at Waypoint 907 [Scale in 5 cm intervals].

Historical archaeological residues were also found. These included ruined stone kraals (Figure 8.37 a & b), farm houses (Figure 8.38 a & b) and various other smaller foundations. Most stonework was constructed using dolerite boulders, although calcrete was also used. The two materials were generally used within the same wall. None of these resources has high significance but their preservation as part of the cultural landscape is advisable. There were also some light scatters of artefacts and a domestic ash dump. They contained glass, metal and ceramics and are not important – they generally seemed to contain 20th century materials (Figure 8.38 c).

a)

b)

Figure 8.37: a) The ruined stone kraal at Waypoint 870. Inset shows the plan view; and b) Stone kraal at Waypoint 897.

Figure 8.38: a) Ruined farm house at Waypoint 886. A modern shed stands to the right; b) Ruined stone house at Waypoint 900; and c) Artefacts from the ash heap at Waypoint 899 [scale in cm].

8.7.1.3 Graves

A number of graves and graveyards were located within the EGI corridor, with some being in PV Maxwell PV A. Some graves were formalised, clustered and fenced into small graveyards (Figure 8.39 a & b), while others were informal and isolated (Figure 8.39 c). In one instance a graveyard contained mostly informal graves and was unfenced, although a few remnant fence poles were present (Figure 8.39 d). This graveyard lies right in the south-eastern corner of the Maxwell PV A footprint, while two isolated graves lie to the northwest in Maxwell PV A. A small graveyard to the east of the large pan has formal graves but some of its headstones have been vandalised. A single grave nearby is also fenced. The grave is stone-built but it has a cement headstone which may be recycled. It is in very poor condition but appears to have had a skin of cement (which has now peeled off) placed over the original face. Both surfaces have engraved writing on them but their condition is poor. A further graveyard was reported by another specialist in the grass to the north of the pan in the Maxwell PV A site. It consisted of six stone-built graves in a line, each with a headstone. A possible grave was located in Maxwell PV B but its lack of structure makes this unlikely. It was comprised of a loose pile of calcrete blocks.

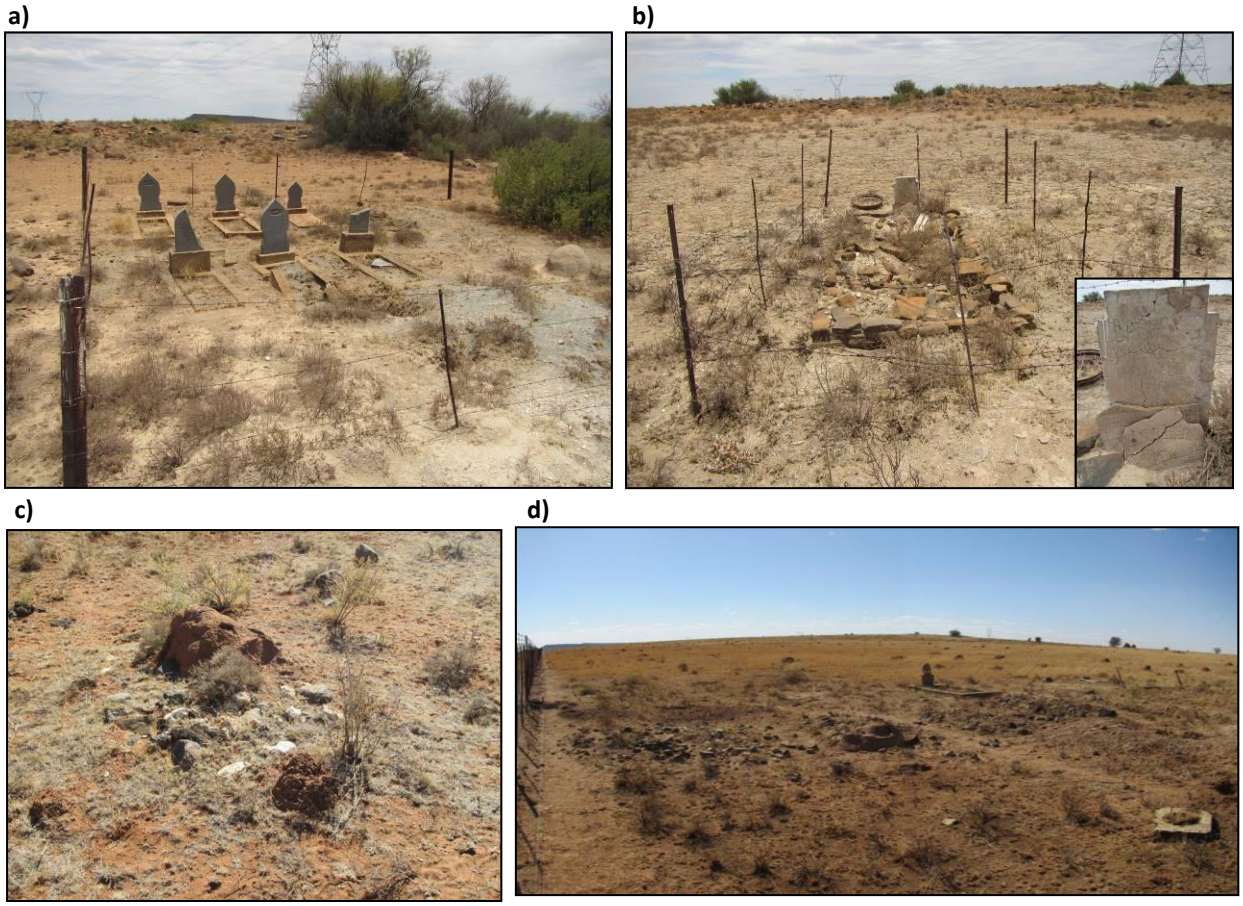

Figure 8.39: a) Small graveyard at Waypoint 912 to the east of the large pan; b) Single formal grave at Waypoint 910 to the east of the large pan; c) Isolated grave at Waypoint 881 located close to other historical features [Note the apparent head- and footstones are actually termite mounds]; and d) Unfenced graveyard at Waypoint 883 in the middle of the EGI corridor.

8.7.1.4 Built environment

No standing heritage buildings were located within the study area. Two stone-built dams were located, one immediately outside the Faraday footprint (Figure 8.40) and the other immediately outside of it in the southwest and the third within the western part of Maxwell PV A alongside what is assumed, from the vegetation pattern evident on aerial photography, to be a spring. The latter one was heavily silted up. The age of these features is unknown but they almost certainly predate the easy access to round concrete reservoirs. They are not significant.

Figure 8.40: Stone dam a Waypoint 929.

8.7.1.5 Cultural landscape

The cultural landscape is generally related to agriculture and grazing, with farm fences, tracks and occasional tree lines and clusters being the main tangible evidence of this landscape. The feeling of serenity created by the openness also contributes to the character of the landscape. However, the addition of many power lines and the two large substations has introduced an industrial element to the landscape. In the northern part of the EGI corridor was a gum tree-lined avenue leading into the farm Cornelia (Figure 8.41 a), while to its east alongside the large pan and falling within the EGI corridor was a large cluster of gum trees marking the site of an old farm complex (Figure 8.41 b). In the far west of Maxwell PV A there is a wind pump with a stone dam, a small concrete reservoir and a cluster of trees alongside the presumed spring. These features also form part of the cultural landscape.

a)

b)

Figure 8.41: a) Gum tree-lined avenue leading into Cornelia located at Waypoint 871; and b) Gum tree cluster around the old farm complex on Modderpan in the vicinity of Waypoint 913.

8.7.3 Statement of significance

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

- The palaeontological resources are considered to be of generally low significance for their scientific value, although the possibility of highly significant, but very localised palaeontological resources does exist.
- The Stone Age archaeological resources mostly have low-medium cultural significance for their scientific value, but a few resources related to the historical farm complexes are of medium significance for their architectural, historical, scientific and social values.
- The graves are deemed to have high cultural significance for their social value.

- The built environment resources (stone dams) have low cultural significance for their historical value.
- The cultural landscape is considered to be of low-medium cultural significance for its aesthetic values.

8.7.4 Summary of heritage indicators and provisional grading

The Faraday Maxwell PV A PV area has many heritage resources on it. While most are not problematic, the graveyard and two isolated graves in the east are significant. There is also a possible, but unlikely, grave in the western part. The Maxwell PV B area, on the other hand, has no significant heritage resources in it. Issues within the EGI corridor include the gum tree-lined avenue in the north, the ruined farmhouse in the southeast, Stone Age and historical archaeology, a rock art site and the various graves and graveyards. Because of their condition, the majority of these resources are suggested to be Grade 3C, while other resources recorded but not listed here are regarded as ungradable. Only the graveyards are considered to be Grade 3B resources.

8.7.5 Issues, risks and impacts

8.7.5.1 Summary of issues identified during the Scoping Phase

The potential heritage issues identified during the scoping phase of this EIA process include:

- Destruction or disturbance of fossils occurring in potentially fossiliferous geological units;
- Destruction or disturbance of MSA and LSA stone artefact scatters; and
- Destruction or disturbance of LSA engravings on dolerite boulders;
- Destruction or disturbance of historical buildings and ruins
- Destruction or disturbance of graves and graveyards; and
- Destruction or disturbance of living heritage sites.

No formal consultation was carried out specifically for the purposes of the heritage impact assessment because all studies were covered by the PPP. The CSIR conducted a joint PPP for all five proposed PV developments. The comments received that are of relevance to this HIA are indicated in Table 8.38.

Table 8.38: Heritage-related comments and responses trail. Comments responded to by the appointed specialist, Jayson Orton.

Comment	Commenter	Response
Noted the need for an HIA.	Yolisa Kupiso (Environmental Management office: Lejweleputswa District Municipality)	An HIA has been conducted.
Violation of graves on Doornhoek - Anglo Boer War graves of British soldiers will be impacted in the process.	Anna Jacobs (Neighbouring landowner)	Not relevant to the Faraday PV project and the graves lie at the opposite end of the Doornhoek farm to where the EGI corridor runs.
Noted potential sensitivity related to palaeontological and archaeological resources and requested specialist studies of these aspects.	SAHRA (commenting heritage authority)	These have been included in the present HIA.

8.7.5.2 Sensitivity of the site in relation to proposed activity

The site is sensitive for the heritage resources on its surface and potentially underground that would be damaged or destroyed through construction related activities. These include site preparation and all works related to installation of the project components.

8.7.5.3. Identification of potential impacts/risks

After the field study conducted during the EIA Phase of the project, it was possible to eliminate impacts to built environment resources and living heritage from the list of potential issues because they were found to not be relevant to the present study area. No further potential impacts were noted during the fieldwork.

The potential impacts identified during the EIA assessment are:

Construction Phase

- Potential impacts to palaeontological resources;
- Potential impacts to archaeological resources;
- Potential impacts to graves (direct and indirect); and
- Potential impacts to the cultural and natural landscape.

Operational Phase

- Potential impacts to the cultural and natural landscape; and
- Potential impacts to graves (indirect).

Decommissioning Phase

- Potential impacts to the cultural and natural landscape; and
- Potential impacts to graves (indirect).

Cumulative impacts

- Potential impacts to palaeontological resources;
- Potential impacts to archaeological resources;
- Potential impacts to graves; and
- Potential impacts to the cultural and natural landscape.

8.7.6 Impact assessment

All five aspects of heritage under consideration here could be affected during the construction phase. Only graves and the cultural landscape are deemed to be vulnerable to impacts during operation and decommissioning.

8.7.6.1 Potential impacts during construction phase

Aspect/Activity	**Palaeontological Resources/Construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	There is the potential that palaeontological resources located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. The PV facility footprint has moderate sensitivity, while in the EGI corridor the possibility exists that a pylon could be located within a locally sensitive geological feature (pan dune or spring deposit). Because the EGI corridor is more sensitive, the ratings reflected here refer to it rather than to the less sensitive PV layout area.

Aspect/Activity	**Palaeontological Resources/Construction of surface infrastructure and preparation**
Mitigation Required	A palaeontologist should: • inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work; • conduct a site inspection once the final layout has been determined in order to ascertain whether there are sensitive spring deposits and/or pan dunes that might require monitoring or mitigation; Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to sites not falling within the study area.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	No
Conditional Authorisation	A palaeontologist should be appointed to: • Appraise the final development footprint and, if necessary, suggest any further measures that may be required to mitigate potential impacts; • Inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work

Aspect/Activity	**Archaeological Resources/Construction of surface infrastructure and preparation**
Type of impact	Direct
Potential Impact	There is the potential that archaeological resources located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. In general, most impacts would occur through construction of the PV facility because the disturbance footprint for the transmission lines would be very small in comparison, although a pylon footing located within an important archaeological site could have significant impacts.
Mitigation Required	The ideal is for all impacts to be avoided during construction with buffers of 20 m from all GPS co-ordinates being applied; • If avoidance is not possible then mitigation should be carried out by a professional archaeologist prior to the commencement of construction. For stone artefact scatters this would involve excavating and collecting samples from the scatters, while for ruined structures it would involve measured drawings to record the structures and compiling detailed photographic records of them. Sites marked "AVOID" should be avoided, while those with "AVOID or …" should be avoided if possible but mitigation as indicated is an acceptable alternative); • Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to sites not falling within the study area.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	No
Conditional Authorisation	•Any significant archaeological sites that cannot be avoided with a buffer of at least 20 m should be mitigated well in advance of the start of construction. It should be noted that it is permissible for transmission lines to span archaeological sites, but any associated service roads and the facility access roads must avoid them. •If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution. •All construction and operation activities must take place within the authorised construction footprint so as to minimise damage to nearby heritage resources.

Aspect/Activity	**Graves / Earthworks and other construction activities**	
Type of impact	Direct	
Potential Impact	There is the potential that any graves located within the final development footprint could be directly and negatively impacted during earthworks and other construction activities. The greatest potential for impacts is through construction of the transmission lines, since all the graves recorded lie within the transmission corridor	
Mitigation Required	•The ideal is for all impacts to be avoided during construction with buffers of at least 5 m from all graves being applied; •If avoidance is not possible then exhumation should be carried out by a professional archaeologist prior to the commencement of construction and under any stipulations that SAHRA might make. It is likely that a public consultation process would be required because of the high likelihood of identifying relatives of the deceased; •Once construction commences then all aspects of the project should be carried out within the approved footprint so as to avoid impacts to graves not falling within the study area.	
Impact Significance (Pre-Mitigation)	**Faraday PV A**	4 (very high negative)
	Faraday PV B	2 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)	
I&AP Concern	Yes	
Conditional Authorisation	•All construction and operation activities must take place within the authorised construction footprint so as to minimise damage to nearby heritage resources. •All graves should be avoided with a buffer of at least 5 m •If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.	

