Marula Solar Photovoltaic Facility
Detailed Impact Assessment

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EXECUTIVE SUMMARY

Marula proposes to change their approved surface infrastructure layout, through the establishment of a Solar Photovoltaic (PV) facility, with a generation capacity of up to 33 Megawatt (MW), within its existing Mining Right Area (MRA) for self-generation only (the solar PV facility is hereafter referred to as the proposed Project). The proposed solar PV facility will be connected through the expansion of the Marula Mine's existing transmission infrastructure and substation.

A Scoping and Environmental Impact Assessment (S&EIA) was undertaken to determine the potential impacts on the biophysical, heritage and socio-economic environment.

The Marula solar facility's biophysical, heritage and socio-economic impacts are summarised for all the phases in Table 1 and discussed in detail in this document.

Table 1: Summary of Impacts

Activity Whether listed or not listed	Potential impact	Aspects affected	Phase	Significance	Significance if mitigated
Biophysical environment					
Establishing the solar PV facility and associated infrastructure	Loss of floral habitat and species diversity	Biodiversity	Construction	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Loss of floral habitat and species diversity	Biodiversity	Operational	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Loss of floral habitat and species diversity in the freshwater habitat	Biodiversity	Operational & Maintenance	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Loss of floral Species of Conservation Concern (SCC)	Biodiversity	Construction	**Low -**	**Very Low -**
Establishing the solar PV facility and associated infrastructure	Loss of floral SCC	Biodiversity	Operational & Maintenance	**Low -**	**Very Low -**
Establishing the solar PV facility and associated infrastructure	Loss of floral SCC in freshwater	Biodiversity	Construction	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Loss of faunal habitat and species diversity	Biodiversity	Construction	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Loss of faunal habitat and species diversity	Biodiversity	Operational	**Very Low -**	**Very Low -**

Activity Whether listed or not listed	Potential impact	Aspects affected	Phase	Significance	Significance if mitigated
Establishing the solar PV facility and associated infrastructure	Loss of faunal habitat and species diversity in the freshwater habitat	Biodiversity	Construction	**Very Low -**	**Insignificant**
Establishing the solar PV facility and associated infrastructure	Loss of faunal SCC	Biodiversity	Construction	**Insignificant**	**Insignificant**
Establishing the solar PV facility and associated infrastructure	Loss of faunal SCC	Biodiversity	Operational	**Insignificant**	**Insignificant**
Establishing the solar PV facility and associated infrastructure	Impact on avifaunal SCC	Biodiversity	Operational	**Very Low -**	**Insignificant**
Establishing the solar PV facility and associated infrastructure	Impact on avifaunal diversity and habitat	Biodiversity	Construction	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Removal and stockpiling of soil and subsequent loss of land capability	Soils	All phases	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Soil erosion	Soils	Construction	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Soil erosion	Soils	Operational	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Soil compaction	Soils	Construction	**Medium -**	**Low -**
Establishing the solar PV facility and associated infrastructure	Soil compaction	Soils	Operational	**Medium -**	**Low -**
Heritage					
Establishing the solar PV facility and associated infrastructure	Loss of cultural heritage resources	Heritage	All phases	**Insignificant**	**Insignificant**
Socio-economic					
Establishing the solar PV facility and associated infrastructure	Clean renewable energy reducing the dependence on coal mining and power plants	Socio-economic	Operational	**Very High +**	**Very High +**
Establishing the solar PV facility and associated infrastructure	Job creation	Socio-economic	Construction and operational	**High +**	**High +**
Establishing the solar PV facility and associated infrastructure	Change to the landscape characteristics	Visual	Operational	**Very High -**	**Medium -**

Activity Whether listed or not listed	Potential impact	Aspects affected	Phase	Significance	Significance if mitigated
Establishing the solar PV facility and associated infrastructure	Change to the landscape characteristics	Visual	Closure	**Low-**	**Very Low -**

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A) IMPACT ON BIOPHYSICAL ENVIRONMENT

1. TERRESTRIAL ECOLOGY

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known value of biodiversity and ecosystems relate to soil formation and fertility maintenance; primary production through photosynthesis; provision of food and fuel; provision of shelter and building materials; regulation of water flows and water quality; regulation and purification of atmospheric gases; moderation of climate and weather; control of pests and diseases; and maintenance of genetic resources.

1.1 ISSUE: LOSS OF FLORAL HABITAT AND SPECIES DIVERSITY

There are a number of activities/infrastructure in all phases that have the potential to destroy biodiversity in the broadest sense. In this regard, the discussion relates to the physical destruction of specific biodiversity areas, of linkages between biodiversity areas and of related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem.

1.1.1 Source of impact

Activities that will likely impact the flora ecological environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Operational	• Uncontrolled runoff, erosion and sedimentation. • Non-compliance with no-go area demarcation. • Poor housekeeping.
Decommissioning/ Closure	• Uncontrolled runoff, erosion and sedimentation. • Non-compliance with no-go area demarcation. • Rehabilitation success.

1.1.2 Impact assessment

The Degraded Bushveld is of moderately low floral sensitivity and the Modified Habitat is of low floral sensitivity. Neither of these habitat units were considered to be representative of the reference vegetation type (because of anthropogenic activities).

Clearing of vegetation for the proposed solar PV facility will lead to the loss of floral species in these habitats. Furthermore, the loss of favourable floral habitat and species diversity within as well as outside of the direct development footprint may result during the construction phase if:

- Potential failure to demarcate sensitive habitat (e.g., Freshwater Habitat) occurring outside of the direct project footprint as "No-Go" areas before construction commences, resulting in unnecessary habitat and species lost within the surrounding areas.
- Fire frequency and intensity increases because of construction activities.
- Edge effects are poorly managed, including ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to the continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas (may result in the alteration of floral habitat and/or the compaction of soils outside of the footprint area).
- Dumping of construction material within areas where no construction is planned, thereby leading to further habitat disturbance - allowing the establishment and spread of AIPs.
- Dust generated during construction activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants and potentially further decreasing optimal growing /re-establishing conditions.
- Indiscriminate driving of construction vehicles through natural vegetation is not managed. Vehicles must remain within designated roads only.

If mitigation measures as presented are implemented, then the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) measures is expected to be **MEDIUM** (for both direct and indirect impacts), and post mitigation is expected to be **LOW** and **VERY LOW** for direct and indirect impacts respectively.

The proposed development will have a notably decreased impact during the operational phase. This is because no further vegetation clearing (aside form clearing of vegetation within the servitude), or construction is anticipated to take place. However, ongoing, or permanent loss of floral habitat and diversity is anticipated during the Operational & Maintenance Phase if:

- Direct Impacts: clearing of vegetation within the demarcated servitude associated with the proposed solar PV facility. This will lead to the loss of floral habitat and diversity; and
- Indirect Impacts: Furthermore, the loss of favourable floral habitat and diversity within as well as outside of the direct development footprint may result during the operational phase. The following impacts are anticipated:
    - AIP Management and/or bush encroachment control programmes are poorly implemented and/or monitored. Failure to implement such control plans may lead to ongoing displacement of natural vegetation outside of the footprint area.
    - Inadequate implementation of safety standards for the BESS (especially the implementation of appropriate standards for the various battery types) which can result in unknown leaks of the BESS into the surrounding environment which will have a negative impact on the receiving environment.
    - Poorly implemented management and failure to appropriately monitor rehabilitation efforts may lead to: landscapes left fragmented, resulting in reduced dispersal capabilities of floral species and a decrease in floral diversity, increases in compacted soils and increased AIP

cover limiting the re-establishment of natural vegetation and an increased risk of erosion in areas left disturbed.

If mitigation measures as presented are implemented, then the significance ratings of the impacts in the operational phase can be reduced. The impact significance (prior to mitigation) measures is expected to be **MEDIUM** for both direct and indirect impacts, and ii) post mitigation is expected to be **VERY LOW** for both direct and indirect impacts.

The impacts anticipated for the proposed Project is shown in Table 2 and Table 3.