8.7.6.1 Potential impacts during all phases

Aspect/Activity	**Cultural and natural landscape/Establishment of infrastructure**
Type of impact	Direct
Potential Impact	There is the potential that the cultural and natural landscape could be directly and negatively impacted during earthworks and other construction activities because of the introduction of industrial activities to the rural landscape. Both the PV facility and transmission lines and substations would introduce impacts.
Mitigation Required	Make use of neutral, earthy coloured paint on the built elements of the facility so as to reduce the degree of contrast in the landscape.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	Yes
Conditional Authorisation	•Neutral/earth coloured paint should be used on the built elements of the project so as to reduce the visual contrast in the landscape.

Aspect/Activity	**Graves/Staff presence**
Type of impact	Indirect
Potential Impact	There is the potential that any graves located outside of but close to the final development footprint could be indirectly and negatively impacted by workers wandering off site and vandalising the graves or applying graffiti to them.
Mitigation Required	The site should be fenced and once construction commences all aspects of the project should be carried out within the approved footprint so as to avoid impacts to graves

Aspect/Activity	Graves/Staff presence
	not falling within the study area.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes
Conditional Authorisation	•All construction and operation activities must take place within the authorised construction footprint so as to minimise damage to nearby heritage resources.

8.7.6.1 Permit requirements

The NHRA does not require the developer to obtain permits prior to construction. However, any archaeological or palaeontological mitigation work (i.e. test excavations, sampling etc.) that may be required (either before development commences or in the event of archaeological resources or graves of significance are found within the development footprint during construction) would need to be conducted under a permit issued to, and in the name of, the appointed archaeologist or palaeontologist. The permit application process allows the heritage authorities to ensure that a suitably qualified and experienced archaeologist or palaeontologist undertakes the work and that the proposed excavation/sampling methodology is acceptable.

Table 8.39: Heritage: Impact assessment summary table – Construction Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures		Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
											Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS														
Clearing of site	**Destruction of palaeontological resources**	Negative	Local	Permanent	Substantial	Unlikely	Non-reversible	Irreplaceable	➢ A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work; and ➢ Appoint a palaeontologist to check for sensitive features prior to construction.		Moderate	Very low	5	High
Clearing of site	**Destruction of archaeological resources**	Negative	Site	Permanent	Moderate	Very likely	Non-reversible	Irreplaceable	➢ Avoid sites with a buffer of 20 m from GPS co-ords; or ➢ Archaeological excavation to be undertaken by a professional archaeologist; and ➢ Ensure all works occur inside approved development footprint.		Low	Very low	5	High
Clearing of site	**Destruction of graves**	Negative	Site	Permanent	Extreme	Very likely	Non-reversible	Irreplaceable	➢ Avoid graves with a buffer of at least 5 m from actual graves.	Faraday PV A	Very High	Very low	5	High
				Permanent	Extreme	Very unlikely	Non-reversible	Irreplaceable		Faraday PV B	Low	Very low	5	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Clearing of site and construction of facility	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	➢ Use earthy-coloured paint on built elements; and ➢ All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High
CONSTRUCTION PHASE INDIRECT IMPACTS													
Workers wondering off site	**Damage to graves**	Negative	Site	Permanent	Moderate	Unlikely	Non-reversible	Irreplaceable	➢ Ensure that construction footprint is fenced and that workers are not allowed off site.	Low	Very low	5	High

Table 8.40: Heritage: Impact assessment summary table – Operation Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERTATION PHASE DIRECT IMPACTS													
Operation of facility	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	➢ All staff and vehicles to remain in authorised project footprint	Low	Low	4	High
OPERATION PHASE INDIRECT IMPACTS													
Staff wondering off site	**Damage to graves**	Negative	Site	Permanent	Moderate	Extremely unlikely	Non-reversible	Irreplaceable	➢ Ensure that PV footprint is fenced and that staff are not allowed off site	Very low	Very low	5	High

Table 8.41: Heritage Impact assessment summary table – Decommissioning Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE DIRECT IMPACTS													
Removal of facility (i.e. construction vehicles, etc.)	**Alteration of the cultural and natural landscape**	Negative	Local	Long term	Moderate	Very likely	High	Moderate	➢ All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High
DECOMMISSIONING PHASE INDIRECT IMPACTS													
Workers wondering off site	**Damage to graves**	Negative	Site	Permanent	Moderate	Extremely unlikely	Non-reversible	Irreplaceable	➢ Ensure that PV footprint is fenced and that staff are not allowed off site.	Very low	Very low	5	High

Table 8.42: Heritage: Impact assessment summary table – Cumulative impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DIRECT CUMULATIVE IMPACTS													
Clearing of site	**Destruction of palaeontological resources**	Negative	Local	Permanent	Substantial	Unlikely	Non-reversible	Irreplaceable	➢ A palaeontologist should inspect the pre-construction geotechnical report to evaluate potential impacts to the Ecca Formation and the need for any further work; and ➢ Appoint a palaeontologist to check for sensitive features prior to construction.	Moderate	Very low	5	High
Clearing of site	**Destruction of archaeological resources**	Negative	Local	Permanent	Moderate	Very likely	Non-reversible	Irreplaceable	➢ Avoid sites with a buffer of 20 m from GPS co-ords; or ➢ Archaeological excavation to be undertaken by a professional archaeologist; and ➢ Ensure all works occur inside approved development footprint.	Low	Very low	5	High
Clearing of site	**Destruction of graves**	Negative	Site	Permanent	Extreme	Very unlikely	Non-reversible	Irreplaceable	➢ Avoid graves with a buffer of at least 5 m from actual graves.	Low	Very low	5	High
Clearing of site and construction of facility	**Alteration of the cultural and natural landscape**	Negative	Regional	Long term	Substantial	Very likely	High	Moderate	➢ Use earthy-coloured paint on built elements; ➢ All staff and vehicles to remain in authorised project footprint.	Low	Low	4	High

8.8 Visual landscape character[9]

8.8.1 Findings of the Visual Impact Assessment Study

8.8.1.1 Visual exposure

Residents and Viewpoints on Surrounding Farms

Viewpoints and buildings on immediately neighbouring farms will potentially be highly exposed to the development (Figure 8.42). 26 buildings will potentially be highly exposed to the development at Option A while 10 buildings will be highly exposed to a PV Plant at Option B (Table 8.43). Not all of these are necessarily residences and can also represent other farm buildings or derelict buildings.

Visual exposure to transmission lines in the proposed corridor will be high for the properties they pass through. There are 23 buildings in moderate visual exposure areas and none in high visual exposure areas of the viewshed (Figure 8.43)

Table 8.43: Number of buildings and their potential visual exposure rating within 10 km of Faraday PV.

Site	Low	Medium	High
Faraday PV Option A	54	18	26
Faraday PV Option B	29	15	10

Residents and viewpoints in protected areas

The nearest protected area (game farm on Mierdam[10]) is more than 5 km from Option A and will experience low visual exposure to the proposed PV Plant at this site, but will have areas of high visual exposure to a PV Plant at Option B. Other known protected areas in the region are more than 10 km from the proposed site. Visual exposure to the transmission lines will also be low since the game farm is more than 2.5 km of the proposed powerline corridor.

Motorists

Motorists using the R64 will be highly exposed to the proposed facility at site Option A for approximately 6.5 km (4 minutes at 100 km/h), although there are sections of the road within this high visual exposure area where trees and high bush adjacent to the road will limit visibility of the development. Motorists on the R64 will experience moderate to low visual exposure to a PV plant at Option B (the road is approximately 3 km from the site).

A 4.6 km section of the R64 will potentially be highly exposed to transmission lines in the proposed corridor and motorists will spend approximately 3 minutes (at 100 km/h) in this section.

[9] Holland, 2016.

[10] Please note the farm Mierdam 638/0 and 638/1 is not a proclaimed or registered protected area as per the South African Protected Areas Database (DEA, 2016).

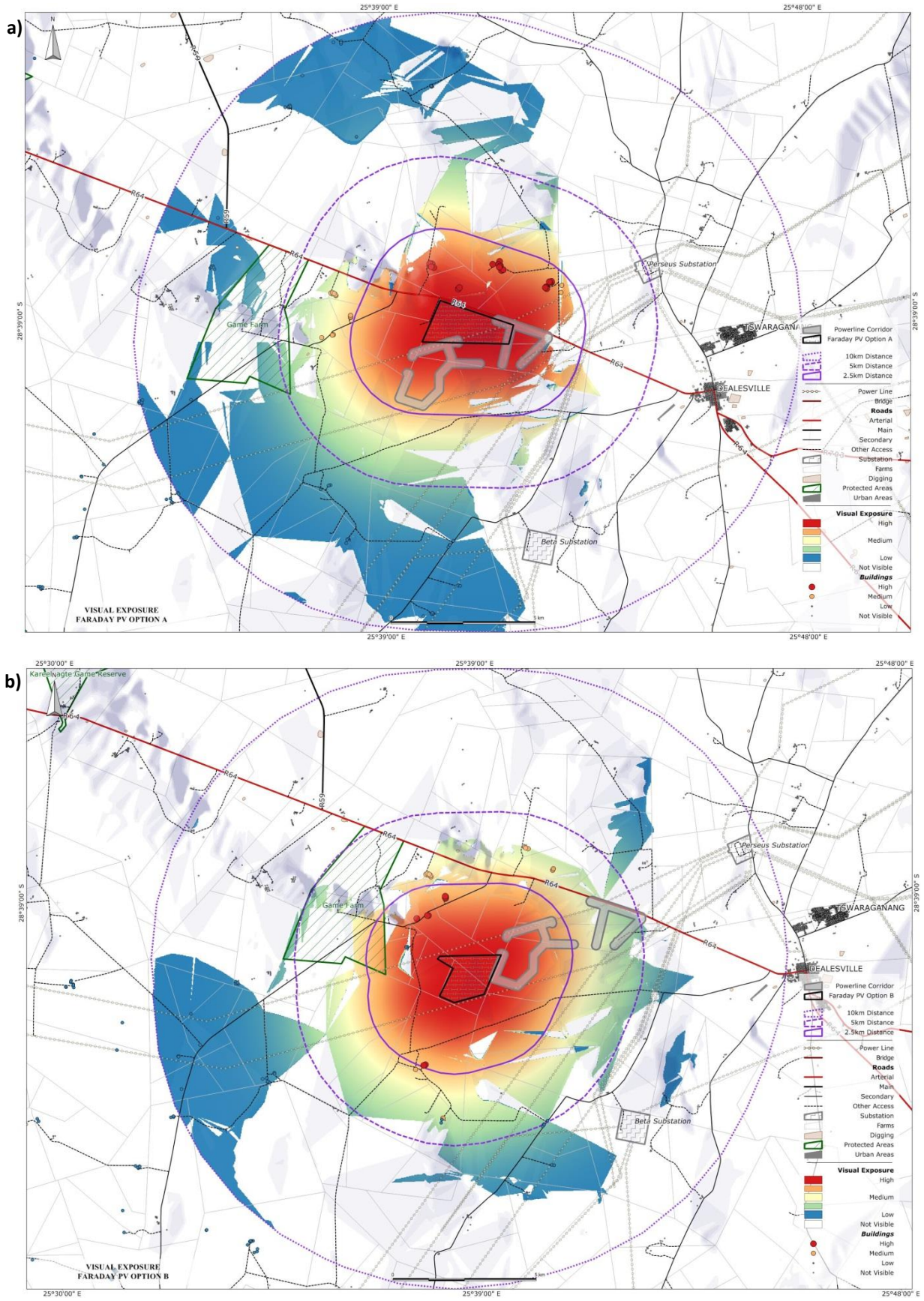

Figure 8.42: Visual exposure for sensitive visual receptors within 10 km of a) Faraday PV A; and b) Faraday PV B.

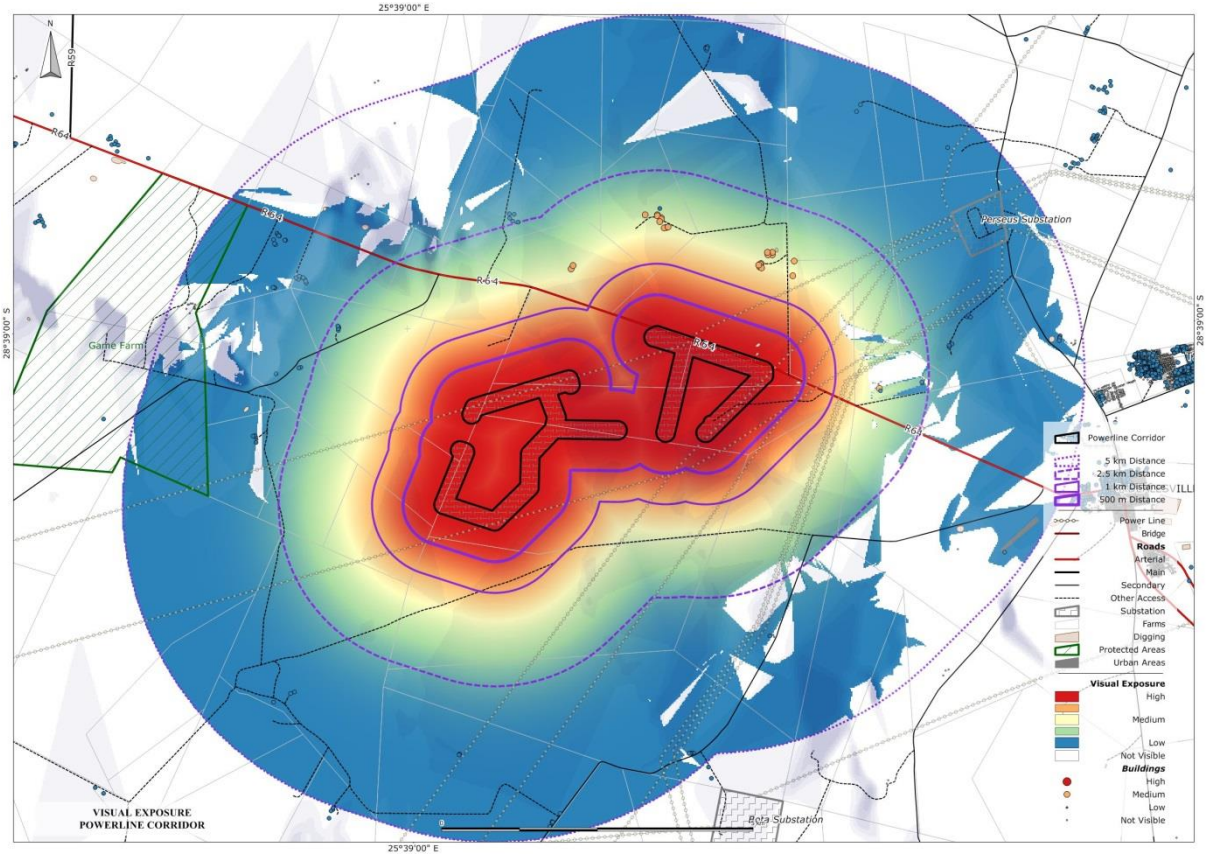

Figure 8.43: Visual exposure map for transmission lines in the proposed powerline corridor (within 5 km of the corridor).