Table 2: Impact on the floral habitat and diversity from the proposed development activities (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Permanent	Permanent
Extent	Whole site and nearby surroundings	Whole site and nearby surroundings
Consequence	Medium	Low
Probability	Very high	Very high
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Not reversable: direct habitat transformation will occur regardless of mitigation measure implementation.	
Degree to which impact may cause irreplaceable loss of resources	High (i.e., loss of ESA 2 habitat in Degraded Bushveld)	
Degree to which impact can be avoided	Low	
Degree to which impact can be mitigated	Low (direct habitat transformation will occur regardless of mitigation measure implementation)	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	**Low -**

Table 3: Impact on the floral habitat and diversity from the proposed development activities (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational & Maintenance	
Criteria	**Without Mitigation**	**With Mitigation**

Intensity	Minor change (Low)	Minor change (Low)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Whole site and nearby surroundings
Consequence	Medium	Low
Probability	Probable (High)	Definite / Continuous (Very high)
Significance	**Medium -**	**Low -**
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversable: The impact can be managed if management measures are put in place and strictly adhered to	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be avoided	High	
Degree to which impact can be mitigated	High provided mitigation measures are strictly implemented	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low	**Very low**

1.1.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of floral biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• Minimise loss of indigenous vegetation where possible through adequate planning and, where necessary, by incorporating the sensitivity of the biodiversity report as well as any other specialist studies. • The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management). • Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved development footprint.
Operational and Closure	• Monitor and maintain the vegetation corridors that were created between the PV panels and along the associated servitudes to contribute to reduced habitat fragmentation and improved regional plant genetics. • No additional habitat is to be disturbed during the operational and Maintenance phase of the development.

Management objective	To prevent the unacceptable disturbance and loss of floral biodiversity and related ecosystem functionality through physical destruction and general disturbance.
	• Night lighting must make use of yellow, fluorescent based lights or red lights and these must be downward and inward facing to minimise skyglow and the attraction of insects and their associated predators. The use of bright white and/or LED lights must be prohibited.
Monitoring	Please refer to Section 36 of the main report for monitoring.

1.2 ISSUE: LOSS OF FLORAL HABITAT AND SPECIES DIVERSITY IN THE FRESHWATER HABITAT

There are a number of activities/infrastructure that have the potential to directly disturb aquatic biodiversity in all project phases, particularly in the unmitigated scenario.

1.2.1 Source of impact

Activities that will likely impact the floral ecological environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Operational	• Uncontrolled runoff, erosion and sedimentation. • Non-compliance with no-go area demarcation. • Poor housekeeping.
Decommissioning/ Closure	• Uncontrolled runoff, erosion and sedimentation. • Non-compliance with no-go area demarcation. • Rehabilitation success.

1.2.2 Impact assessment

The Freshwater Habitat is of moderately high floral sensitivity. This habitat is considered to provide unique habitat within the footprint area as well as the surrounding areas. Furthermore, ESA habitat was identified within this habitat.

Clearing of vegetation for the proposed solar PV facility. This will lead to the loss of floral species in these habitats. Although the large channel associated with the Freshwater Habitat will not be impacted, small sections of the associated tributaries will be impacted by the proposed development. Furthermore, construction activities within the tributaries could lead to the fragmentation and/or cut off of these systems from other such features within the landscape. Furthermore, the loss of favourable floral habitat and species

diversity within as well as outside of the direct development footprint may result during the construction phase if:

- Potential failure to demarcate sensitive habitat (e.g., Freshwater Habitat) occurring outside of the direct project footprint as "No-Go" areas before construction commences resulting in unnecessary habitat and species lost within the surrounding areas.
- Edge effects are poorly managed, including ineffective rehabilitation of compacted areas, bare soils, or eroded areas leading to the continual proliferation of AIP species in disturbed areas and subsequent spread to surrounding natural areas (may result in the alteration of floral habitat and/or the compaction of soils outside of the footprint area).
- Impaired water quality and reduced seasonal flow of drainage lines due to altered hydrology in the area because of poor management of sediment loads and the potential for accumulation of vegetation cuttings and debris resulting from vegetation clearing activities.
- A decrease in ecoservice provision and a decrease in the ability to support biodiversity by freshwater systems due to vegetation and soil disturbance.
- Dumping of construction material within areas where no construction is planned, thereby leading to further habitat disturbance (allowing the establishment and spread of AIPs) and the fragmentation of the Freshwater systems within the surrounding area.
- Dust generated during construction activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants and potentially further decreasing optimal growing /re-establishing conditions.
- Fire frequency and intensity increases because of construction activities.
- Indiscriminate driving of construction vehicles through natural vegetation is not managed. Vehicles must remain within designated roads only.

If mitigation measures as presented are implemented, then the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) is anticipated to be **MEDIUM** and **LOW** for the direct and indirect impacts respectively, and post mitigation is expected to be **LOW** and **VERY LOW** for direct and indirect impacts respectively.

The proposed development will have a notably decreased impact during the operational phase. This is because no further vegetation clearing (aside form clearing of vegetation within the servitude), or construction is anticipated to take place. However, ongoing, or permanent loss of floral habitat and diversity is anticipated during the operational & maintenance phase if:

- Clearing of vegetation within the Freshwater Habitat within the demarcated servitude associated with the proposed solar PV facility. This will lead to the loss of floral habitat and diversity, increased erosion risks and overall bank stability which may increase sediment loads; and
- Furthermore, the loss of favourable floral habitat and diversity within as well as outside of the direct development footprint may result during the operational phase. The following impacts are anticipated:
    - AIP Management and/or bush encroachment control programmes are poorly implemented and/or monitored. Failure to implement such control plans may lead to ongoing displacement of natural vegetation outside of the footprint area and/or changes to the hydrology of the Freshwater Habitats; and

- Poorly implemented management and failure to appropriately monitor rehabilitation efforts may lead to: landscapes left fragmented, resulting in reduced dispersal capabilities of floral species and a decrease in floral diversity, increases in compacted soils and increased AIP cover limiting the re-establishment of natural vegetation and an increased risk of erosion and overall bank stability which may increase sediment loads in areas left disturbed.

If mitigation measures for the operational phase are implemented, then the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) is expected to be medium for both direct and indirect impacts, and post mitigation is expected to be **VERY LOW** for both direct and indirect impacts

The impacts anticipated for the proposed Project is shown in Table 4 (construction phase) and Table 5 (operational phase).

Table 4: Impact on the floral habitat and diversity from the proposed development activities within the freshwater habitat (operational and maintenance phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational & Maintenance	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term (10 to 20 years)	Permanent
Extent	Beyond site	Whole site and nearby surroundings
Consequence	Medium	Low
Probability	Very high	Very high
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable: The impact can be managed in the construction phase if layouts are designed to avoid the Freshwater Habitat (where possible) and partially reversed during the operational phase if management measures are put in place and strictly adhered to	
Degree to which impact may cause irreplaceable loss of resources	Medium (i.e., loss of ESA1 & 2 habitat in Freshwater Habitat)	
Degree to which impact can be avoided	High (layout can be designed to avoid the Freshwater features and associated buffers)	
Degree to which impact can be mitigated	Low (direct habitat transformation will occur if layouts are not amended to exclude the Freshwater Habitat)	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Low**

Table 5: Impact on the floral habitat and diversity from the proposed development activities (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational & Maintenance	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Permanent	Permanent
Extent	Whole site and nearby surroundings	Part of site/property
Consequence	Medium	Low
Probability	High	Medium
Significance	**Medium**	**Very Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversable: The impact can be managed if management measures are put in place and strictly adhered to	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be avoided	High	
Degree to which impact can be mitigated	High provided mitigation measures are strictly implemented	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low	**Very low**

1.2.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of freshwater floral biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• Suppress dust to mitigate the impact of dust on flora within a close proximity of construction activities (Sett 2017) – any chemicals used for this purpose must not be permitted to enter the Freshwater habitats. • An AIP Management/Control Plan should be implemented by a qualified professional. No use of uncertified chemicals may be used for chemical control of AIPs. Only trained personnel are

Management objective	To prevent the unacceptable disturbance and loss of freshwater floral biodiversity and related ecosystem functionality through physical destruction and general disturbance.
	to use chemical and mechanical control methods of AIPs. Chemical control may not be used within the Freshwater Habitat.
Operational and Closure	• Ongoing monitoring of the state of the biodiversity associated with the footprint areas, the servitudes, and the vegetation surrounding the footprint areas, must continue throughout the operation and maintenance of the proposed project to ensure that detrimental residual impacts are detected early enough to be reversed/prevent. No additional habitat is to be disturbed during the operational and Maintenance phase of the development. • No dumping of litter must be allowed on-site
Monitoring	Please refer to Section 36 of the main report for monitoring.

1.3 ISSUE: LOSS OF FLORAL SCC

The construction of the solar PV facility and the associated infrastructure would result in the removal of vegetation within the development footprint of the proposed project infrastructure.

1.3.1 Source of impact

Activities that will likely impact the floral ecological environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Operational	• Uncontrolled runoff, erosion and sedimentation. • Non-compliance with no-go area demarcation. • Poor housekeeping.
Decommissioning/ Closure	• Uncontrolled runoff, erosion and sedimentation. • Non-compliance with no-go area demarcation. • Rehabilitation success.