8.6.1.1 Visual intrusion

Photographic Survey

Sites from which landscape photographs were taken are shown in Figure 8.45. Sites with the prefix 'DVP' refers to a photographic survey done in October 2014 for a different project in the same region, while '29VP' refers to the survey done in January 2016 for this project. The discussion below refers to photograph sites on the map.

The landscape surrounding the proposed PV plant site is agricultural with stock farming the predominant land use. It is not pristine wilderness and the natural landscape has been affected by grazing as well as a number of man-made structures not normally associated with agricultural landscapes. These include a large network of transmission lines and two large substations (

Figure 8.44). There are very few views that do not include a number of transmission lines and many powerline pylons.

Residents and Viewpoints on Surrounding Farms

Views from neighbouring farms contain many transmission lines and powerline pylons, and often also one or two large substations. The potential for scenic views of rural agricultural landscape is very low and it is unlikely that these farms have scenic views (where a scenic view is defined as

"providing or relating to views of impressive or beautiful natural scenery"[11]). Visual receptors in high visual exposure areas are already likely to also be highly exposed to several transmission lines and are likely to have at least one substation in their views. Most farmsteads with high visual intrusion ratings are surrounded by tall trees which will limit visibility of the proposed development. Visual intrusion ratings are therefore low for potentially affected visual receptors.

Visual intrusion of construction activities related to the solar energy facility will be moderate since large construction vehicles and equipment will be visible and active in relatively quiet areas. An increase in workers will be noticeable, as will areas cleared of vegetation (although these will be similar to areas cleared and ploughed for crops).

Construction activities associated with transmission lines are likely to cause low visual intrusion since the activities will be familiar to visual receptors in the surrounding landscape. Construction of transmission lines will not seem out of place in the area.

Residents and Viewpoints in Protected Areas

Views towards the proposed development will contain many transmission lines, pylons and are likely to also include at least one substation. It is therefore unlikely that visitors to the protected areas are attracted by the landscape or scenic views (unless there are views away from transmission lines, in which case these views will also be in a direction away from the proposed development). The development is therefore unlikely to intrude on views valued for their scenic beauty and, since it is located among several transmission lines, the visual intrusion on existing views is rated as low. Similarly, the visual intrusion for transmission lines in the powerline corridor is also expected to be low since power lines will fit into the existing landscape.

Visual intrusion of construction activities related to the solar energy facility will be moderate – similar to that for surrounding residents. Visual intrusion of construction activities related to transmission lines in the proposed powerline corridor will be low since it will be a familiar component of the landscape.

Motorists

Motorists using the R64 will be in close proximity to many transmission lines and large pylons when they are in high visual exposure sections of the road. The severe negative impact of the existing electrical infrastructure on views from the road indicates that the visual intrusion of the proposed development on motorists will be low.

Motorists will pass in close proximity to the proposed site and construction activities, vehicles and structures will be clearly noticeable. Visual intrusion will therefore be moderate for the solar energy facility. The large number of existing transmission lines to which motorists are already highly exposed to indicates that construction activities associated with transmission lines will not be incongruent with the existing landscape and visual intrusion is expected to be low.

[11] Definition in Oxford Dictionary: http://www.oxforddictionaries.com/definition/english/scenic

Figure 8.44: View towards Faraday PV a) south-east from photo site 29VP10 (300 m from Option A); b) south from photo site 29VP10 (3 km from Option B); c) south-west from photo site DVP007 (100 m from Option A and 3 km from Option B) across site Option A towards Faraday PV Option B; d) east from photo site 29VP05 (3 km from Option A and 6 km from Option B); e) north from photo site DVP029 (approximately 7 km from Option B and 9 km from Option A); and f) south-west from photo site DVP006 (3 km from Option A and 6.5 km from Option B).

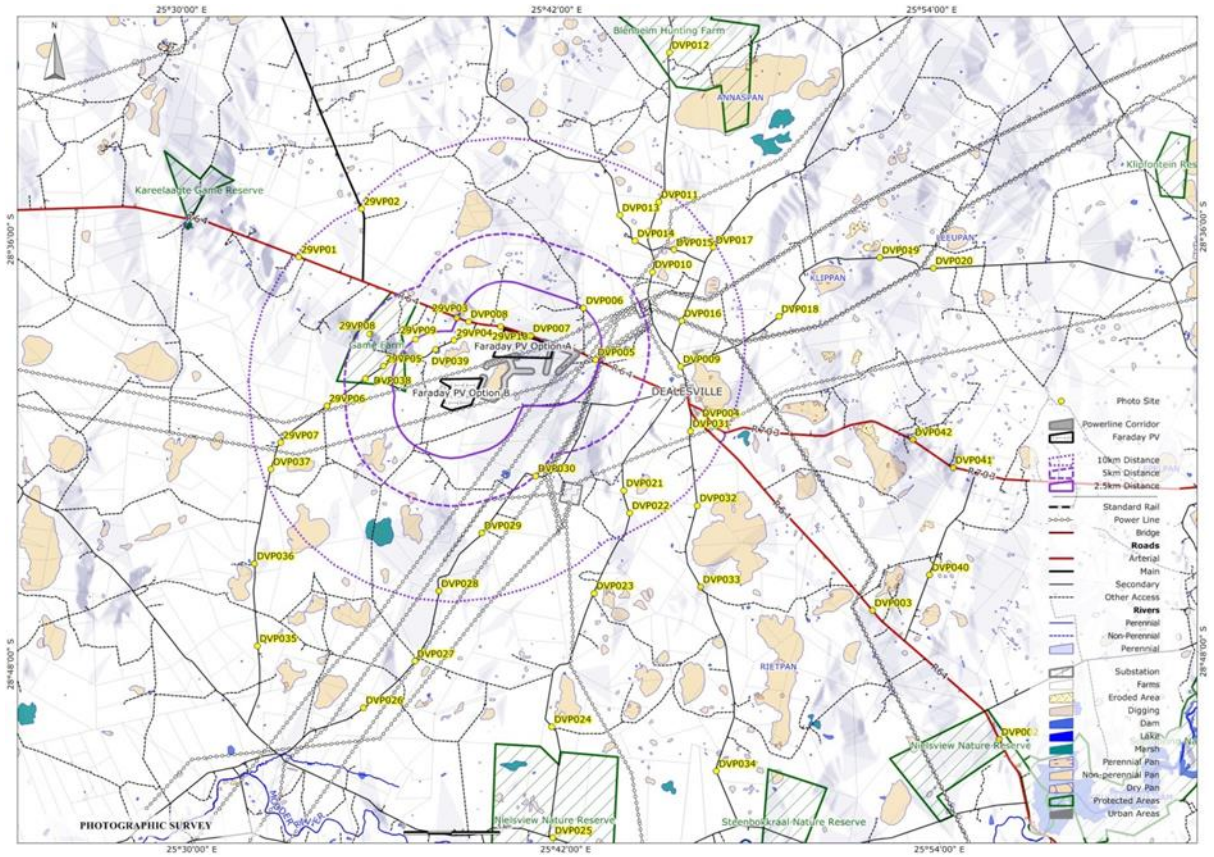

Figure 8.45: Sites visited during photographic survey (DVP - October 2014; 29VP – January 2016)

8.8.2. Issues, risks and impacts

8.8.2.1 Summary of issues identified during the Scoping Phase

The potential visual issues identified during the Scoping Phase of this EIA Process include:

- Construction Phase: Visual intrusion of construction activities on existing views of sensitive visual receptors in the surrounding landscape.
- Construction Phase: Visual intrusion of a large area cleared of vegetation on the existing views of sensitive visual receptors;
- Construction Phase: Visual impact of night lighting during the construction phase on the nightscape of the region;
- Operational Phase: Landscape impact of introducing a large solar plant into a remote rural landscape;
- Operational Phase: Visual intrusion of a large solar field on the existing views of sensitive visual receptors;
- Operational Phase: Visual intrusion of tall, relatively large structures on the existing views of sensitive visual receptors; and
- Operational Phase: Visual impact of night lighting of the proposed development on the relatively dark rural nightscape.

Table 8.44: Visual-related comments and responses trail. Comments responded to by the appointed specialist, Henry Holland.

Comment	Commenter	Response
Impact on neighbouring farms: landscape; view	Pieter Vermeulen(Neighbouring landowner)	The potential impacts on landscape and sensitive visual receptors (including neighbouring farms) are discussed in this Chapter.
Reflection/glare	Jack Amour (Freestate Agri)	It is important to note that the anticipated glare produced by the solar PV panels will not exceed the Standard Industry Norm generally accepted throughout South Africa. The glass used in the manufacture of PV panels is designed to maximise the absorption of light (to improve the energy efficiency of the panels) and minimize reflection and glare. PV panels are less reflective than water and it is therefore not anticipated to influence train drivers and users of the TFR Service Road. Many airports in Europe and the United States of America have installed solar fields on airport building roofs and glare has not been an issue for pilots using these airports.
Aesthetics	Gerhard van Rhyn (Neighbouring landowner)	The potential impacts on landscape and sensitive visual receptors (including neighbouring farms) are discussed in this Chapter.
The panels must be positioned so as not to have one panel in the shadow of another. This makes the development even more visible. At certain times of the day, the reflection is high making the development visually disturbing. Night lighting also makes the area more visible.	Gerhard van Rhyn (Neighbouring landowner), with support from Gert Jonker, Annetjie Jacobs, Kobus van Staden, Wouter de Vos, Ivan Stevens & E. Stevens, G.P. Van Straaten	The potential visibility of the project is discussed in Section 8.6.3.4 below and the potential visual impact on the existing views of sensitive visual receptors is assessed in this Chapter. The potential impact of night lighting of the proposed facility is assessed in this Chapter.
It is an unsightly development.	Gert Jonker (Neighbouring landowner)	The potential impacts on landscape and sensitive visual receptors (including neighbouring farms) are discussed in this Chapter.
A game farm which also promotes eco-tourism, cannot be judged in isolation. The general appearance of the surrounding areas plays a role in the rating of a game farm, which was one of the original reasons for the acquisition of the farm.	Gerhard van Rhyn (Neighbouring landowner)	The existing landscape contains two large substations and a large network of high voltage transmission lines with tall, highly visible pylons/towers. The scenic potential for the region surrounding Dealesville has been severely impacted by these structures.
Bright lights shining all night, clearly visible from everywhere.	Gerhard van Rhyn (Neighbouring landowner)	The potential impact of night lighting of the proposed facility is assessed in this Chapter.

8.8.2.2 Sensitivity of the site in relation to proposed activity

The visibility of the proposed Faraday PV project is high in terms of viewshed area (140 km2 and 120 km2 within 10 km of Option A and B respectively). The viewshed of the transmission line corridor is approximately 140 km2 within a 5 km radius. The existing vegetation will have a screening effect in some areas but the actual viewsheds are likely to be very similar to the calculated viewsheds. There are 98 buildings in the viewshed for Option A and 54 for Option B (Table 8.45). The visibility of the facility is rated as moderate for both proposed sites. The viewshed within 5 km of the transmission line corridor contains 98 buildings and the visibility of the proposed corridor is rated as moderate.

Features at risk of impact in a VIA are the landscape and sensitive visual receptors in the landscape.

Table 8.45: Viewshed sizes for Faraday PV A and B for a 10 km distance around the sites.

Site	Viewshed Size (km^2)	Number of Buildings in Viewshed
Faraday PV Option A	140	98
Faraday PV Option B	120	54

Landscape

A landscape impact occurs when a development alters the existing landscape character. If the landscape character is highly sensitive to the development type then the consequence of the impact will be high. A landscape impact of high consequence, for instance, will be highly significant if the landscape character type is scarce as well as highly valued by the community (local, regional, national and international). The landscape impact does not depend only on the existing sensitive visual receptors since it can also affect future visual receptors and communities beyond the local or regional context.

As noted above, the existing landscape character of the surrounding region is rural-agricultural with large scale electrical infrastructure in the form of a network of transmission lines and two large substations. The landscape contains transformed natural vegetation used for cattle and sheep grazing (predominantly south of the R64), interspersed with crop land used for the cultivation of maize (north of the R64). The landscape character has a low sensitivity to potential changes introduced by a solar energy facility since the landscape is significantly transformed by these components.

The viewshed maps for the proposed solar facility (Figure 8.46) show that potentially affected sensitive visual receptors are mainly limited to farmsteads, dwellings and viewpoints on farms surrounding the proposed sites. Approximately 12 km of the R64 (9 minutes at 100 km/h) will be within the viewshed for Option A while approximately 7 km (4 minutes at 100 km/h) of the R64 will be within the viewshed for Option B. The only protected area in the viewshed within 10 km of the site is the game farm on farms Mierdam 638/0 and 638/1, owned by Mr. Gert van Rhyn[12]. The farm is between 5 and 10 km from site Option A and between 2 and 5 km of site Option B. Dealesville and Tswaraganang are outside the viewshed.

Dealesville and Tswaraganang lie outside the viewshed for the solar facility but residents will potentially be able to see powerlines in the proposed corridor (Figure 8.47). The viewshed also

[12] Please note the farm Mierdam 638/0 and 638/1 is not a proclaimed or registered protected area as per the South African Protected Areas Database (DEA, 2016).

includes a number of protected areas although, apart from the game farm on Mierdam, these are more than 10 km from the corridor.