1.3.2 Impact assessment

The Degraded Bushveld is of moderately low floral sensitivity and the Modified Habitat is of low floral sensitivity. Suitable habitat for SCC was available within these habitats, albeit not extensively.

Clearing of vegetation for the proposed solar PV facility will lead to the loss of floral SCC (e.g., Aloe *cryptopoda*, *Boscia albitrunca*, and *Sclerocarya birrera* subsp. *caffra*) within these habitats. Furthermore, the

loss of favourable SCC floral habitat and SCC diversity within as well as outside of the direct development footprint may result during the construction phase. The following impacts are anticipated for SCC:

- Loss of SCC because of failure to conduct a floral walk through of the footprint area prior to the commencement of construction activities and identify species for possible rescue and/or relocation activities.
- Failure to comply with national and regional legislation regarding permit applications for the potential removal, destruction, and/or relocation of floral SCC and/or protected floral species (nationally and provincially) within footprint areas (depending on the outcome of the walkdown).
- Failure to conduct rescue and relocation activities prior to the commencement of construction activities leading to a loss of SCC.
- A loss of SCC during failure to monitor the success of relocation activities occurs.
- Over exploitation through the removal and/or collection of SCC beyond the direct footprint which will result in the loss of SCC abundance and diversity.
- Potential failure to demarcate sensitive habitat (e.g., Freshwater Habitat) occurring outside of the direct project footprint as “No-Go” areas before construction commences resulting in unnecessary habitat and species lost within the surrounding areas.
- Additional pressures associated with increased human presence within the footprint area resulting in an increase in the potential spread of AIP species which could result in the loss of SCC individuals and associated habitat.
- Poorly managed edge effects - including ineffective rehabilitation of bare areas and the subsequent spread of AIP species into surrounding areas which may result in the degradation of habitat and SCC individuals.
- Inadequate implementation of safety standards for the BESS (especially the implementation of appropriate standards for the various battery types) which can result in unknown leaks of the BESS into the surrounding environment which will have a negative impact on the receiving environment (i.e., impacting SCC habitat).
- Ineffective monitoring of relocated SCC can result in the loss of SCC from the footprint area and poorly reinstated and represented floral SCC within rehabilitated sites.

If mitigation measures are implemented, then the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) measures is expected to be low and **VERY LOW** for the direct and indirect impacts respectively, and post mitigation is expected to be low and **VERY LOW** for direct and indirect impacts respectively

The impacts anticipated for the proposed Project is shown in Table 6 (construction phase) and Table 7 (operational phase).

Table 6: Impact on the floral SCC from the proposed development activities (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very low
Duration	Medium	Short-term

Extent	Part of site/property	Part of site/property
Consequence	Low	Low
Probability	Very high	Very high
Significance	**Low**	**Very Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversable: The impact can be managed if management measures are put in place and strictly adhered to	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be avoided	High	
Degree to which impact can be mitigated	High provided mitigation measures are strictly implemented	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Low**

Table 7: Impact on the floral SCC from the proposed development activities (operational and maintenance phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational & Maintenance	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very low
Duration	Permanent	Permanent
Extent	Part of site/property	Part of site/property
Consequence	Low	Low
Probability	Probable (High)	Possible / frequent (Medium)
Significance	**Low**	**Very Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversable: The impact can be managed if management measures are put in place and strictly adhered to	
Degree to which impact may cause irreplaceable loss of resources	Low (direct habitat transformation should not occur)	
Degree to which impact can be avoided	High (impacts can be managed)	
Degree to which impact can be mitigated	High (rescued and relocated SCC can be monitored)	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low	**Very low**

1.3.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of floral SCC biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• A site walk through of the footprint area should be conducted prior to the commencement of construction activities and all SCC identified and marked for potential rescue and relocation activities. • Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the proposed development footprint area.
Operational	• As far as possible, no collection of floral SCC/protected or medicinal floral species within the footprint area or adjacent natural habitat must be allowed during the Operational & Maintenance Phase of the proposed development.
Monitoring	Please refer to Section 36 of the main report for monitoring.

1.4 ISSUE: LOSS OF FLORAL SCC IN FRESHWATER

There are a number of activities/infrastructure that have the potential to directly disturb aquatic biodiversity in all project phases, particularly in the unmitigated scenario.

1.4.1 Source of impact

Activities that will likely impact the floral ecological environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.

1.4.2 Impact assessment

The freshwater habitat is of moderately high floral sensitivity. Suitable habitat for SCC was available within this habitat.

Clearing of vegetation for the proposed solar PV facility will lead to the loss of floral species in these habitats. Although the large channel associated with the freshwater habitat will not be impacted, small sections of the associated tributaries will be impacted by the proposed development. Furthermore, construction activities within the tributaries could lead to the fragmentation and/or cut off of these systems from other such features within the landscape.

Furthermore, the loss of favourable SCC floral habitat and SCC diversity within as well as outside of the direct development footprint may result during the construction phase. The following impacts are anticipated for SCC:

- Loss of SCC because of failure to conduct a floral walk through of the Habitat unit prior to the commencement of construction activities and identify species for possible rescue and/or relocation activities.
- Failure to comply with national and regional legislation regarding permit applications for the potential removal, destruction, and/or relocation of floral SCC and/or protected floral species (nationally and provincially) within footprint areas (depending on the outcome of the walkdown).
- Failure to conduct rescue and relocation activities prior to the commencement of construction activities leading to a loss of SCC.
- Increased risk of SCC harvesting due to increased presence of personnel on site.
- A loss of SCC where potential failure to monitor the success of relocation activities has been conducted.
- Over exploitation through the removal and/or collection of SCC beyond the direct footprint which will result in the loss of SCC abundance and diversity.
- Potential failure to demarcate sensitive habitat (e.g., Freshwater Habitat) occurring outside of the direct project footprint as “No-Go” areas before construction commences resulting in unnecessary habitat and species lost within the surrounding areas.
- Additional pressures associated with increased human presence within the footprint area resulting in an increase in the potential spread of AIP species which could result in the loss of SCC individuals and associated habitat.
- Poorly managed edge effects - including ineffective rehabilitation of bare areas and the subsequent spread of AIP species into surrounding areas which may result in the degradation of habitat and SCC individuals.

The proposed activities will not impact on any CBAs. However, the proposed activities will impact on ESA1 habitat, ESA2 habitat. ESAs are important features in the greater landscape and provide unique conditions for flora and important ecological functionality within the ecosystem. Due to their ecological importance, it is recommended that impacts to ESAs be avoided or minimised as far as possible and kept to approved areas only. ESA1 habitat (albeit only a small section) was identified within the Freshwater Habitat, whereas ESA2 habitat (albeit only a small section) was identified within the Freshwater Habitat and the Degraded Bushveld Habitat

If mitigation measures as presented are implemented, then the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) is expected to be medium and low for direct and indirect impacts respectively, and ii) post mitigation is expected to be **MEDIUM** and **VERY LOW** for direct and indirect impacts respectively.

The impacts anticipated for the proposed Project is shown in Table 8 (construction phase) and Table 9 (operational phase).

Table 8: Impact on the floral SCC from the proposed development activities within the freshwater habitat (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Beyond site	Part of site/property
Consequence	High	Low
Probability	High	High
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable: The impact can be managed (and or avoided) through the strict implementation of mitigation measures (e.g., conduct floral walk down of the footprint area).	
Degree to which impact may cause irreplaceable loss of resources	Medium (i.e., loss of ESA1 & 2 habitat in Freshwater Habitat)	
Degree to which impact can be avoided	High (SCC can be rescued and relocated, Freshwater Features can be avoided)	
Degree to which impact can be mitigated	Medium (SCC can be rescued and relocated (or avoided in the case of RDL species), Freshwater Features can be avoided and/or channels redirected)	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
	Without Mitigation	**With Mitigation**
	Medium	**Low**

Table 9: Impact on the floral SCC from the proposed development activities (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational & Maintenance	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very low
Duration	Permanent	Permanent
Extent	Beyond site	Whole site and nearby surroundings

Consequence	Medium	Low
Probability	High	Medium
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversable: The impact can be managed if management measures are put in place and strictly adhered to	
Degree to which impact may cause irreplaceable loss of resources	Low (direct habitat transformation should not occur)	
Degree to which impact can be avoided	High (impacts can be managed)	
Degree to which impact can be mitigated	High (rescued and relocated SCC can be monitored)	
Cumulative Impact		
Extent to which a cumulative impact may arise	Likely	
	Without Mitigation	**With Mitigation**
	Low	**Very low**

1.4.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of freshwater floral SCC biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• A site walk through of the footprint area should be conducted prior to the commencement of construction activities and all SCC identified and marked for potential rescue and relocation activities • Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the proposed development footprint area. •
Operational and maintenance	• As far as possible, no collection of floral SCC/protected or medicinal floral species within the footprint area or adjacent natural habitat must be allowed during the Operational & Maintenance Phase of the proposed development.
Monitoring	Please refer to Section 36 of the main report for monitoring.

1.5 ISSUE: LOSS OF FAUNAL HABITAT AND SPECIES DIVERSITY

The construction of the proposed project would result in the removal of vegetation within the project footprint of the solar PV facility which will lead to an impact on faunal diversity, habitat as well as on faunal

species of conservation concern. During decommissioning, similar impacts would be expected to those during construction, albeit likely of lower intensity.

During the operational phase, maintenance activities for the proposed project may result in the disturbance of fauna.

1.5.1 Source of impact

Activities that will likely impact the terrestrial faunal ecological environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Closure	• Removal of equipment and disassembly of construction camp.

1.5.2 Impact assessment

The Degraded Bushveld is of moderately low faunal sensitivity and the Modified Habitat is of low faunal sensitivity. Both these habitat units provided limited habitat and food resources to faunal species, whilst the increased anthropogenic activities in and surrounding the habitats further decreased faunal habitation suitability.

Impacts Associated with the Construction Phase: this phase will result in the direct impacts to the associated habitats:

- Vegetation clearance within the footprint area, leading to loss of faunal habitat.
- Loss of remaining faunal species diversity, albeit already low.
- Potential mortalities of small faunal species due to collisions with construction equipment.
- Human – wildlife conflict during resulting in faunal mortalities / injuries.
- Potential hunting/trapping of faunal species by construction personnel within the footprint area as well as the adjacent areas.

If mitigation measures are implemented, then the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) in the construction phase is expected to be **MEDIUM** and post mitigation is expected to be **LOW**. The impact significance (prior to mitigation) in the operational phase is expected to be **VERY LOW**, and post mitigation is expected to remain **VERY LOW**

The impacts anticipated for the proposed Project is shown in Table 10 (construction phase) and Table 11 (operational phase).

Table 10: Impact on the faunal habitat and diversity from the proposed development activities (construction phase)

Description of Impact		
Type of Impact	Direct/Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Whole site and nearby surroundings	Part of site/property
Consequence	Medium	Low
Probability	Very high	Very high
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable. Upon removal of solar facility habitat could be re-instated overtime through rehabilitation (revegetation) efforts.	
Degree to which impact may cause irreplaceable loss of resources	Low: No important or niche habitat is located within the footprint area.	
Degree to which impact can be avoided	Low: Not avoidable but rehabilitation efforts in the remaining footprint extent whilst ensuring that a short herbaceous layer is sustained below the panels will minimise impacts.	
Degree to which impact can be mitigated	Low: Direct habitat transformation will occur within the demarcated footprint area regardless of mitigation. Mitigation can however limit impacts to areas not planned for development.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low	**Low**

Table 11: Impact on the faunal habitat and diversity (operational phase)

Description of Impact		
Type of Impact	Direct/Indirect	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Part of site/property	Part of site/property
Consequence	Low	Low
Probability	Low	Low
Significance	**Very low**	**Very low**
Additional Assessment Criteria		

Degree to which impact can be reversed	Partially reversable. Upon removal of solar facility habitat could be re-instated overtime through rehabilitation (revegetation) efforts. Use of correct lighting measures at night to decrease impacts to nocturnal insects (see mitigation measures).	
Degree to which impact may cause irreplaceable loss of resources	Low: No important or niche habitat is located within these habitat units.	
Degree to which impact can be avoided	Low: Not avoidable but mitigation measures will help to minimise impacts.	
Degree to which impact can be mitigated	Low: Impacts can be minimised through the implementation of mitigation measures during the operational phase.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Very low	**Very low**

1.5.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of faunal biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• Avoid soil sealing (i.e., the destruction or covering of the ground by an impermeable material). Ensure that a vegetation layer is maintained below PV panels to promote soil health, vegetation establishment, reduced habitat fragmentation, and resources for fauna. In this regard, where a vegetation layer is maintained below and between the PV panels, use of indigenous plants from the reference vegetation type is recommended for best biodiversity outcomes. • Maintain vegetation corridors between the PV panels. Contribution towards conserving the regional genetic diversity of plants and fauna in these areas must be ensured through revegetating with indigenous species from the area.
Operational and maintenance	• Should any venomous snake, scorpions or spiders be encountered in the operational area and they pose a direct threat/risk to operational staff, they are to be carefully relocated to a suitable area outside of the operational footprint by a suitably qualified/trained staff member or snake handler. • No additional habitat is to be disturbed during the Operational & Maintenance Phase of the development.
Monitoring	Please refer to Section 36 of the main report for monitoring.

1.6 ISSUE: LOSS OF FAUNAL HABITAT AND SPECIES DIVERSITY IN THE FRESHWATER HABITAT

The construction of the proposed project would result in the removal of vegetation within the project footprint of the solar PV facility which will lead to an impact on faunal diversity, habitat as well as on faunal species of conservation concern. During decommissioning, similar impacts would be expected to those during construction, albeit likely of lower intensity.

During the operational phase, maintenance activities for the proposed project may result in the disturbance of fauna.

1.6.1 Source of impact

Activities that will likely impact the faunal ecological environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Closure	• Removal of equipment and disassembly of construction camp.

1.6.2 Impact assessment

The Freshwater Habitat is of intermediate sensitivity for faunal species. Erosion activities and the surrounding communities has led to habitat degradation, however there was an increase of woody species diversity within this habitat (largely in the riparian areas), which may be utilised by faunal species for refuge. During high rainfall events this habitat will also serve as an important source of surface water for fauna, however due to the ephemeral nature of these systems, water availability is likely to be of short duration.

Impacts Associated with the Construction Phase: this phase will result in the direct impacts to the freshwater habitat, notably if the applicable zones of regulation are not adhered to during the construction phase:

- Failure to demarcate the footprint area leading to vegetation clearance beyond the approved footprint, which include the freshwater habitat.
- Runoff and erosion leading to increased sedimentation of the freshwater habitat.
- Altered hydrology and water runoff from the footprint area to the freshwater habitat impacting flow regimes and seasonal availability of surface water in these systems for fauna.
- Dumping of construction material / cleared material into the freshwater habitat leading to habitat degradation and potential impacts on the hydrology and ecoservice provisioning of the freshwater habitat.
- Potential for alien plant proliferation to occur in the designated construction areas in the footprint, spreading to the freshwater habitat. Alien plant proliferation in the freshwater habitat will lead to decreased habitat availability and suitability for faunal species.

The proposed development is unlikely to have an impact on the habitat unit during the operational phase, as it is anticipated that the solar PV facility will be located outside of the habitat unit and the associated zones of regulation. Indirect impacts may however be possible, given that the solar PV facility and associated roads may provide easier access to riparian areas, which may be harvested for firewood.

If mitigation measures are implemented, the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) in the construction phase is expected to be a **VERY LOW**, and post mitigation is expected to be insignificant. The impact significance (prior to mitigation) in the operational phase is expected to be **VERY LOW**, and post mitigation is expected remain **VERY LOW.**

Table 12: Impact on the faunal habitat and diversity from the proposed development activities (construction phase)

Description of Impact		
Type of Impact	Direct/Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Very low
Duration	Medium-term	Short-term
Extent	Part of site/property	Part of site/property
Consequence	Low	Very low
Probability	Medium	Low
Significance	**Very Low**	Insignificant
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable. Impacts to this habitat unit can be managed and areas rehabilitated.	
Degree to which impact may cause irreplaceable loss of resources	Low: No important or niche habitat is located within the footprint area.	
Degree to which impact can be avoided	High: Adhere to the regulated zones of the freshwater habitat and ensure that all mitigation measures are implemented.	
Degree to which impact can be mitigated	High: Adhere to the regulated zones of the freshwater habitat and ensure that all mitigation measures are implemented.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low	**Very low**

1.6.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of freshwater faunal biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• An AIP Management/Control Plan should be implemented by a qualified professional. No use of uncertified chemicals may be used for chemical control of AIPs. Only trained personnel are to use chemical and mechanical control methods of AIPs. Chemical control may not be used within the Freshwater Habitat
Operational and Closure	• Ongoing monitoring of the state of the biodiversity associated with the footprint areas, the servitudes, and the vegetation surrounding the footprint areas, must continue throughout the operation and maintenance of the proposed project to ensure that detrimental residual impacts are detected early enough to be reversed/prevent • No additional habitat is to be disturbed during the operational and Maintenance phase of the development. • No dumping of litter must be allowed on-site
Monitoring	Please refer to Section 36 of the main report for monitoring.