Dealesville and Tswaraganang lie outside the viewshed for the solar facility but residents will potentially be able to see powerlines in the proposed corridor (Figure 8.47). The viewshed also includes a number of protected areas although, apart from the game farm on Mierdam, these are more than 10 km from the corridor.

Sensitive visual receptors therefore include:

- Residents and viewpoints on farms surrounding the proposed site and corridor;
- Residents and viewpoints on surrounding protected areas (e.g. the game farm on Mierdam[13]); and
- Motorists using the R64 which passes in close proximity to the proposed site and powerline corridor.

Residents on surrounding farms are highly sensitive to changes in their views since they have an active interest in the landscape. Viewpoints are unlikely to be valued for their scenic views in the direction of the proposed site due to the powerlines and substations that are in most of these views.

Residents and viewpoints in protected areas are highly sensitive visual receptors since the surrounding landscape is an important aspect of their sense of place.

The R64 is a busy route between Bloemfontein and Kimberley and motorists on this route are unlikely to focus their attention on the landscape. It is not a recognized scenic route. Motorists are therefore rated as low sensitivity visual receptors.

8.8.2.3 Identification of potential impacts/risks

Construction Phase

- Potential visual intrusion of construction activities on existing views of sensitive visual receptors; and
- Potential visual intrusion of construction activities associated with transmission lines on existing views of sensitive visual receptors.

Operational Phase

- Potential landscape impact of a large solar energy facility on a rural agricultural landscape;
- Potential landscape impact of transmission lines on a rural agricultural landscape;
- Potential visual intrusion of the proposed solar energy facility on the views of sensitive visual receptors;
- Potential visual intrusion of transmission lines on the views of sensitive visual receptors; and
- Potential impact of night lighting of a large solar energy facility on the nightscape of the region.

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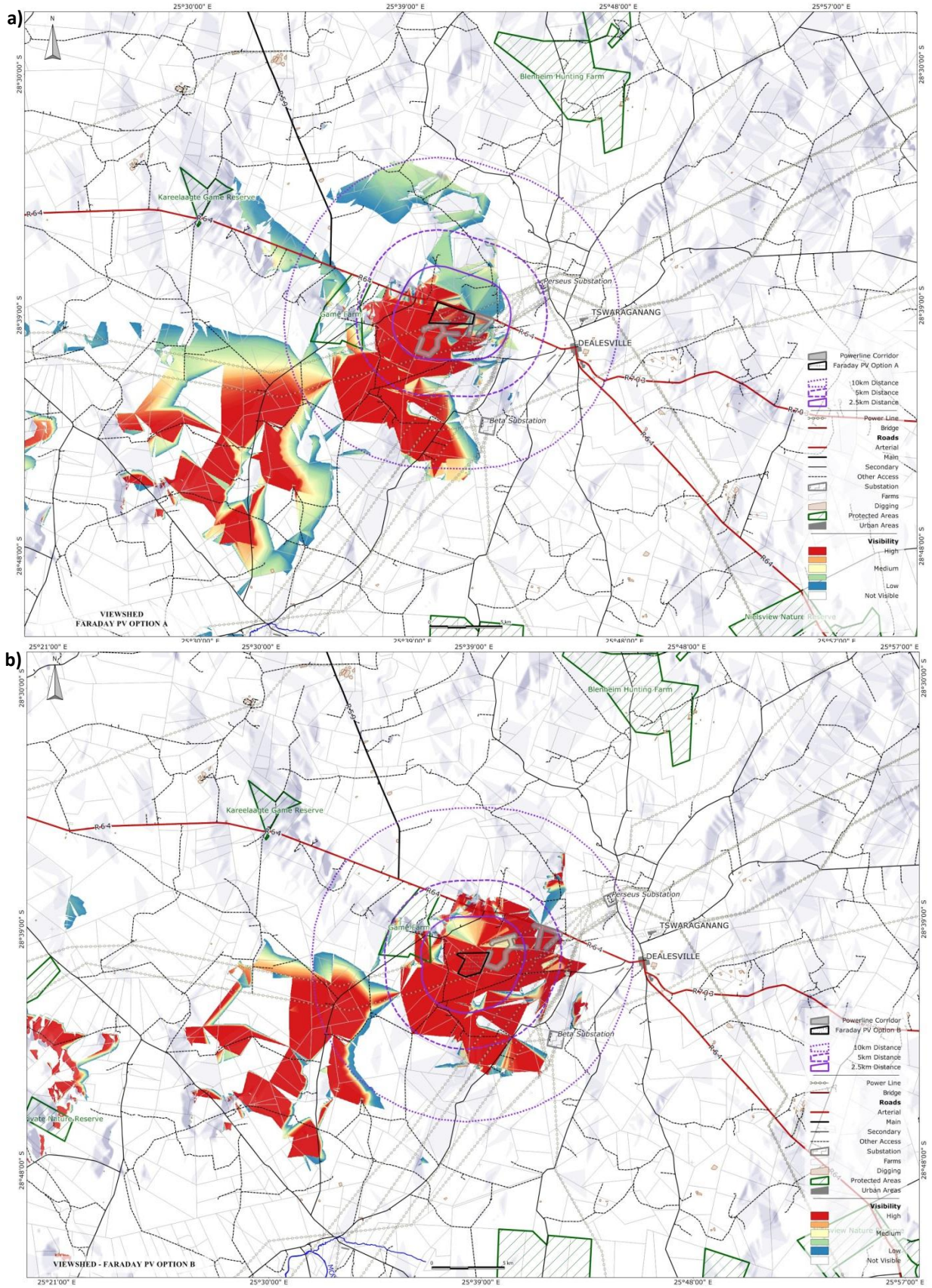

Figure 8.46: Viewshed for a) Faraday PV A; and b) Farday PV B.

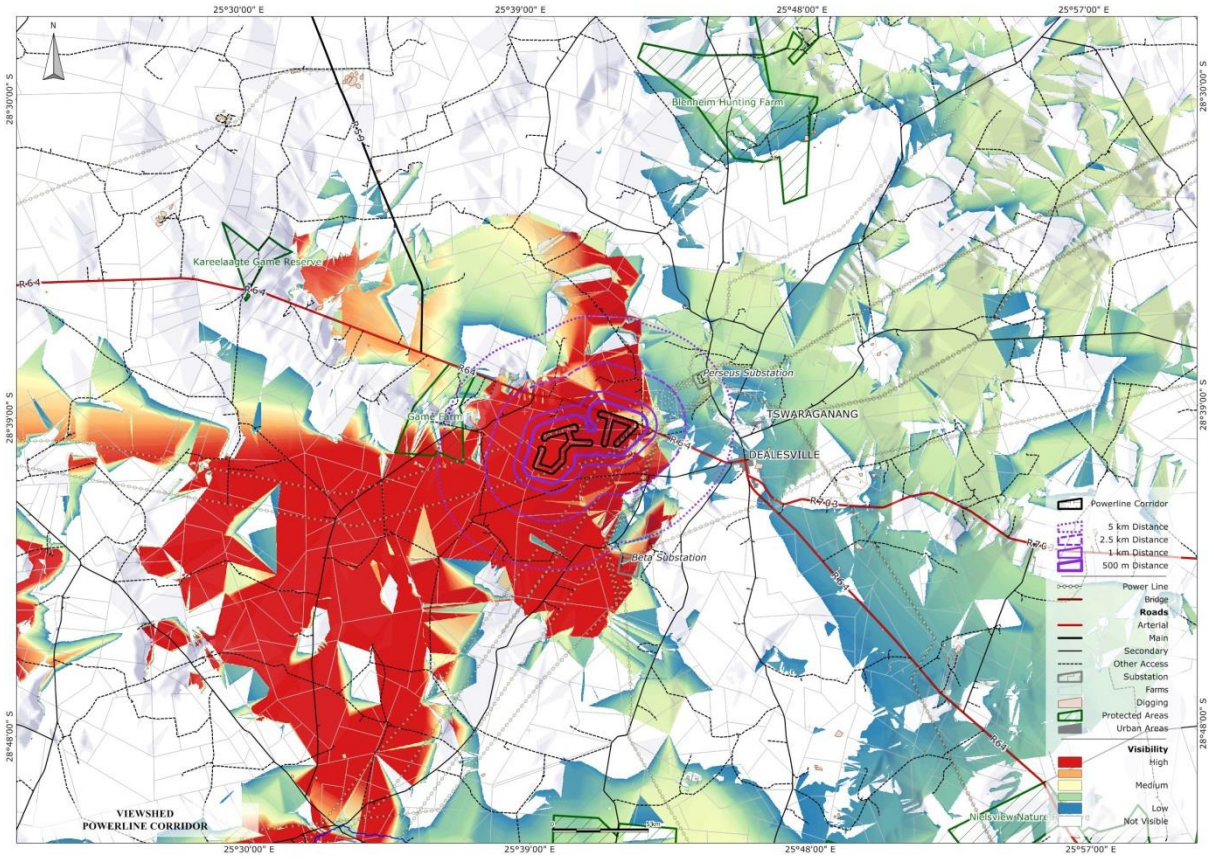

Figure 8.47: Viewshed of the proposed electricity infrastructure.

Decommissioning Phase

- Potential visual intrusion of decommissioning activities associated with the proposed solar energy facility on views of sensitive visual receptors and
- Potential visual intrusion of decommissioning activities related to transmission lines on the existing views of sensitive visual receptors.

Cumulative Impacts

- Cumulative impact of solar energy generation projects on the existing rural-agricultural landscape; and
- Cumulative visual impact of solar energy generation projects on existing views of sensitive visual receptors in the surrounding landscape.

8.8.3 Impact Assessment

8.8.3.1 Potential impacts during construction phase

Aspect/Activity	**Visual intrusion of on existing views of sensitive visual receptors / PV area construction activities**
Type of impact	Direct
Potential Impact	The spatial extent of the impact will be regional since sensitive visual receptors within 10 km of the proposed development are likely to be affected. The consequence of the impact will be substantial since construction will introduce numerous activities and elements that are incongruent with the quiet rural nature of the region and there are a number of highly sensitive visual receptors in the surrounding landscape. The impact will be of short to medium term duration since construction should be possible in 14

Aspect/Activity	**Visual intrusion of on existing views of sensitive visual receptors / PV area construction activities**
	months (the Kalkbult 75 MW plant was built in 9 months, however it is understood that the construction period is subject to the final requirements of Eskom and the REIPPPP Request for Proposal provisions at that point in time).The reversibility of the impact is rated as moderate since removing the impact will entail further (and similar) activities related to the removal of structures, soil stockpiles and vegetation heaps, and rehabilitation of areas cleared of vegetation. The irreplaceability of the visual resource is low since construction activities produce low quality visual resources. The impact status will be negative since construction is normally viewed as cluttered and untidy. The probability of the impact occurring is very likely since there are sensitive visual receptors that will be affected.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • Preparation of the solar field area (i.e. clearance of vegetation, grading, contouring and compacting) and solar field construction should be phased in a way that makes practical sense in order to minimise the area of soil exposed and duration of exposure; • Parking areas should be demarcated and strictly controlled so that vehicles are limited to specific areas only; • Night time construction should be avoided where possible; and • Night lighting of the construction sites should be minimised within requirements of safety and efficiency. The significance of the impact after mitigation will be low if mitigation measures are successfully implemented to lower the impact intensity/consequence.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	Yes

Aspect/Activity	**Visual Intrusion of on existing views of sensitive visual receptors / Electricity infrastructure construction activities**
Type of impact	Direct
Potential Impact	The spatial extent of the potential impact will be local since sensitive visual receptors further than 2 km from the proposed transmission line route will at most experience low visual exposure. The consequence of the potential impact will be moderate since construction will introduce activities and elements that are incongruent with the quiet rural nature of the region. The impact will be of very short-term duration since the proposed corridor will host at most 15 km of transmission lines. Reversibility of the impact is high and irreplaceability of visual resources low. The impact status will be negative since construction is normally viewed as cluttered and untidy. The probability of the impact occurring is likely since those highly sensitive visual receptors that may be affected are likely to be very familiar with these activities in the landscape.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • Night time construction should be avoided where possible; and • Night lighting of the construction sites should be minimised within requirements of safety and efficiency. • The significance of the impact after mitigation will remain low with the implementation of mitigation measures.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	Yes

8.8.3.2 Potential impacts during operational phase

Aspect/Activity	**Landscape impact on a rural agricultural landscape with large scale electrical infrastructure / Established large solar energy facility**
Type of impact	Direct
Potential Impact	The spatial extent of the impact will be regional since it will affect the surrounding landscape. The consequence of the impact will be slight since the landscape character is significantly impacted by the electrical infrastructure and has a low sensitivity to the proposed development. The impact duration will be long term and will cease only once the proposed PV plant has been removed from the landscape. The reversibility of the potential impact is rated as high since removal of the visible structures and rehabilitation of cleared areas will return the landscape to the current state. The irreplaceability of the landscape character type is rated as low because it is a compromised landscape and other areas where the rural agricultural landscape is less altered exist in the region. The impact status will be negative since the rural agricultural character of the landscape will be further altered with unrelated structures. The probability of the impact occurring is very likely since the change will be obvious and extensive (i.e. vegetation will be replaced with technologically complex structures).
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • A maintenance plan for buildings and structures should be followed to ensure that structures remain as non-reflective as possible, and buildings remain as unobtrusive as possible. • Maintenance of access roads should not cause further disturbance and damage to the surrounding landscape
Impact Significance (Pre-Mitigation)	5 (very low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Landscape impact on a rural agricultural landscape with large scale electrical infrastructure / Established electricity infrastructure with transmission lines**
Type of impact	Direct
Potential Impact	The spatial extent of the potential impact will be local since it is unlikely to affect the landscape beyond 2 km from the proposed transmission line route. The consequence of the potential impact will be slight since the landscape already contains a significant electrical infrastructure component. The impact will be long term and will cease only once the power line has been removed. The reversibility of the impact is high since removal of the powerlines and pylons will remove the impact. The irreplaceability of the landscape character type is low because it is a compromised landscape and other areas where the rural agricultural landscape is less altered exist in the region. The impact status will be neutral since the landscape already contains many transmission lines in close proximity to the proposed corridor. The probability of the impact occurring is probable since additional transmission lines will increase the electrical infrastructure component of the landscape.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • A maintenance plan for buildings and structures should be followed to ensure that structures remain as non-reflective as possible, and buildings remain as unobtrusive as possible. • Maintenance of access roads should not cause further disturbance and damage to the surrounding landscape