1.7 ISSUE: LOSS OF FAUNAL SCC

The construction of the proposed project would result in the removal of vegetation within the project footprint of the solar PV facility which will lead to an impact on faunal diversity, habitat as well as on faunal species of conservation concern. During decommissioning, similar impacts would be expected to those during construction, albeit likely of lower intensity.

During the operational phase, maintenance activities for the proposed project may result in the disturbance of fauna.

1.7.1 Source of impact

Activities that will likely impact the faunal ecological environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Closure	• Removal of equipment and disassembly of construction camp.

1.7.2 Impact assessment

The Degraded Bushveld is of moderately low faunal sensitivity and the Modified Habitat is of low faunal sensitivity. These habitat units did not provide suitable habitat or resources that would support faunal SCC populations or individuals.

With the exception of potential leaks occurring from a failed BESS (though considered unlikely provided all safety measures are in place), the operation phase of the proposed solar facility is unlikely to impact upon any faunal SCC, as no SCC are currently expected to occur in the footprint area, and it is unlikely that this will change during the operational phase of the project.

If mitigation measures are implemented, then the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) for the construction phase is expected to be **INSIGNIFICANT**, and post mitigation is expected to be I**NSIGNIFICANT**. The impact significance (prior to mitigation) in the operational phase is expected to be insignificant, and post mitigation is expected remain insignificant.

The impacts anticipated for the proposed Project is shown in Table 13 (construction phase) and Table 14 (operational phase).

Table 13: Impact on the faunal SCC from the proposed development activities (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very low	Very low
Duration	Short-term	Short-term
Extent	Part of site/property	Part of site/property
Consequence	Very low	Very low
Probability	Very low	Very low
Significance	Insignificant	Insignificant
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable. Impacted areas can be rehabilitated, however surrounding anthropogenic activities will likely still preclude faunal SCC occurrences in the footprint area.	
Degree to which impact may cause irreplaceable loss of resources	Low: No important or niche habitat is located within the footprint area.	
Degree to which impact can be avoided	High: Habitat in the footprint area is not considered suitable for faunal SCC habitation, as such, direct impacts to faunal SCC in the region are avoidable.	
Degree to which impact can be mitigated	High: Faunal SCC are unlikely to occur within the footprint area.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Unlikely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Very low	Insignificant

Table 14: Impact on the faunal SCC (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very low	Very low
Duration	Short-term	Short-term
Extent	Part of site/property	Part of site/property
Consequence	Very low	Very low
Probability	Very low	Very low
Significance	Insignificant	Insignificant
Additional Assessment Criteria		
Degree to which impact can be reversed	Activities unlikely to result in any impacts to faunal SCC, however, degraded areas should be rehabilitated as and where necessary regardless.	
Degree to which impact may cause irreplaceable loss of resources	Low: No important or niche habitat is located within the footprint area.	
Degree to which impact can be avoided	High: Habitat in the footprint area is not considered suitable for faunal SCC habitation, as such, direct impacts to faunal SCC in the region are avoidable.	
Degree to which impact can be mitigated	High: Faunal SCC are unlikely to occur within the footprint area.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Unlikely	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Insignificant	Insignificant

1.7.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of faunal SCC biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• A site walk through of the footprint area should be conducted prior to the commencement of construction activities and all SCC identified and marked for potential rescue and relocation activities.

Management objective	To prevent the unacceptable disturbance and loss of faunal SCC biodiversity and related ecosystem functionality through physical destruction and general disturbance.
	• No collection or hunting of any fauna species is to be allowed by personnel during the construction phase, especially with regards to avifaunal SCC (if encountered and not part of a rescue/relocation plan).
Monitoring	Please refer to Section 36 of the main report for monitoring.

2. AVIFAUNA ASSESSMENT

2.1 ISSUE: IMPACT ON AVIFAUNAL SCC

The construction and decommissioning phases of the proposed project would result in the disturbance of avifauna and potential habitat destruction. During the operational phase, avifauna may collide with the surface of the PV panel modules or be entrapped within the perimeter fence of the proposed project

2.1.1 Source of impact

Activities that will likely impact the avifaunal environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Operational	• Solar PV panels
Closure	• Removal of equipment and disassembly of construction camp.

2.1.2 Impact assessment

Numerous avifaunal SCC have distribution ranges which encompass the footprint area and may utilise it for foraging on an irregular basis. None of these species have been recorded in the footprint area, and only the Lanner Falcon (*Falco biarmicus)* has been recorded in the pentad in which the footprint area is required. Of the species that have been recorded in the neighbouring pentads, only the Verreaux's Eagle (*Aquila verreauxii*) would potentially move into the footprint area on an occasional basis.

Due the high human activity present in the area, there is a limited chance of SCC being adversely impacted by the proposed Project at a regional or population level, and the area is not considered to be a regionally important breeding, roosting or foraging habitat for any of the abovementioned species and thus no impacts on their respective populations breeding productivity are likely to occur. Mitigation measures will further reduce the impact on SCC.

The impact significance of the proposed development (prior to mitigation) on avifaunal habitat, diversity and SCC range from **MEDIUM LOW** to **INSIGNIFICANT** (negative). Potential regional-scale impacts are highly unlikely, and if recommended mitigation measures are adhered to, impacts on avifaunal diversity and habitat are likely to be localised. If effective mitigation takes place at all stages of the proposed project, most of the impacts may be reduced to lower significance ratings, minor to insignificant (negative).

The impacts anticipated for the proposed Project is shown in Table 15.

Table 15: Impact on avifaunal SCC (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Permanent	Permanent
Extent	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low
Probability	Very low	Very low
Significance	**Very Low**	**Insignificant**
Additional Assessment Criteria		
Degree to which impact can be reversed	Fully Reversible.	
Degree to which impact may cause irreplaceable loss of resources	Low: The development will be very unlikely to cause irreversible loss of resources due to being part of a new baseline, and not being likely to have a significant collision risk for SCC, primarily due to the very low POC of SCC in the area.	
Degree to which impact can be avoided	High: The operation and maintenance of the solar development will be unlikely to result in a measurable impact on avifaunal SCC in the local area.	
Degree to which impact can be mitigated	High: The site is not located adjacent to any bird movement corridors and is within an area of low degree of SCC POC which mitigates the impact.	
Cumulative Impact		
The extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low	**Very Low**

2.1.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of avifaunal SCC biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement a biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• A site walk-through of the footprint area should be conducted prior to the commencement of construction activities and all SCC identified and marked for potential rescue and relocation activities

Management objective	To prevent the unacceptable disturbance and loss of avifaunal SCC biodiversity and related ecosystem functionality through physical destruction and general disturbance.
	• No collection or hunting of any fauna species is to be allowed by personnel during the construction phase, especially with regards to avifaunal SCC (if encountered and not part of a rescue/relocation plan).
Monitoring	Please refer to Section 36 of the main report for monitoring.

2.2 ISSUE: IMPACT ON AVIFAUNAL DIVERSITY AND HABITAT

The proposed project will physically transform a large area of natural vegetation The habitat transformation associated with the clearing of vegetation could result in several impacts on birds, including:

- Direct habitat loss which would be particularly significant for species with restricted ranges or very specific habitat requirements.
- Habitat fragmentation and/or modification.
- Disturbance/displacement of species (e.g., Through construction/maintenance activities).

2.2.1 Source of impact

Activities that will likely impact the avifaunal environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Operational	• PV arrays
Closure	• Removal of equipment and disassembly of construction camp.

2.2.2 Impact assessment

In this context, and at the scale of the development site, the development of the arrays will have a significant impact on the bird assemblage (abundance and species density), and most birds that currently occur in the degraded bushveld on the site will no longer be able to inhabit the site once construction (vegetation clearing) has commenced.

Only a very small number of birds (most likely to be granivores – seed eaters) such as weavers, widows, waxbills, and some gamebirds such as Helmeted Guineafowl (*Numida meleagris*) etc. would be likely to forage within the arrays if a pioneer grass layer is allowed to become established under the arrays. It is important to note that none of the affected species have restricted ranges or very specific habitat requirements; all of the commonly occurring woodland species that have been commonly recorded on the development site and more widely in the surrounds are very well-represented in the wider surrounding area

where woodland habitat has been retained and will be present once the development becomes operational. As such, none of the affected species have limited distributions and the loss of habitat at the scale of the proposed development will not have a population-level impact.

At a wider footprint area scale (i.e., a 2 km radius of the development site), the habitat transformation impact will be less significant, as parts of the proposed Project footprint will still be characterised by degraded bushveld habitat, and certain ecological linkages will be retained.

The impacts anticipated for the proposed Project is shown in Table 16.

Table 16: Impact on avifaunal habitat and diversity (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Permanent	Permanent
Extent	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low
Probability	High	High
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Irreversible: The development will result in loss of most (woody) vegetation over most of the development site which will irreversibly affect the habitat for avifauna; albeit at a limited spatial scale	
Degree to which impact may cause irreplaceable loss of resources	Low: Despite the loss of a woody vegetation over most of the spatial extent of the development site, the development will be very unlikely to cause irreversible loss of resources due to the highly degraded nature of the habitat and the relatively small spatial extent of the area to be transformed.	
Degree to which impact can be avoided	Low	
Degree to which impact can be mitigated	Low: The loss of woody habitat on the site is very difficult to mitigate due to the permanent nature of the loss. Should grassy / herbaceous vegetation be allowed to re-establish itself under the panel arrays, certain granivores would return to forage on the site. The retention of the freshwater ecosystem movement corridors on either side of the site is a mitigatory measure as bird movement corridors in the vicinity of the site will be retained	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	**Low -**

2.2.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the unacceptable disturbance and loss of avifaunal biodiversity and related ecosystem functionality through physical destruction and general disturbance.
Management outcome	• Implement biodiversity action plan • Limit project footprint • Monitoring • Rehabilitation
Mitigation measures	
Construction	• Edge effect control must be implemented to ensure no further degradation and potential loss of avifaunal habitat outside of the proposed project footprint area. An on-site Environmental Control Officer (ECO) must monitor and mitigate any edge effects throughout the construction phase. Special attention must be paid to potential increase and spread of AIPs • No collection or hunting of any fauna species is to be allowed by personnel during the construction phase, especially with regards to avifaunal SCC (if encountered and not part of a rescue/relocation plan). • Construction should preferably occur in the drier winter months when most bird species are not breeding, and when many granivores tend to become nomadic in nature and less territorial. •
Operational	• Monitoring of the solar arrays for bird fatalities must occur at regular intervals during the operational phase of the development, in line with the BLSA Birds and Solar Energy Guideline. • Anti-roosting spikes / diverters should be fitted to the solar panels, if required
Monitoring	Please refer to Section 36 of the main report for monitoring.

3. SOILS, LAND USE AND LAND CAPABILITY

Soils are a significant component of most ecosystems. As an ecological driver soil is the medium in which most vegetation grows and a range of vertebrates and invertebrates exist. In the context of mining operations, soil is even more significant as mining is a temporary land use where after rehabilitation, soil availability is the key factor to the establishment of post closure land capability and use.

3.1 ISSUE: REMOVAL AND STOCKPILING OF SOIL AND SUBSEQUENT LOSS OF LAND CAPABILITY

The development of the proposed project will lead to several impacts from a soils and agricultural potential perspective. These impacts are anticipated to occur during the pre-construction, construction (including decommissioning) and the operation phase of the proposed project.

3.1.1 Source of impact

Activities that will likely impact the soil, land use and land capability environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Closure	• Removal of equipment and disassembly of construction camp.

3.1.2 Impact assessment

Vegetation clearing and soil stripping prior to the commencement of construction activities can result in potential loss and degradation of productive topsoil material if not managed and mitigated properly. Stripped and stockpiled soils are prone to compaction, loss of soil structure, nutrient degradation by mixing topsoil with lower quality subsoil, and salinisation through heavy machinery handling.

If mitigation measures are implemented, the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) is expected to be **MEDIUM**, and post mitigation is expected to be **LOW**.

The impacts anticipated for the proposed Project is shown in Table 17.

Table 17: Summary of the impact significance for soil land capability during all phases of development

Description of Impact	
Type of Impact	Direct

Nature of Impact	Negative	
Phases	All phases	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Confined within the project site	Immediate footprint of activity
Consequence	Medium	Low
Probability	Very high	Probable
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable. Upon removal of solar PV facility the soils could be re-instated overtime through rehabilitation efforts.	
Degree to which impact may cause irreplaceable loss of resources	Medium: The soils which are stripped my not be replaced during the decommissioning phase	
Degree to which impact can be avoided	Low: Not avoidable but rehabilitation efforts in the remaining footprint extent to ensure that the soils are conserved.	
Degree to which impact can be mitigated	Medium: This depends entirely on the rehabilitation plan if the soils of similar land capability will be replaced.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Low**

3.1.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the subsequent loss of land capability from soil removal and stockpiling
Management outcome	• Limit project footprint • Control through appropriate design (incl. access roads) • Closure planning and rehabilitation
Mitigation measures	
Construction And Operational	• The topsoil stockpile should be vegetated and while vegetating, measures will be needed to contain erosion of the stockpile during rain events • Separate stockpiles of different soil to obtain the highest post-mining land capability and thus reduce the residual loss of agricultural potential. • Temporary roads should be well marked and should only cross drainage lines on areas identified as permanent road features where erosion and soil loss management can be contained.
Monitoring	Please refer to Section 36 of the main report for monitoring.

3.2 ISSUE: SOIL EROSION

Soil erosion is largely dependent on land use and soil management and is generally accelerated by anthropogenic activities. In the absence of detailed South African guidelines on erosion classification, the erosion potential and interpretation are based on field observations as well as observed soil profile characteristics. In general, soils with high clay content have a high-water retention capacity, thus less prone to erosion in comparison to sandy textured soils, which in contrast are more susceptible to erosion.

3.2.1 Source of impact

Activities that will likely impact the soil, land use and land capability environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Site clearing, removal of vegetation. • Stripping and stockpiling of soil resources. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Closure	• Removal of equipment and disassembly of construction camp.

3.2.2 Impact assessment

The proposed development is located on a relatively flat to gently sloping terrain, which decreases the erosion hazard. Although the soils identified within the footprint area less susceptible to erosion due to their high clay content as these soils have strong cohesive forces between the particles. However, due to their low infiltrability these soils are more prone to erosion during heavy rains as a result of surface runoff. Their susceptibility to erosion is likely to increase once the land is cleared for excavation, and the soils will inevitably be exposed to wind and stormwater.

If mitigation measures are implemented, the significance ratings of the impacts can be reduced. The impact significance (prior to mitigation) is expected to be **MEDIUM**, and post mitigation is expected to be **LOW**.

The cumulative loss from a soil and land capability point of view is not anticipated to be significant as the dominant soils identified within the study are not suitable for cultivation unless intense management practices are implemented. In addition, considering the climatic conditions of the area which is associated with limited rainfall as per the review of desk based data sources and the absence of any irrigation scheme, this renders the footprint area not suitable for any large-scale agricultural cultivation. However, some areas used for subsistence grazing will potentially be impacted, which will ultimately impact on the local livestock production. The overall impact on the soil and land capability is anticipated to be **MEDIUM-LOW** without mitigation measures and **LOW** with mitigation measures in place under the condition that the integrated mitigation measures are implemented accordingly, with the aim of minimising the potential loss of valuable topsoil material

The impacts anticipated for the proposed Project is shown in Table 18 (construction phase) and Table 19 (operational phase).

Table 18: Summary of the impact significance on soil erosion (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Short-term	Short-term
Extent	Beyond site	Whole site and nearby surroundings
Consequence	Medium	Low
Probability	High	High
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable. Upon removal of solar facility the soils could be re-instated overtime through rehabilitation efforts.	
Degree to which impact may cause irreplaceable loss of resources	Medium: The soils which are stripped my not be replaced during the decommissioning phase.	
Degree to which impact can be avoided	Low: Not avoidable but rehabilitation efforts in the remaining footprint extent to ensure that the soils are conserved.	
Degree to which impact can be mitigated	Medium: This depends entirely on the rehabilitation plan if the soils of similar land capability will be replaced.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	**Low**

Table 19: Summary of the impact significance on soil erosion (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Beyond site	Part of site/property
Consequence	Medium	Low
Probability	High	High
Significance	**Medium**	**Low**
Additional Assessment Criteria		

Degree to which impact can be reversed	Partially reversable. Upon removal of solar facility, the soils could be re-instated overtime through rehabilitation efforts.	
Degree to which impact may cause irreplaceable loss of resources	Medium: The soils which are stripped my not be replaced during the decommissioning phase	
Degree to which impact can be avoided	Low: Not avoidable but rehabilitation efforts in the remaining footprint extent to ensure that the soils are conserved.	
Degree to which impact can be mitigated	Medium: This depends entirely on the rehabilitation plan if the soils of similar land capability will be replaced.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Low**

3.2.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the subsequent loss of land capability from soil erosion
Management outcome	• Limit project footprint • Control through appropriate design (incl. access roads) • Closure planning and rehabilitation
Mitigation measures	
Construction And Operational	• Soil erosion should be controlled on stockpiles by having control measures to reduce erosion risk such as erosion control blankets, soil binders, revegetation, contours, diversion banks and spillways. • The topsoil stockpile should be vegetated and while vegetating, measures will be needed to contain erosion of the stockpile during rain events. • Temporary berms can be installed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion • Edge effects arising from the proposed development, such as erosion, encroachment, and AIP proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b and 2 AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020). Ongoing monitoring and clearing/control should take place throughout the Construction and Operational & Maintenance Phase of the development.
Monitoring	Please refer to Section 36 of the main report for monitoring.