Aspect/Activity	**Landscape impact on a rural agricultural landscape with large scale electrical infrastructure / Established electricity infrastructure with transmission lines**
Impact Significance (Pre-Mitigation)	5 (very low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Visual intrusion on the views of sensitive visual receptors / Established solar energy facility**
Type of impact	Direct
Potential Impact	The spatial extent of the impact will be regional since sensitive visual receptors within 10 km of the development are likely to be affected. The consequence of the impact will be moderate since the visual intrusion on existing views will be low. The impact will be of long term duration since it will only end once the project ends and the cleared area has been rehabilitated. The reversibility of the potential impact is rated as high since removal of the visible structures and rehabilitation of cleared areas will restore views to their current state (agricultural practices in the region include crop farming where large areas are cleared of vegetation and landscaped to some extent). The visual resources of the region are already impacted by farming activities and extensive electrical infrastructure and the irreplaceability of visual resources is therefore seen as low. The impact status will be negative since highly technological structures will replace natural vegetation and familiar landscape over a relatively large area. The probability of the impact occurring is very likely since there are highly sensitive visual receptors in the surrounding landscape that will be affected.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: **Solar Arrays** • The project developer should maintain rehabilitated surfaces until a self-sustaining stand of vegetation is established and visually adapted to the undisturbed surrounding vegetation. No new disturbance should be created during operations without approval by the Environmental Officer; • Restoration of disturbed land should commence as soon after disturbance as possible; • Dust and noxious weed control should be part of maintenance activities; • Road maintenance activities should avoid damaging or disturbing vegetation; and • Painted features should be maintained and repainted when colour fades or paint flakes. **Buildings** • Appropriate coloured materials should be used for structures to blend in with the backdrop of the project where this is technically feasible and the colour or paint will not have a deleterious effect on the functionality of the structures; • Appropriate colours for smooth surfaces often need to be two to three shades darker than the background colour to compensate for shadows that darken most textured natural surfaces; • Materials, coatings and paints should be chosen based on minimal reflectivity where possible; and • Grouped structures should be painted the same colour to reduce visual complexity and contrast.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Visual intrusion on the views of sensitive visual receptors / Established electricity infrastructure**
Type of impact	Direct
Potential Impact	The spatial extent of the potential impact will be local since only sensitive visual receptors within 2 km of the proposed development are likely to be affected and there are many existing transmission lines and pylons in the same area as the proposed corridor. The consequence of the impact will be rated as slight since the visual intrusion is expected to be low. The potential impact is rated as long term duration since it will only end once the project ends. The reversibility of the potential impact is rated as high since removal of the highly visible structures of the transmission lines will reverse the impact. The landscape (or visual resources) has been severely affected by the existing transmission lines and substations and irreplaceability of the existing visual resources is therefore seen as low. The impact status will be negative since power lines detract from the scenic potential of views. The probability of the impact occurring is likely since there are motorists that will pass in close proximity to the proposed transmission line corridor.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • Where possible, the type of power line towers used for the proposed power line should be similar to existing power line towers in the landscape.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Night lighting impacts on the nightscape of the region / Established large solar energy facility**
Type of impact	Direct
Potential Impact	The nightscape in the vicinity of the proposed site is not very dark due to the bright lights of the two substations and lights at Dealesville and Tswaraganang. The proposed facility can potentially add to light pollution in the area since security and office lights will be required. The spatial extent of the impact will be local since the lights should resemble security lights at a farmstead. The consequence of the potential impact will be slight since the substation lights dominate the nightscape already. The impact will be of long term duration since it will only end once the project ends. The reversibility of the potential impact is rated as high since removal of the plant will remove all lights as well. The irreplaceability of the visual resources is seen as low since there are already similar lights in the nightscape and not many will be added. The impact status will be negative since the lights will reduce the dark nightscape further. The probability of the impact occurring is likely since there are sensitive visual receptors that will be affected.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • A lighting plan that documents the design, layout and technology used for lighting purposes should be prepared, indicating how nightscape impacts will be minimised; • The lighting plan should include a process for promptly addressing and mitigating complaints about potential lighting impacts; • Lighting of the facility should not exceed, in number of lights and brightness, the minimum required for safety and security; • Uplighting and glare (bright light) should be minimised using appropriate screening; • Low-pressure sodium light sources should be used to reduce light pollution; • Light fixtures should not spill light beyond the project boundary;

Aspect/Activity	**Night lighting impacts on the nightscape of the region / Established large solar energy facility**
	• Timer switches or motion detectors (within safety requirements) should be used to control lighting in areas that are not occupied continuously; and • Lights should be switched off when not in use whenever it is in line with safety and security.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

8.8.3.3 Potential impacts during decommissioning phase

Aspect/Activity	**Visual intrusion on views of sensitive visual receptors / Decommissioning activities associated with the proposed solar energy facility**
Type of impact	Direct
Potential Impact	The spatial extent of the impact will be regional since sensitive visual receptors within 10 km of the development are likely to be affected. The consequence of the impact will be substantial since activities similar to those during the construction phase will intrude on the quiet rural nature of the region. The impact duration should be shorter than for the construction phase (i.e. short-term). The reversibility is rated as high and irreplaceability of the visual resource is low. The impact status will be negative since this phase will be perceived as cluttered and untidy. The probability of the impact occurring is rated as very likely since there are sensitive visual receptors that will be affected.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes; • Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of indigenous species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape; • Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape; • Working at night should be avoided where possible; and • Night lighting of reclamation sites should be minimised within requirements of safety and efficiency.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	Yes

Aspect/Activity	**Visual intrusion on views of sensitive visual receptors / Decommissioning activities associated with the electricity infrastructure**
Type of impact	Direct
Potential Impact	The spatial extent of the potential impact will be local since sensitive visual receptors further than 2 km from the proposed transmission line route will at most experience low visual exposure. The consequence of the impact will be moderate since activities similar to those during the construction phase will intrude on views of sensitive visual receptors. The impact duration should be shorter than for the construction phase – very short-term. Reversibility of the impact will be high and irreplaceability of visual

Aspect/Activity	**Visual intrusion on views of sensitive visual receptors / Decommissioning activities associated with the electricity infrastructure**
	resources low. The impact status will be negative since this phase will be perceived as cluttered and untidy. The probability of the impact occurring is likely since there are very few sensitive visual receptors that will be affected.
Mitigation Required	Mitigation measures in addition to the best practice guidelines are: • Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes; • Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of indigenous species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape; • Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape; • Working at night should be avoided, where possible; and • Night lighting of reclamation sites should be minimised within requirements of safety and efficiency.
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	Yes

8.8.3.4 Cumulative impacts

Aspect/Activity	**Cumulative impact on existing rural-agricultural landscape/ Multiple established solar energy generation projects with large scale electrical infrastructure**
Type of impact	Direct
Potential Impact	The landscape is not a simple rural-agricultural landscape since it is covered in a large network of transmission lines and contains two large substations within 10 km of each other. More transmission lines are planned for the area. Several large solar energy facilities have been proposed for farms surrounding that of the site, as well as a couple further away towards Bloemfontein and Boshoff. In the event that some of them are built, large areas of natural vegetation and stock farming land will be transformed into fields covered in thousands of solar panels. Solar fields will become a common feature of the landscape and the rural-agricultural landscape character will have a significant power generation component (including the large scale electrical infrastructure). The cumulative change in landscape character from rural agricultural/electrical infrastructure to include a large power generation component will have only a slight consequence since the existing character is not representative of rural-agricultural landscapes, and there are other landscapes in the surrounding region with higher quality. These do not include electrical infrastructure of this magnitude and are more representative of rural agriculture in the surrounding region. The reduction in the existing landscape character due to solar energy facilities will be small. The spatial extent of the cumulative impact is regional (solar energy facilities up to 50 km from the proposed site are considered for the cumulative impact). The duration of the impact is rated as long term since the cumulative impact will last for as long as the solar fields are in the landscape. The status of the impact is neutral since the overall change in landscape character will not affect a highly sensitive, scarce or highly valued landscape character and the probability of it occurring is likely since there are a number of large projects proposed for the area. The significance of this cumulative impact on the landscape is rated as very low without the implementation of mitigation measures. Specific mitigation measures are

Aspect/Activity	**Cumulative impact on existing rural-agricultural landscape/ Multiple established solar energy generation projects with large scale electrical infrastructure**
	not recommended in this regard
Mitigation Required	Best practice and implementation of appropriate management and mitigation of impacts by all proposed solar energy facility
Impact Significance (Pre-Mitigation)	5 (very low negative)
Impact Significance (Post-Mitigation)	5 (very low negative)
I&AP Concern	Yes

Aspect/Activity	**Cumulative impact on existing views of sensitive visual receptors in the surrounding landscape / Multiple established solar energy generation projects with large scale electrical infrastructure**
Type of impact	Direct
Potential Impact	The original visual resources of the region under assessment were reduced by introduction of various farming practices, buildings and structures through their impact on the natural vegetation and sense of place. The introduction of a large network of transmission lines and two substations have further altered the sense of place of the region and severely reduced the opportunities for scenic views. The addition of several large fields of solar arrays and associated electrical infrastructure will affect the existing visual resources but since the visual resources are not of high quality and opportunities for scenic views are very limited the consequence of the cumulative visual impact is rated as moderate. The majority of the proposed solar projects are in close proximity to the two substations and they are generally on properties that are traversed by at least one major transmission line. Existing views towards sites proposed for solar energy facilities are already severely impacted by the existing electrical infrastructure. The spatial extent of the cumulative impact is regional. The duration of the impact is rated as long term since the cumulative impact will last for as long as the solar fields are in the landscape. The status of the impact is negative since the visual resources of the region are reduced, and the probability of it occurring is likely since there are highly sensitive visual receptors that will be affected. The significance of the cumulative impact is rated as low without the implementation of mitigation measures. Specific mitigation measures are not recommended in this regard.
Mitigation Required	Best practice and implementation of appropriate management and mitigation of impacts by all proposed solar energy facility
Impact Significance (Pre-Mitigation)	4 (low negative)
Impact Significance (Post-Mitigation)	4 (low negative)
I&AP Concern	Yes

8.8.4 Legislative and permit requirements

There are no permit requirements related to visual or landscape impacts. The following legislation and local and district municipal plans are applicable to the proposed project:

- The National Environmental Management Act (NEMA) and the Regulations in terms of Chapter 5 of NEMA. (Act No.107 of 1998);

- The Protected Areas Act (PAA) (Act 57 of 2003, Section 17) which refers to the conservation and protection of natural landscapes;
- The Free State SDF (COGTA 2014) aims to grow the Free State tourism sector, but Dealesville is not included in the tourism potential list. In its spatial plan it refers to Dealesville specifically: "P*romote the expansion of the solar energy projects at Dealesville into a solar energy hub. High Priority*". Construction of energy infrastructure should be regulated and "*carefully placed to avoid visual impacts on landscapes of significant symbolic, aesthetic, cultural or historic value and should blend in with the surrounding environment to the extent possible.";*
- Game farming is seen as a priority by the Lejweleputswa District Municipality for the Tokologo Local Municipality to boost development (Lejweleputswa DM, 2012);
- The Tokologo Local Municipality aims to explore the solar radiation potential of the region as a sustainable source of energy (CNdV 2012). Proposed solar energy facilities should minimize impact on "*tourist sensitive scenic landscapes*".

Table 8.46: Visual: Impact assessment summary table – Construction Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Visual intrusion of construction activities associated with a PV Plant on existing views of sensitive visual receptors	**Loss of visual resources**	Negative	Region	Short to Medium Term	Substantial	Very likely	High (removal of highly visible structures)	Low	➢ Phased clearing of the area for solar field in order to reduce the amount and duration of bare soil exposure.	Moderate	Low	4	High
Construction activities associated with transmission lines	**Loss of visual resources**	Negative	Local	Very Short Term	Moderate	Likely	High (removal of highly visible structures)	Low	➢ In line with best practice construction guidelines.	Low	Low	5	High

Table 8.47: Visual: Impact assessment summary table – Operation Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATION PHASE DIRECT IMPACTS													
Potential landscape impact of a large Solar Energy Facility on a rural agricultural landscape	**Change of landscape character**	Negative	Regional	Long Term	Slight	Very Likely	High	Low	➢ A maintenance plan for buildings and structures should be followed to ensure that structures remain as non-reflective as possible, and buildings remain as unobtrusive as possible. ➢ Maintenance of access roads should not cause further disturbance and damage to the surrounding landscape	Very Low	Very Low	4	High
Landscape impact caused by transmission lines	**Change of landscape character**	Negative	Local	Long Term	Slight	Likely	High	Low	➢ A maintenance plan for buildings and structures should be followed to ensure that structures remain as non-reflective as possible, and buildings remain as unobtrusive as possible. ➢ Maintenance of access roads should not cause further disturbance and damage to the surrounding landscape	Very Low	Very Low	5	High
Visual intrusion of a solar energy facility on views of sensitive visual receptors	**Change in existing views of sensitive visual receptors.**	Negative	Regional	Long Term	Moderate	Very Likely	High	Low	➢ Building facades and colours such that they blend in with the landscape background where technically feasible.	Low	Very Low	4	High
Visual intrusion of transmission lines on views of sensitive visual receptors	**Change in existing views of sensitive visual receptors**	Negative	Local	Long Term	Slight	Likely	High	Low	➢ Powerline towers to be similar to those in the landscape already where possible.	Very Low	Very Low	5	High
Impact of night lighting on the nightscape of the region	**Light pollution in a dark nightscape.**	Negative	Local	Long Term	Slight	Likely	High	Low	➢ Lighting plan should be prepared which will minimise impacts on the nightscape	Very Low	Very Low	5	High

Table 8.48: Visual: Impact assessment summary table – Decommissioning Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE DIRECT IMPACTS													
Visual impact of decommissioning activities associated with a PV Plant on existing views of sensitive visual receptors	**Impact on visual resources .**	Negative	Regional	Short Term	Substantial	Very Likely	High	Low	➢ Rehabilitation of areas cleared for solar field	Moderate	Low	4	High
Visual impact of decommissioning activities associated with transmission lines on existing views of sensitive visual receptors	**Impact on visual resources**	Negative	Local	Very short term	Moderate	Likely	High	Low	➢ Disturbed and transformed areas should be rehabilitated. Other best practice guidelines for construction activities apply.	Low	Low	4	High

Table 8.49: Visual: Impact assessment summary table – Cumulative impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CUMULATIVE IMPACTS													
Cumulative impact on the landscape of the region.	**Change in landscape character**	Neutral	Regional	Long term	Slight	Likely	High	Low	➢ Best practice and implementation of appropriate management and mitigation of impacts by all proposed solar energy facility	Very Low	Very Low	5	High
Cumulative impact on sensitive visual receptors.	**Visual intrusion**	Negative	Regional	Long Term	Moderate	Likely	High	Low	➢ Best practice and implementation of appropriate management and mitigation of impacts by all proposed solar energy facility	Low	Low	4	High

8.9 Socio-economics[14]

8.9.1 Findings of the socio-economic study

An important indicator of economic desirability is whether the proposed projects complements national energy planning, economic development planning and spatial development planning. Each individual project achieves a high degree of fit with energy planning policy for renewable energy and should further the goals of local and regional economic development planning. Financial viability risks are also considered minor particularly if a long term contract can be agreed on with the relevant authorities that secure payment for the electricity generated through the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP).

Each individual project has the potential to have a significantly positive impact on economic activity in the local area and region given the size of the new spending injection associated with it and the clear need for economic opportunities in the area. Whilst increasing economic activity, the project would also result in the increased diversification of the local economy which is currently dominated by agriculture. For each 100 MW project, construction would represent a significant investment of between R2.25 billion and R2.5 billion. Between 358 and 438 person years of work should be associated with the construction phase spread over roughly one year. In addition, it is anticipated by the applicant that roughly R32 million to R40 million would be spent annually on operations resulting in between 114 and 139 person-years of employment per year during operations. All jobs are expected to be allocated to South Africans, of which, at least three quarters should go to previously disadvantaged people and half to local residents.

The REIPPPP bidding process specifies that significant contributions to local socio-economic development are mandatory for all bidders. For each 100 MW project, socio-economic Development and Enterprise Development contributions should amount to between R10.4 million and R12.7 million per year. Assuming average discount rates, the present values of these funding flows would be between R162 million and R199 million. This is a highly significant flow of funds and, assuming good fund management and project selection, it has the potential to result in the creation of significant socio-economic benefits in the local area. Note that the local community would also be given the opportunity to own shares in the project.

Community concerns have been raised regarding the negative impacts associated with an influx of workers and job seekers particularly during the construction phase of the projects. These concerns are common especially in smaller communities and include those associated with negative impacts on social structures and increased ‘social ills’ such as increased crime levels, increased alcohol and drug use, increased teenage and unwanted pregnancies, increased prostitution and increases in sexually transmitted diseases (STDs). It is expected that a significant proportion of workers would be sourced locally especially low and medium skilled workers. These workers would already be part of the local community and its social structures thereby reducing the risk posed by influx. With mitigation, it is expected that impacts could be reduced to low levels of significance in this regard for each of the five PV projects.

[14] Laurie, 2015.

Surrounding land owners are likely to experience greater risks due to greater activity nearby and the presence of workers nearby particularly during construction. These risk would essentially include further deterioration of local gravel roads, increased risk of stock theft and poaching, damage to farm infrastructure such as fences, increased littering and increased potential for veld fires. In keeping with the findings of social impact assessments for other renewable energy and similar projects, it was found that these risks are relatively common and that their significance can be reduced to low levels with adequate mitigation for each of the five PV projects.

A review of known tourism facilities relatively nearby the site (i.e. within 3 to 4 km) revealed one facility in the form of the Mierdam Game Farm[15] which offers recreational hunting. It is considered likely that this limited amount of tourism activity nearby the site is partially due to the presence of significant amounts of unsightly electricity infrastructure in the form of two major sub-stations (Perseus and Beta) along with a number of major transmission lines. This limits current and future tourism potential. With respect to distances from the proposed PV sites, it is important to note that he nearest point on Faraday PV B would be ~1.5 km from the Mierdam farm boundary. This distance would increase to at least ~3.5 km in the case of Faraday PV A. Faraday PV B's risks are likely to be higher reaching a moderate significance primarily as a result of risks to Mierdam. Although there would be risks during construction, which would be similar for all of the projects, they would be substantially more significant during the operational phase given its duration.

Project impacts discussed above and in other specialist studies have the potential to be reflected in, or impact on property values. These include impacts on agricultural production, visual/aesthetic impacts and impacts associated with the presence of workers or social impacts. Overall risks to property values during operations are considered low with mitigation (which may include the need for compensation if it can be proven to be warranted) for all of the PV projects and their alternatives. Without mitigation, however, risks would be higher for Faraday PV B and potentially reaching a moderate level driven by their location closer to Mierdam. Although there would be risks during construction, which would be similar for all of the projects, they would be substantially more significant during the operational phase given its duration. Note that the fact that impacts on property values are a reflection of other impacts already assessed in this study along with impacts assessed in other studies forming part of the EIA needs to be borne in mind in order to avoid double counting of impacts.

8.9.1.1 Compatibility with policy and planning guidance

The proposed project's key strategic objectives can be summarised as providing additional generation capacity and grid stability in the local area and region whilst meeting national renewable energy and climate change targets. This section assesses the likely impact of the project on achieving these objectives along with a wider consideration of the project's fit or compatibility with economic and associated spatial development planning objectives and guidance.

Energy policy imperatives and the environment

[15] Please note the farm Mierdam 638/0 and 638/1 is not a proclaimed or registered protected area as per the South African Protected Areas Database (DEA, 2016).

Historically, South Africa has relied heavily on non-renewable fossils fuels (primarily coal) for energy generation purposes. This reliance remains a key feature of the current energy mix with just over 90% of our electricity generation needs met by non-renewables. Given our abundance of coal reserves relative to most other countries, it is not particularly surprising that our energy mix favours coal and it is to be expected that coal will remain dominant at least in the short and medium term. However, imperatives with regard to global warming, other environmental impacts associated with 'dirty' fuels and energy security have elevated renewable energy solutions. Most governments in the global community now recognise that the roll-out of renewable energy will be needed among a number of other actions to curb global warming. In addition, the renewable energy industry is now a major economic sector contributing to socio-economic development goals.

With the above in mind, South African longer term energy policy has rapidly changed from one that did very little to encourage renewable energy to one that actively encourages it. The first draft version of the national integrated Resource Plan (IRP) released in 2010 set a target for 30% of new generation to come from renewables by 2030. This was subsequently increased to a target of 42% from renewables in the final IRP approved by cabinet in 2011. Meeting the target will require substantial investment given the extremely low base.

In order to facilitate the roll-out of renewable energy and meet ambitious targets, three key economic incentives have been initiated to encourage investment in renewable energy. Firstly, tax incentives in the form of accelerated depreciation allowances for renewable energy developments are in place. Secondly, an Environmental Levy on electricity generated from non-renewable resources was implemented by National Treasury with effect from July 2009. Thirdly, and probably most importantly, the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) was launched in 2011 to replace the previously mooted Renewable Energy Feed-In Tariff (REFIT) programme. Through the REIPPPP, aspirant renewable developers bid for contracts in terms of which government commits to purchase power from them in keeping with national targets. The REIPPPP has the following key features:

- A two-phase tender system in which bidders must first meet qualification criteria (including legal, environmental and financial requirements) and will then be evaluated on bid price and economic-development objectives.
- The programme's evaluation criteria currently scores 70% on price and 30% on a range of economic development requirements.

In summary, the policy case for the roll-out of renewable energy in South Africa has been made at a national and provincial government level using arguments that are in line with international policy trends. Targets that include solar energy have been set and incentives have been offered to renewable energy developers through the REIPPPP in order to encourage projects.

Energy security

At a provincial level, the Free State Province is currently facing constraints in the availability and stability of electricity supply. This is a consequence of South Africa's electricity generation and supply system being overstretched; and as the Free State is reliant on the import of power for the majority of its electricity needs.

Aside from impacts on the achievement of national goals and policy imperatives outlined in the preceding section, the project therefore has the potential to contribute to:

- Greater energy supply stability in the province and local area
- Higher levels of energy security in the province and local area

This will benefit local residential electricity consumers as well as farmers and businesses.

Strategic spatial planning for solar and wind areas in South Africa

A Strategic Environmental Assessment (SEA) commissioned by the Department of Environmental Affairs identified Renewable Energy Development Zones (REDZs) for the roll-out of wind and solar PV energy in South Africa. The identification of these areas is aimed at enabling the development of large scale wind and solar PV energy facilities in a manner that avoids or minimises significant negative impact on the environment while being commercially attractive and maximizing socio-economic benefit to the country. The overall strategic suitability of the area for solar PV is therefore supported pending the finding of the EIA which focuses on site specific assessment.

Economic development and spatial planning

Economic development imperatives inform spatial planning imperatives. A critical aspect of economic desirability is thus whether the proposed development complements economic planning as reflected in spatial development planning. Integrated Development Plans (IDPs) and their accompanying Spatial Development Frameworks (SDFs) are particularly important in this regard. SDFs in particular are central to economic development planning and are drawn up in order to guide overall development in a direction that local and provincial authorities see as desirable. Indeed, the basic purpose of an SDF is to specify the spatial implications of IDPs designed to optimise economic opportunities.

The proposed development thus ideally needs to 'fit' or be compatible with what is envisaged in SDFs, structure plans and other planning documents in order for it to clearly 'fit' with the optimal distributions of economic activity as envisaged in these plans. Or, if it doesn't obviously fit with existing planning, there need to be clear and compelling reasons why a deviation from planning should be considered.

The following provincial and regional planning documents were found to be of relevance and are reviewed in more detail in the study: i) Free State Provincial Growth and Development Strategy (PGDS) and Provincial Spatial Development Framework (PSDF); and ii) Lejweleputswa District Municipality and Tokologo Local Municipality IDP and SDF.

Considered as a whole these documents recognise the importance of integrated and diversified economic development that makes optimal use of each area's comparative advantages and creates economic opportunities. The concept of a solar energy project is thus broadly supported provided environmental impacts and impacts on other land uses and potentials are acceptable.

At a provincial level, renewable energy is a key focus area of the Free State Development Corporation and the potential of solar energy in particularly is recognised in the Provincial Growth and Development Strategy (FSPG, 2012). This includes recognition of the solar resource in the provinces and the potential to establish manufacturing and service business to support solar energy development. In the Free State SDF (DMP, 2013) this potential is also recognised and it is pointed out that solar energy project are operational, under way or in the planning phase indicating that the Free State is becoming a favoured region for solar energy projects. Examples of existing facilities include the 75MW Letsatsi project approximately 35km north-west of Bloemfontein and the Boshof

Solar Park. At a district and local level there is also no reason to suspect that the concept of solar energy development is not supported, particularly given its potential socio-economic benefits.

8.9.1.2 Financial viability and risks

Long term positive economic impacts can only flow from a project that is financially sustainable (i.e. financially viable in the long term with enough income to cover costs). The REIPPPP offers the additional government financial support in order to 'level the playing field' as outlined in Section 5.1.1. It should essentially ensure relatively low levels of financial risks for appropriate renewables projects in order to encourage these types of projects. The Project is thus highly likely to prove financially viable assuming it is able to secure a long term contract through the REIPPPP and then proceed to control its costs - this has been confirmed with the proponent (D. Palm, Twenty Nine Solar, pers com).

As mentioned previously, under the REIPPPP competitive bidding process, the relevant authorities will only be offering limited producers long term power purchase contracts. The Project will therefore have to compete with other projects. At this stage it is not possible to determine whether the Project will be one of those chosen - the adjudication process will determine this. The existence of a number of alternative solar energy developers and sites looking to access REIPPPP contracts means that the state can be selective in allocating contracts to those projects and project alternatives that meet stringent qualification criteria and offer the cheapest electricity and highest socio-economic development commitments.

The balance between financial benefits and costs are thus likely to be positive for the applicant and land owners partners barring unforeseen risks. These financial returns that motivate developments such as the proposed project are necessary as the promise of profit is what fuels much of our economy. The remainder of this report focuses on the economic impacts (including costs and benefits) that would accrue to wider society in order to provide information on the overall economic desirability of the project.

8.9.2 Issues, risks and impacts

8.9.2.1 Summary of issues identified during the Scoping Phase

Aside from fit with planning and financial viability (and associated risks), the following impacts were identified as relevant for assessment based on the guidelines for socio-economic specialist inputs, information from I&APs inputs and consultations and the nature of the project and receiving environment:

- Impacts linked to expenditure on project construction and operation
- Impacts associated with the funding of local socio-economic development initiatives
- Social impacts associated primarily with the influx of people
- Impacts on surrounding land owners
- Impacts on tourism
- Impacts on property values

Note that impacts on agriculture on the project sites are not assessed in this report as they are dealt with in a separate agricultural specialist study which concluded that the sites are suitable for solar energy development primarily due to low soil potentials (Lanz, 2016).

The potential impacts per phase identified during the EIA assessment are summarized below. The same impact categories would apply to each of the five individual projects. Further detailed discussion and assessment of impacts are provided in the section dealing the assessment of impacts and identification of management measures.

Table 8.50: Socio-economic-related comments and responses trail. Comments responded to by the appointed specialist, Dr. Hugo van Zyl.

Comment	Commenter	Response
Crime rates that will disturb the peaceful environment.	Anna Jacobs (Neighbouring landowner)	Impacts on safety are addressed in the sections dealing with social impacts associated primarily with the influx of people and impacts on surrounding land owners. The strict application of a workers Code of Conduct and security measures will be particularly important in terms of mitigation.
Market value of properties adjacent to the projects;	Gerhard van Rhyn (Neighbouring landowner)	The report includes a section dealing with impacts on property values. They are assessed and preferred alternatives are recommended for particularly sensitive neighbouring properties such as the Mierdam game farm.
Liability in the event of negative effects;		Negative impacts or risks are addressed in the sections on the social impacts associated primarily with the influx of people, impacts on surrounding land owners, impacts on tourism and on property values. Mitigation measures are provided for these impacts to the degree possible.
Fair treatment of affected parties;		Mitigation measures are recommended for all risks. They include a Code of Conduct, Monitoring Programme and Monitoring Forum involving surrounding landowners.
Impacts on the socio-economic environment;		Taken together, the impacts assessed provide an overall assessment of socio-economic impacts.
Impacts on safety;		Impacts on safety are addressed in the sections dealing with social impacts associated primarily with the influx of people and impacts on surrounding land owners. The strict application of a workers Code of Conduct and security measures will be particularly important in terms of mitigation.
Dealesville is already over-developed with electricity infrastructure, how does this influence agriculture and property values in Dealesville?		The report includes a section dealing with impacts on property values. They are assessed taking existing electricity infrastructure into account, the presence of which tends to reduce risks from new projects of a similar nature. Preferred alternatives are recommended for particularly sensitive neighbouring properties such as the Mierdam game farm. Note that further assessment of impacts on agriculture is contained in the agricultural specialist study.
Also, what is the broader impact of such a development on the region outside of farming interests, such as security risks etc.?		Impacts on safety/security are addressed in the sections dealing with social impacts associated primarily with the influx of people and impacts on surrounding land owners. Other broader impacts are also addressed to provide an overall assessment of socio-economic impacts both negative and positive.