3.3 ISSUE: SOIL COMPACTION

Heavy equipment traffic during construction and activities is anticipated to cause soil compaction.

3.3.1 Source of impact

Activities that will likely impact the soil, land use and land capability environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Site clearing, removal of vegetation. • Stripping and stockpiling of soil resources. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Closure	• Removal of equipment and disassembly of construction camp.

3.3.2 Impact assessment

The severity of this impact is likely to be significant for most of the soils due to amount of disturbance that could occur due to the clayey texture of the soils which dominate the footprint area. The impact significance can be reduced significantly, should the proposed activities be restricted to access roads, vehicle hard stand areas and equipment and machinery laydown areas. Soil compaction will potentially lead to:

- Increased bulk density and soil strength, reduced aeration and lower infiltration rate
- Destroyed soil structure, causing it to become more massive with fewer natural voids with a high possibility of soil crusting.
- Soil biodiversity is also influenced by reduced soil aeration. Severe soil compaction may cause reduced microbial biomass. Soil compaction may not influence the quantity, but the distribution of macro fauna that is vital for soil structure including earthworms due to reduction in large pores.

The impacts anticipated for the proposed Project is shown in Table 20 (construction phase) and Table 21 (operational phase).

Table 20: Summary of the impact significance on soil compaction (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Short-term	Short-term
Extent	Beyond site	Whole site and nearby surroundings
Consequence	Medium	Low
Probability	High	High
Significance	**Medium**	**Low**
Additional Assessment Criteria		

Degree to which impact can be reversed	Partially reversable. Upon removal of solar facility the soils could be re-instated overtime through rehabilitation efforts.	
Degree to which impact may cause irreplaceable loss of resources	Medium: The soils which are stripped my not be replaced during the decommissioning phase	
Degree to which impact can be avoided	Low: Not avoidable but rehabilitation efforts in the remaining footprint extent to ensure that the soils are conserved.	
Degree to which impact can be mitigated	Medium: This depends entirely on the rehabilitation plan if the soils of similar land capability will be replaced.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Low**

Table 21: Summary of the impact significance on soil compaction (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Beyond site	Whole site and nearby surroundings
Consequence	Medium	Medium
Probability	High	Medium
Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	Partially reversable. Upon removal of solar facility the soils could be re-instated overtime through rehabilitation efforts.	
Degree to which impact may cause irreplaceable loss of resources	Medium: The soils which are stripped my not be replaced during the decommissioning phase	
Degree to which impact can be avoided	Low: Not avoidable but rehabilitation efforts in the remaining footprint extent to ensure that the soils are conserved.	
Degree to which impact can be mitigated	Medium: This depends entirely on the rehabilitation plan if the soils of similar land capability will be replaced.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Low**

3.3.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the subsequent loss of land capability from soil compaction
Management outcome	• Limit project footprint • Control through appropriate design (incl. access roads) • Closure planning and rehabilitation
Mitigation measures	
Construction And Operational	• Soil Compaction is usually greatest when soils are moist, so soils should be stripped when moisture content is as low as possible. If they have to be moved when wet, shovel and truck should be used as bowl scrapers create excessive compaction when moving wet soils. • Compaction should be minimised by use of appropriate equipment and replacing soils to the greatest possible thickness in single lifts. • Following placement, compacted soils should be ripped to full rooting depth (30 cm as the bare minimum seedbed) to allow penetration of plant roots.
Monitoring	Please refer to Section 36 of the main report for monitoring.

4. FRESHWATER ASSESSMENT

4.1 ISSUE: DEGRADATION OF FRESHWATER SYSTEMS

There are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure.
- Changes to the sociocultural and service provision.
- Impacts on the hydrology and sediment balance of the freshwater ecosystems.
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

4.1.1 Source of impact

Activities that will likely impact the freshwater environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Site clearing. • Cleaning, grubbing and bulldozing activities. • Digging trenches and foundations.
Operation	• Operational stormwater control and design of stormwater attenuation facilities on the development site.
Closure	• Removal of equipment and disassembly of construction camp.

4.1.2 Impact assessment

Following the assessment of the freshwater ecosystems associated with the proposed PV facility, the DWS prescribed Risk Assessment Matrix (2016) was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of these freshwater ecosystems.

A summary of the DWS Risk Assessment Matrix applied to the proposed development activities, is provided in Table 22 below.

Table 22: Summary of the results of the DWS risk assessment matrix applied to the freshwater ecosystems associated with the proposed PV facility.

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
Pre-construction Phase	1	Site clearing prior to commencement of construction activities and the set-up of contractor camps.	• Removal of vegetation leading to exposure and associated disturbances to soil. • Increased likelihood of dust generation in adjacent freshwater ecosystems due to exposed soil. • Removal of topsoil and creation of topsoil stockpiles. • Potential creation of access roads to facilitate contractor laydown and subsequent construction activities. • Laydown of construction offices and ablution facilities.	• Increased runoff and possible development of erosion, or exacerbation of existing erosion resulting in increased potential sedimentation and within the channel and riparian zone of the drainage lines on the boundaries of the footprint area. • Anthropogenic and noise-pollution to surrounding biota.	1	4	13	52	L	The design of the facility must ensure that the construction and development footprint does not encroach upon any delineated freshwater ecosystem, or the NEMA 32 m ZoR as a buffer. The riparian zone (outer boundary of the riparian zone) must be cordoned off using a suitable barrier or material which is also able to control sedimentation. All construction and site clearing must take place during the dry season to limit potential impacts to downgradient drainage lines as a result of construction activities. Areas which are to be cleared of vegetation including contractor laydown areas must remain as small as possible and it must be ensured as far as possible that vegetation clearing is focused to the proposed development footprint.

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
										Areas to be cleared of vegetation must be cleared in a controlled, phased manner. Contractor laydown areas should remain outside of the delineated boundaries of the drainage line and site boundaries. A designated contractor laydown area should be approved by the Environmental Control Officer (ECO) prior to use. An Environmental Control Officer (ECO) must be appointed in order to ensure all water related aspects are adequately mitigated for the life of the proposed development. All existing roads must be used for access and the development of new roads avoided.
Construction Phase	2	Ground-breaking, excavation of foundations and other construction related earthworks upgradient of / within the catchment of the two	• Removal of topsoil and creation of soil stockpiles upgradient of the drainage lines on the boundaries of the site.	• Disturbances of soil leading to increased alien vegetation proliferation, and in turn to altered freshwater ecosystem habitat.	1	4	14	56	L	The following measures are recommended to mitigate against indirect impacts with regards to excavation and soil compaction activities within vicinity of the drainage lines on the boundaries of the development site:

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
		drainage lines on the boundaries of the development site.	• Potential runoff of sediment and waste material into the drainage lines on the boundaries of the site. • The movement of construction machinery, personnel and equipment upgradient of the drainage lines on the boundaries of the site. • Mixing and casting of concrete for construction purposes upgradient of the drainage lines.	• Altered runoff patterns within the landscape, leading to increased erosion and sedimentation of freshwater ecosystem habitat. • Potential for deteriorated water quality, including increased likelihood of dust generation, turbidity and sedimentation within the drainage lines on the site boundaries. • Noise disturbance to avifauna and aquatic biota associated with the drainage lines on the site boundaries.						• A construction-phase stormwater control system must be implemented as part of the development and implementation of stormwater controls across all development phases. Temporary measures must be used to control construction phase stormwater - e.g., the use of berms, silt traps / silt curtains, along with the retention of natural vegetation where possible. • During excavation activities, it must be ensured that stockpiles are not higher than 2 m in height and all exposed soil must be protected for the duration of the construction phase with a suitable geotextile (e.g., Geojute or hessian sheeting) to prevent erosion and sedimentation of the drainage line. Furthermore, measures must be undertaken to limit the time in which soil is exposed. • Dust suppression measures must be implemented (such as

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
										spray watering on gravel roads) throughout the proposed development activities to prevent excessive dust which may adversely affect riparian vegetation within the drainage lines. With regards to concrete mixing on site: • Concrete and cement-related mortars can be toxic to aquatic life and other biota. Proper handling and disposal are considered imperative to minimise or eliminate discharge into the drainage lines. High alkalinity associated with cement can dramatically affect and contaminate both soil and ground water. The following recommendations must be adhered to: • Fresh concrete and cement mortar must not be mixed near the site boundaries (i.e., within the 100m Zone of Regulation) of the drainage lines; • Mixing of cement should only be undertaken within the