8.3.3.2 Identification of potential impacts/risks

Construction Phase

- Impacts linked to project expenditure
- Social impacts associated primarily with the influx of people
- Impacts on surrounding land owners
- Impacts on tourism
- Impacts on property values

Operational Phase

- Impacts linked to project expenditure
- Impacts associated with the funding of local socio-economic and enterprise development initiatives
- Social impacts associated primarily with the influx of people
- Impacts on surrounding land owners
- Impacts on tourism
- Impacts on property values

Decommissioning Phase

- Impacts linked to project expenditure
- Impacts associated with the funding of local socio-economic and enterprise development initiatives
- Social impacts associated primarily with the influx of people
- Impacts on surrounding land owners
- Impacts on tourism
- Impacts on property values

Cumulative Impacts

- Impacts linked to project expenditure
- Impacts associated with the funding of local socio-economic and enterprise development initiatives
- Social impacts associated primarily with the influx of people
- Impacts on surrounding land owners
- Impacts on tourism
- Impacts on property values

8.9.3 Impact Assessment

8.9.3.1 Potential direct impacts during construction phase

Aspect/Activity	**Increased economic activity (incl. jobs) / Project expenditure**
Type of impact	Direct
Potential Impact	Construction expenditure would not displace other investment and would constitute a positive injection of new investment. The development would provide a major injection for contractors and workers in the area that would, in turn, purchase goods and services in the local area and the wider region. It is expected that a total of between 358 and 438 person years of work would be associated with the construction phase spread over roughly one year. Note that the number of people getting work on the project would exceed this amount as a number of jobs would be less than one full year in duration. The majority of these jobs would go to South Africans and between 43 and 53 person years of work would go to workers from the local area. The operation of the facility would result in direct and indirect economic opportunities. These would stem from expenditure on operations including

Aspect/Activity	Increased economic activity (incl. jobs) / Project expenditure
	expenditure on employees that would not otherwise have occurred particularly in the local area. It is anticipated by the applicant that roughly R32 million to R40 million would be spent annually on operations escalating gradually in line with inflation (see Table below). Approximately 75% of this spend should go to BBBEE enterprises and 8% to small and micro enterprises.

Mitigation Required	• Maximise positive impacts through tendering, procurement and employment policies.
	• Set targets for use of local labour and maximise opportunities for the training of unskilled and skilled workers.
	• Use local sub-contractors where possible
	• Aim to meet DoE socio-economic development scorecard:
	  ○ Set targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training.
	  ○ Maximise opportunities for the training of unskilled and skilled workers from local communities.
	  ○ Use local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment.
	  ○ Explore ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement
	• Set up a skills and services database in partnership with the local municipality and civil society for the local area before any hiring or contracting decisions are made to ensure fairness and limit potential interference in hiring processes.
	• Assist smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects.
	• Avoid potential service provider decisions that may lead to abuse or local dissatisfaction.
	• As far as possible, avoid significant variation in salaries between various contractors for the same types of jobs. When variations are too high, the likelihood of dissatisfaction increases.

Impact Significance (Pre-Mitigation)	3 (moderate positive)
Impact Significance (Post-Mitigation)	3 (moderate positive)
I&AP Concern	No

8.9.3.2 Potential direct impacts during operation phase

Aspect/Activity	Increased economic activity (incl. jobs) / Project expenditure
Type of impact	Direct
Potential Impact	Construction expenditure would not displace other investment and would constitute a positive injection of new investment. The development would provide a major injection for contractors and workers in the area that would, in turn, purchase goods and services in the local area and the wider region. It is expected that a total of between 358 and 438 person years of work would be associated with the construction phase spread over roughly one year. Note that the number of people getting work on the project would exceed this amount as a number of jobs would be less than one full year in duration. The majority of these jobs would go to South Africans and between 43 and 53 person years of work would go to workers from the local area. The operation of the facility would result in direct and indirect economic opportunities. These would stem from expenditure on operations including expenditure on employees that would not otherwise have occurred particularly in the local area. It is anticipated by the applicant that roughly R32 million to R40 million

Aspect/Activity	**Increased economic activity (incl. jobs) / Project expenditure**
	would be spent annually on operations escalating gradually in line with inflation (see Table below). Approximately 75% of this spend should go to BBBEE enterprises and 8% to small and micro enterprises.

Mitigation Required	• Maximise positive impacts through tendering, procurement and employment policies.
	• Set targets for use of local labour and maximise opportunities for the training of unskilled and skilled workers.
	• Use local sub-contractors where possible
	• Aim to meet DoE socio-economic development scorecard:
	  ○ Set targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training.
	  ○ Maximise opportunities for the training of unskilled and skilled workers from local communities.
	  ○ Use local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment.
	  ○ Explore ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement
	• Set up a skills and services database in partnership with the local municipality and civil society for the local area before any hiring or contracting decisions are made to ensure fairness and limit potential interference in hiring processes.
	• Assist smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects.
	• Avoid potential service provider decisions that may lead to abuse or local dissatisfaction.
	• As far as possible, avoid significant variation in salaries between various contractors for the same types of jobs. When variations are too high, the likelihood of dissatisfaction increases.

Impact Significance (Pre-Mitigation)	3 (moderate positive)
Impact Significance (Post-Mitigation)	3 (moderate positive)
I&AP Concern	No

Aspect/Activity	**Funding of socio-economic and enterprise development initiatives / Socio-economic development contribution**
Type of impact	Direct
Potential Impact	Between R9.7 million and R11.9 million per year should flow to the local community from the applicant's likely Socio-economic Development Contributions. In addition, between R695,000 and R850,000 per year would be contributed to enterprise development in the local community. All future fund flows are likely to have a present value of between R162 million and R199 million (i.e. one would need to have this magnitude of funds available for investment today in order to be able to receive, as an annuity, the annual amounts of fund flows). This is a highly significant flow of funds and, assuming good fund management and project selection, it has the potential to result in the creation of significant economic opportunities in the local area.
Mitigation Required	• The DoE intends monitoring the compliance of IPPs with the commitments that they make to local socio-economic development as part of the bidding process. The environmental authorities should therefore liaise with the DoE in order to gather information regarding compliance with the applicant's commitments. • Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies and plans with regard to socio-economic development.

Aspect/Activity	Funding of socio-economic and enterprise development initiatives / Socio-economic development contribution
	• Establish a Monitoring Forum for the project. The Forum should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors and the contractor. The role of the Forum would be to monitor the project and the implementation of the recommended mitigation measures. • Develop, in consultation with representatives from the Monitoring Forum, a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding land owners and residents. • Implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase. • Make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks.
Impact Significance (Pre-Mitigation)	3 (moderate positive)
Impact Significance (Post-Mitigation)	3 - 2 (moderate to high positive)
I&AP Concern	No

8.9.3.3 Potential direct impacts during decommissioning phase

Aspect/Activity	Funding of socio-economic and enterprise development initiatives / Socio-economic development contribution
Type of impact	Direct
Potential Impact	Between R9.7 million and R11.9 million per year should flow to the local community from the applicant's likely Socio-economic Development Contributions. In addition, between R695,000 and R850,000 per year would be contributed to enterprise development in the local community. All future fund flows are likely to have a present value of between R162 million and R199 million (i.e. one would need to have this magnitude of funds available for investment today in order to be able to receive, as an annuity, the annual amounts of fund flows). This is a highly significant flow of funds and, assuming good fund management and project selection, it has the potential to result in the creation of significant economic opportunities in the local area.
Mitigation Required	• The DoE intends monitoring the compliance of IPPs with the commitments that they make to local socio-economic development as part of the bidding process. The environmental authorities should therefore liaise with the DoE in order to gather information regarding compliance with the applicant's commitments. • Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies and plans with regard to socio-economic development. • Establish a Monitoring Forum for the project. The Forum should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors and the contractor. The role of the Forum would be to monitor the project and the implementation of the recommended mitigation measures. • Develop, in consultation with representatives from the Monitoring Forum, a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding land owners and residents. • Implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase. • Make necessary arrangements to enable workers from outside the area to return

Aspect/Activity	**Funding of socio-economic and enterprise development initiatives / Socio-economic development contribution**
	home over weekends and or on a regular basis during the construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks.
Impact Significance (Pre-Mitigation)	3 (moderate positive)
Impact Significance (Post-Mitigation)	3 - 2 (moderate to high positive)
I&AP Concern	No

8.9.3.4 Potential direct impacts during all phases

Aspect/Activity	**Social impact associated with an influx of people / Influx of workers**
Type of impact	Direct
Potential Impact	Community concerns are common especially in smaller communities regarding the negative impacts associated with an influx of outside workers particularly during the construction of large projects. These concerns include those associated with negative impacts on social structures and increased 'social ills' such as increased crime levels, increased alcohol and drug use, increased teenage and unwanted pregnancies, increased prostitution and increases in sexually transmitted diseases (STDs). These types of impacts are more commonly associated with the influx of people looking for work without success, but can also be associated with workers that do find work. While the presence of construction and other workers does not in itself constitute an impact, the manner in which workers conduct themselves can affect the local community and lead to increased social ills. They also make the observation that likely impacts are related to the number of employment opportunities that would go to non-locals and how the recruitment process is managed.
Mitigation Required	• Implement a 'locals first' policy with regard to construction and operational labour needs. • The community will be able to contact the site manager to report any issues which they may have. The site manager will be stationed within the area and will therefore be available on hand to deal with and address any concerns which may be raised. • Make available a complaints register on site to any individual who may have a particular complaint with regards to the construction or operations processes. • Establish a Monitoring Forum for the project. The Forum should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors, farmers, and the contractor. The role of the Forum would be to monitor the project and the implementation of the recommended mitigation measures. • Develop, in consultation with representatives from the Monitoring Forum, a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding land owners. • Implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; • Make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks; • Make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed.
Impact Significance	3 (moderate negative)

Aspect/Activity	**Social impact associated with an influx of people / Influx of workers**
(Pre-Mitigation)	
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	Yes

Aspect/Activity	**Impacts on surrounding land owners / Presence of facility and workers**
Type of impact	Direct
Potential Impact	Experiences with the influx of construction workers associated with the Eskom sub-stations and transmission lines in the area have also made land owners particularly wary of the risks that come with the introduction of a significant labour force into the area. More people in farming areas are seen as a risk factor for trespassing, theft, damages to farm infrastructure and equipment, littering along with veld fires. These types of concerns and potential impacts have been assessed in detail as part of the social impact assessments for other renewable energy and similar projects which found that these issues are relatively common risks but that their significance can be reduced to low levels with adequate mitigation.
Mitigation Required	• No construction workers, with the exception of security personnel, will be allowed to stay on the site overnight. • The community will be able to contact the site manager to report any issues which they may have. The site manager will be stationed within the area and will therefore be available on hand to deal with and address any concerns which may be raised. • Make available a complaints register on site to any individual who may have a particular complaint with regards to the construction or operations processes. • Develop, in consultation with representatives from the Monitoring Forum, a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding land owners. • Implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on and put in place before construction commences. • A fire management plan should be drawn up prior to construction in agreement with neighbouring land owners. This plan should clearly specify what types of behaviour would not be acceptable with appropriate sanction for transgressions. The applicants should also ensure that they join the local fire protection agency. Fire breaks around the site should be constructed as a first order of business before any other construction works begin. • Outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. • Set up a monitoring programme in collaboration with neighbouring land owners that is specifically designed to provide clarity on impacts and risks. Formally commit to mitigation and compensation actions that may arise from the monitoring programme
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	Yes

Aspect/Activity	**Impacts on tourism / Reduction in visual and environmental resources**
Type of impact	Direct
Potential Impact	Tourism is recognised as an important sector om the wider region and has the

Aspect/Activity	**Impacts on tourism / Reduction in visual and environmental resources**
	potential to play an increasingly prominent role as a driver of economic development making it important to consider potential impacts on this sector. In order to assess tourism impacts, information on current tourism use and potential future use focusing on the area surrounding the site was gathered. A review of know tourism facilities relatively nearby the site (i.e. within 3 to 4 km) revealed one facility in the form of the Mierdam Game Farm which offers recreational hunting. It is considered likely that this limited amount of tourism activity nearby the site is partially due to the presence of significant amounts of unsightly electricity infrastructure in the form of two major sub-stations (Perseus and Beta) along with a number of major transmission lines. This limits current and future tourism potential. The site can also be seen from roads used by tourists such as the R64. Again, existing major electricity infrastructure tends to be prominent in views from the road.
Mitigation Required	• Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports on these impacts (primarily the minimisation of visual and ecological impacts) would thus also minimise tourism impacts.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	3 (moderate negative)
I&AP Concern	Yes

Aspect/Activity	**Impact on surrounding property values / Reduction in visual and environmental resources**
Type of impact	Direct
Potential Impact	Economic theory assumes that property values capture not only the physical characteristics and productive potential of properties, but also the environmental and social characteristics of their surroundings. The project's impacts discussed in preceding sections and in other specialist studies thus also have the potential to be reflected in, or impact on property values. These include impacts on agricultural production, visual/aesthetic impacts and impacts associated with the presence of workers or social impacts. Based on the findings of the agricultural specialist study, it is considered unlikely that agricultural production on surrounding farms would be materially affected. This should result in minimal if any impacts on the major portion of farm values which relate to their agricultural production potential. Negative social impacts associated with operational activities and the presence of workers on the project site also have the potential to result in negative pressure on property values. Impacts in this regard should, however, be largely manageable and are predicted to be of a low significance with mitigation. The potential for the visual impacts of the project to result in negative impacts on property values has been raised as a concern. However, the findings of the visual impact assessment don't provide reasons to suspect that significant negative impact are likely given the nature of the project along with the receiving environment which includes significant man-made structures in the form of major electricity infrastructure substations and power lines (see Holland, 2016).
Mitigation Required	• Impacts on property values are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other sections of this report and in other specialist reports on these impacts (primarily the minimisation of visual, agricultural and ecological impacts) would thus also contribute to the minimisation of property value risks. • Monitor impacts on values with the assistance of an independent valuer. If it is independently confirmed that value reductions have taken place and they cannot be mitigated, then this information can be used as a basis for negotiation and/or mediation between the applicant and neighbouring land owners focused on

Aspect/Activity	Impact on surrounding property values / Reduction in visual and environmental resources
	compensation. It does, however, need to be recognized that compensation is not necessarily required under South African law. Legal implications would therefore need to be considered further should impacts be found during monitoring.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	3 (moderate negative)
I&AP Concern	Yes

8.9.3.5 Potential cumulative impacts

Aspect/Activity	Increased economic activity (incl. jobs) / Project expenditure
Type of impact	Direct
Potential Impact	Cumulative impacts associated with this significantly greater expenditure would also be consequently significantly greater. Positive cumulative impacts are also likely to stem from the fact that the project should set a positive precedent for further investment in the area. By committing to investment in large developments, the applicants would be casting a strong 'vote of confidence' in the local economy. This has the potential to influence other investors (including locals) to also act with similar confidence thereby resulting in cumulative impacts on overall investment levels. These could reach medium to high significance levels given the size of the investments involved relative to the size of the local economy. In a sense the projects have the potential to lead to the 'crowding in' of further investment. As has been noted, if the renewable energy industry grows in size (aided by the proposed project) it should provide opportunities for manufacturing and servicing at scale and the additional, cumulative benefit that would flow from it.
Mitigation Required	• Applicant has limited control over other projects.
Impact Significance (Pre-Mitigation)	4 (high positive)
Impact Significance (Post-Mitigation)	4 (high positive)
I&AP Concern	No

Aspect/Activity	Funding of socio-economic and enterprise development initiatives / Socio-economic development contribution
Type of impact	Direct
Potential Impact	Similar to the case of project expenditure, the total cumulative funding of local socio-economic and enterprise development associated with five or more projects would be at least five times higher than for one project.
Mitigation Required	• Applicant has limited control over other projects.
Impact Significance (Pre-Mitigation)	4 (high positive)
Impact Significance (Post-Mitigation)	4 (high positive)
I&AP Concern	No

Aspect/Activity	Social impact associated with an influx of people / Influx of workers
Type of impact	Direct
Potential Impact	The cumulative impact associated with numerous projects going ahead would be a substantial increase in the likelihood of more significant influxes of people to the area whether they have jobs secured or are job seekers. This should result in a higher risk of social problems associated with influx particularly during construction. Risks would be greatest if all projects proceed in relatively quick succession and lower if they are

Aspect/Activity	**Social impact associated with an influx of people / Influx of workers**
	introduced more gradually thereby allowing for a more orderly introduction of new people to the local area.
Mitigation Required	• Applicant has limited control over other projects.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	3 (moderate negative)
I&AP Concern	Yes

Aspect/Activity	**Impacts on surrounding land owners / Presence of facility and workers**
Type of impact	Direct
Potential Impact	The cumulative impact associated with numerous projects going ahead would be a substantial increase in the potential severity of impacts on surrounding land owners. There would be a greater number of projects which would result in greater risks with respect to potential negative impacts associated with changed land use, greater activity nearby and the presence of workers in the area particularly during construction. These concerns essentially include further deterioration of local gravel roads, increased risk of stock theft and poaching, damage to farm infrastructure such as fences, increased littering, increased potential for veld fires and visual impacts linked to property values. Risks would be greatest if all projects proceed in relatively quick succession and lower if they are introduced more gradually thereby allowing for a more orderly introduction of projects and people to the local area.
Mitigation Required	• Applicant has limited control over other projects.
Impact Significance (Pre-Mitigation)	3 (moderate negative)
Impact Significance (Post-Mitigation)	2 (low negative)
I&AP Concern	Yes

Aspect/Activity	**Impacts on tourism / Reduction in visual and environmental resources**
Type of impact	Direct
Potential Impact	The cumulative impact associated with numerous projects going ahead would increase in the potential severity of tourism risks. The concern would be that if these projects all go ahead, the area would become visually dominated by solar installations with consequences for tourism. Should all of the projects go ahead, these types of projects would certainly become a prominent feature of the local environment. Tourism risks would, however, be significantly mitigated by the existence of significant electricity transmission infrastructure in the area. The VIA rates the significance of the cumulative landscape impact of various solar energy projects in the surrounding landscape as very low. It also points out that cumulative impacts on sensitive receptors would be low since it is unlikely that there are any views of scenic value that have not already been impacted by transmission infrastructure and as many of the other solar facilities proposed for the area are in relatively close proximity (Holland, 2016). Bear in mind that there are also relatively few tourism assets or facilities in the area that could be at risk. Cumulative risks have thus been rated as having a low to moderate significance when considered for the wider area (i.e. not only considering localized impacts on facilities such as Mierdam).
Mitigation Required	• Applicant has limited control over other projects.
Impact Significance (Pre-Mitigation)	2-3 (low to moderate negative)
Impact Significance	2-3 (low to moderate negative)

Aspect/Activity	**Impacts on tourism / Reduction in visual and environmental resources**
(Post-Mitigation)	
I&AP Concern	Yes

Aspect/Activity	**Impact on surrounding property values / Reduction in visual and environmental resources**
Type of impact	Direct
Potential Impact	The cumulative impact associated with numerous projects going ahead would be an increase in potential risks to property values. Based on the findings of the agricultural specialist study, it is considered likely that agricultural production on surrounding farms would remain largely unaffected. This should result in minimal if any impacts on the major portion of farm values which relate to agricultural production potential. Negative social impacts associated with the presence of workers on the project site also have the potential to result in negative pressure on property values. Impacts in this regard should, however, be largely manageable. The agricultural landscape character of the area would change fairly significantly bearing in mind that the area already has significant man-made structures in the form of major electricity infrastructure substations and transmission lines. Given the factors above, cumulative impacts on property values are predicted to have a low to moderate significance for the wider area. Bear in mind also that if a number of solar project are established, the value of a property may become driven more by the prospect for having a solar facility established on it and less by agricultural or leisure potential. This could eventually lead to an increase in property values depending on how the market develops.
Mitigation Required	• Impacts on property values are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other sections of this report and in other specialist reports on these impacts (primarily the minimisation of visual, agricultural and ecological impacts) would thus also contribute to the minimisation of property value risks.
Impact Significance (Pre-Mitigation)	2-3 (low to moderate negative)
Impact Significance (Post-Mitigation)	2-3 (low to moderate negative)
I&AP Concern	Yes

8.9.4 Legislative and permit requirements

No permit requirements were identified

Table 8.51: Socio-economics: Impact assessment summary table – Construction Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION PHASE DIRECT IMPACTS													
Project expenditure	**Expenditure related impacts on jobs etc.**	Positive	Regional	Short-term	Substantial	Definite	Low	Low	➢ Maximise positive impacts ➢ Set targets for use of local labour ➢ Maximise opportunities for the training of unskilled and skilled workers. ➢ Use local sub-contractors where possible ➢ Assist smaller enterprises where possible in tendering for contracts ➢ Aim to meet DoE socio-economic development scorecard	Moderate positive	Moderate positive	3	High
Influx of workers	**Social impact associated with an influx of people**	Negative	Regional	Short-term	Moderate	Highly probable	High	Low	➢ Implement a 'locals first' policy ➢ Make available a complaints register on site to any individual ➢ Establish a Monitoring Forum for the project ➢ Implement an HIV/AIDS awareness programme ➢ enable workers from outside the area to return home over weekends	Moderate	Low	4	Medium to high
Presence of facility and workers	**Impacts on surrounding land owners**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced ➢ No construction workers allowed staying on the site overnight. ➢ The community will be able to contact the site manager ➢ Make available a complaints register ➢ A fire management plan should be drawn up ➢ Outline procedures for managing and storing waste on site ➢ Set up a monitoring programme ➢ in collaboration with neighbouring land owners that is specifically designed to provide clarity on impacts and risks	Moderate	Low	4	Medium to high

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Visual and other impacts	**Impacts on tourism**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to minimise visual and ecological impacts which would contribute to minimising tourism impacts.	Moderate	Low	4	Medium
Visual and other impacts	**Impact on surrounding property values**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to minimise visual, agricultural and ecological impacts which would contribute to minimising impacts on property values.	Moderate	Low	4	Medium

Table 8.52: Socio-economics: Impact assessment summary table – Operation Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
OPERATION PHASE DIRECT IMPACTS													
Project expenditure	**Expenditure related impacts on jobs etc.**	Positive	Regional	Short-term	Substantial	Definite	Low	Low	➢ Maximise positive impacts ➢ Set targets for use of local labour ➢ Maximise opportunities for the training of unskilled and skilled workers. ➢ Use local sub-contractors where possible ➢ Assist smaller enterprises where possible in tendering for contracts ➢ Aim to meet DoE socio-economic development scorecard	Moderate positive	Moderate positive	3	High
Socio-economic development contribution	**Funding of socio-economic and enterprise development initiatives**	Positive	Regional	Long-term	Substantial	Definite	Low	Low	➢ Close liaison with local municipal and other stakeholders involved in socio-economic development ➢ Establish a Monitoring Forum for the project ➢ Implement an HIV/AIDS awareness program ➢ Make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the construction phase	Moderate positive	Moderate to high positive	3 - 2	High
Influx of workers	**Social impact associated with an influx of people**	Negative	Regional	Short-term	Moderate	Highly probable	High	Low	➢ Implement a 'locals first' policy ➢ Make available a complaints register on site to any individual ➢ Establish a Monitoring Forum for the project ➢ Implement an HIV/AIDS awareness programme ➢ enable workers from outside the area to return home over weekends	Moderate	Low	4	Medium to high

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Presence of facility and workers	**Impacts on surrounding land owners**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced ➢ No construction workers allowed staying on the site overnight. ➢ The community will be able to contact the site manager ➢ Make available a complaints register ➢ A fire management plan should be drawn up ➢ Outline procedures for managing and storing waste on site ➢ Set up a monitoring programme ➢ in collaboration with neighbouring land owners that is specifically designed to provide clarity on impacts and risks	Moderate	Low	4	Medium to high
Visual and other impacts	**Impacts on tourism**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to minimise visual and ecological impacts which would contribute to minimising tourism impacts.	Moderate	Moderate	4	Medium
Visual and other impacts	**Impact on surrounding property values**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to minimise visual, agricultural and ecological impacts which would contribute to minimising impacts on property values. ➢ Monitor impacts on property values with the assistance of an independent valuer.	Moderate	Moderate	4	Medium

Table 8.53: Socio-economics: Impact assessment summary table – Decommissioning Phase impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
DECOMMISSIONING PHASE DIRECT IMPACTS													
Project expenditure	**Expenditure related impacts on jobs etc.**	Positive	Regional	Short-term	Substantial	Definite	Low	Low	➢ Maximise positive impacts ➢ Set targets for use of local labour ➢ Maximise opportunities for the training of unskilled and skilled workers. ➢ Use local sub-contractors where possible ➢ Assist smaller enterprises where possible in tendering for contracts ➢ Aim to meet DoE socio-economic development scorecard	Moderate positive	Moderate positive	3	High
Socio-economic development contribution	**Funding of socio-economic and enterprise development initiatives**	Positive	Regional	Long-term	Substantial	Definite	Low	Low	➢ Close liaison with local municipal and other stakeholders involved in socio-economic development ➢ Establish a Monitoring Forum for the project ➢ Implement an HIV/AIDS awareness program ➢ Make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the construction phase	Moderate positive	Moderate to high positive	3 - 2	High
Influx of workers	**Social impact associated with an influx of people**	Negative	Regional	Short-term	Moderate	Highly probable	High	Low	➢ Implement a 'locals first' policy ➢ Make available a complaints register on site to any individual ➢ Establish a Monitoring Forum for the project ➢ Implement an HIV/AIDS awareness programme ➢ enable workers from outside the area to return home over weekends	Moderate	Low	4	Medium to high

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Presence of facility and workers	**Impacts on surrounding land owners**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced ➢ No construction workers allowed staying on the site overnight. ➢ The community will be able to contact the site manager ➢ Make available a complaints register ➢ A fire management plan should be drawn up ➢ Outline procedures for managing and storing waste on site ➢ Set up a monitoring programme ➢ in collaboration with neighbouring land owners that is specifically designed to provide clarity on impacts and risks	Moderate	Low	4	Medium to high
Visual and other impacts	**Impacts on tourism**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to minimise visual and ecological impacts which would contribute to minimising tourism impacts.	Moderate	Moderate	4	Medium
Visual and other impacts	**Impact on surrounding property values**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	➢ Implement measures to minimise visual, agricultural and ecological impacts which would contribute to minimising impacts on property values. ➢ Monitor impacts on property values with the assistance of an independent valuer.	Moderate	Moderate	4	Medium

Table 8.54: Socio-economic: Impact assessment summary table – Cumulative impacts.

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CUMULATIVE IMPACTS													
Project expenditure	**Expenditure related impacts on jobs etc.**	Positive	Regional	Short-term	Substantial	Definite	Low	Low	Applicant has limited control over other projects and therefore cumulative impacts	High positive	High positive	5	High
Socio-economic development contribution	**Funding of socio-economic and enterprise development initiatives**	Positive	Regional	Long-term	Substantial	Definite	Low	Low	Applicant has limited control over other projects and therefore cumulative impacts	High positive	High positive	5	High
Influx of workers	**Social impact associated with an influx of people**	Negative	Regional	Short-term	Moderate	Highly probable	High	Low	Applicant has limited control over other projects and therefore cumulative impacts	Moderate	Moderate	4	Medium to high
Presence of facility and workers	**Impacts on surrounding land owners**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	Applicant has limited control over other projects and therefore cumulative impacts	Moderate	Moderate	4	Medium to high

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Visual and other impacts	**Impacts on tourism**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	Applicant has limited control over other projects and therefore cumulative impacts	Low to moderate	Low to moderate	4 to3	Medium
Visual and other impacts	**Impact on surrounding property values**	Negative	Local	Short-term	Moderate	Highly probable	High	Low	Applicant has limited control over other projects and therefore cumulative impacts	Low to moderate	Low to moderate	4 to3	Medium