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
										construction camp and may not be mixed on bare soils. • Mixing of concrete is also to be strictly undertaken within a lined, bound or bunded portable mixer. Consideration must be taken to use ready mix concrete. • A batter board or other suitable platform/mixing tray is to be provided onto which any mixed concrete can be deposited whilst it awaits placing. • A washout area must be designated outside of the confines of the 100 m Zone of Regulation around the drainage lines. • Cement bags must be disposed of in the demarcated hazardous waste receptacles. • Concrete spillage outside of the demarcated area must be promptly removed and taken to a suitably licenced waste disposal site.
Operational	3	Operational stormwater control	• Operation of stormwater infrastructure and	• Potential pollutants and toxicants entering the	1	5	11	55	L	• It is recommended that herbaceous (grassy) vegetation be allowed to become re-

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
		and design of stormwater attenuation facilities on the development site.	discharge of stormwater into drainage lines on the boundaries of the development site.	downgradient drainage lines. • Potential changes to the water retention pattern, timing and flows within the downgradient drainage lines. • Potential exacerbation of existing erosion and development of new erosion, along with concomitant increased sedimentation within the downgradient drainage lines as a result of the increased stormwater discharge causing increased scour and velocity and due to decreased infiltration capacity of soils cleared of all vegetation in the solar panel array footprint.						established in the footprint of the solar arrays, thereby preventing soils under the solar panels from being permanently exposed, which would render them more vulnerable to erosion, and which render the soils less permeable and thus reducing the infiltration capacity of the soils. It is recommended that a grassy layer be allowed to grow within the array footprints, or within certain parts of the array footprint to improve infiltration of runoff and to trap surface runoff during precipitation events. • Stormwater infrastructure on the development site must be designed in line with the principles of SuDS in order to polish stormwater by trapping sediments and by removing pollutants that could pollute downgradient freshwater ecosystems, and in order to allow the gradual discharge of stormwater into the drainage lines following rainfall events.

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
										• As such the use of 'soft' engineering features such as bioswales that are vegetated with suitable vegetation that is tolerant of both wet and dry conditions is strongly recommended. • The use of stone pitching to reduce velocity of stormwater is strongly recommended. • The proposed stormwater infrastructure must also be incorporated into a suitable and site-specific Stormwater Management Plan (SWMP).
	4	Operations and maintenance of the development (e.g., sewage infrastructure associated with the proposed office and control room, if applicable) and BESS	• Potential failure of infrastructure and waste management systems (e.g., sewage infrastructure associated with the proposed office and control room, if applicable) resulting in leakages and possible contamination of surface and ground water into the adjacent drainage systems.	• Potential contamination and deterioration of water quality within the drainage line in the event of a spill / damage to sewage infrastructure (associated with the proposed office and control room, if applicable). • Damage to riparian habitat within the drainage lines and potentially decreased ecoservice provision and disturbance to biota during maintenance activities.	1	5	10	50	L	• It should be ensured that regular maintenance takes place to prevent failure of any waste / sewage infrastructure associated with the proposed development. • Maintenance activities must be confined to the developed footprint of the solar energy facility which must be fenced off to prevent accidental access into the adjacent freshwater ecosystems (riparian zones).

Phase	No	Activity	• Aspect	• Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation measures
			• Potential leakage of hazardous materials associated with BESS technology (i.e., batteries) • Indiscriminate movement of vehicles and vegetation trampling within the adjacent drainage lines as part of maintenance activities.							• A formal waste management and disposal system must be implemented at the solar energy facility.

The activities associated with the construction and operation of all the proposed PV facility options pose a **Low** risk significance to the freshwater ecosystems within the study and investigation areas, provided that all construction and operational activities take place outside the delineated boundaries of the freshwater ecosystems and an associated buffer. In addition to the non-development of the delineated extent of the freshwater ecosystems (drainage lines) it is very important that the NEMA 32 m ZoR be utilised as a non-development buffer beyond the delineated extent of the drainage lines on the boundaries of the site. This buffer can however be used for the development of soft stormwater attenuation facilities (e.g., bioswales) as part of the implementation of Sustainable Drainage Systems (SuDS) for the development.

In addition, all mitigation measures as stipulated in the above table, must be implemented to prevent any edge effects and cumulative impacts from occurring on the freshwater ecosystems within the study and investigation areas.

Assuming that strict enforcement of cogent, well-developed mitigation measures takes place, the significance of impacts arising from the proposed solar PV facility are likely to be reduced during the construction and operational phases assuming that a high level of mitigation takes place.

Tables 8 and 9 have assessed all potential impacts on the freshwater environment in the footprint area and investigation areas according to the method provided by the EAP). It is understood that the freshwater ecosystem habitat that is located on the development site would be left undeveloped, no direct impacts on freshwater habitat in either the construction or operational phase would materialise, and as such no direct impacts have been assessed. Indirect impacts for the construction and operational phase have been separately assessed.

It should be noted that the tables also provide the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

Table 23: Impact on Freshwater Environment associated with the proposed development activities in the footprint area and immediate surrounds (construction phase)

Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate change (Medium)	Minor change (Low)
Duration	Short-term (1 to 5 years)	Very Short-term (< 1 year)
Extent	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low
Probability	Conceivable (Low)	Unlikely / improbable (Very low)
Significance	**Very Low**	**Insignificant-**

Degree to which impact can be reversed	Fully Reversible: If stormwater-related or other indirect impacts such as dust-related impacts occur, these will be able to be reversed as the impacts will not be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Low: The development will be very unlikely to cause irreversible loss of resources as indirect construction-related impacts will not be of a magnitude to completely transform the riparian zone or instream habitat of the downgradient drainage lines.	
Degree to which impact can be avoided	High	
Degree to which impact can be mitigated	High: Indirect construction impacts on the drainage lines are able to be effectively mitigated through proper design and the implementation of construction-phase environmental controls.	
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	**Low -**

Table 24: Impact on Freshwater Environment associated with the proposed development activities in the footprint area and immediate surrounds (operational phase).

Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate change (Medium)	Minor change (Low)
Duration	Permanent (> 20 years)	Permanent (> 20 years)
Extent	Whole site and nearby surroundings	Part of Site / Property
Consequence	Medium	Low
Probability	Conceivable (Low)	Unlikely / improbable (Very low)
Significance	**Very Low**	**Insignificant-**
Degree to which impact can be reversed	Fully Reversible: If stormwater-related or other indirect impacts occur, these will be able to be reversed as the impacts will not be permanent.	
Degree to which impact may cause irreplaceable loss of resources	Low: The development will be very unlikely to cause irreversible loss of resources as indirect (stormwater)-related impacts will not be of a magnitude to completely transform the riparian zone or instream habitat of the downgradient drainage lines.	
Degree to which impact can be avoided	High	
Degree to which impact can be mitigated	High: Indirect operational impacts on the drainage lines are able to be effectively mitigated through proper design and the implementation of operational-phase environmental controls.	
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	**Low -**

5. AIR QUALITY ASSESSMENT

A desktop-based air quality assessment was undertaken for the proposed project. A regulatory assessment indicated no triggers of the listed activities. As such, the facility does not require an Atmoshperic Emissions Licence. Local existing air pollution sources include mining, agricultural activities, domestic fuel burning and veld

fires. The key pollutant from the proposed site during the construction and decommissioning phases would be Particulate Matter (PM.) Other pollutants include gaseous emissions from vehicle exhausts and from any generators used onsite. Strict BESS management and maintenance procedures will ensure containment and prevent any significant air quality impacts. On decommissioning, the BESS should be promptly removed offsite in line with manufacturer guidance and taken to the nearest appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium-ion batteries need further investigation.

Air quality impacts specific to the Project are expected to be temporary (limited largely to the construction phase), and the need for a full Air Quality Impact Assessment (AQIA) comprising emissions inventory and dispersion modelling is not considered necessary. However, SLR recommends the follow:

- A full meteorological assessment to assess the likely dispersion of ambient dust from the construction operations.
- A full review of existing dust fallout monitoring reporting for the Marula Mine to contextualise cumulative ambient air quality impacts for local receptors.
- The development of an Air Quality Management and Monitoring Plan for the various phases of the Project to minimise any potential impacts and keep track of any emission fluctuations in time.

A summary of the findings are provided below.

5.1.1 Pollutants Associated with the Project

5.1.1.1 Particulate Matter

PM is the key pollutant of concern during the construction phase of the Project. PM refers to solid or liquid particles suspended in the air, varying in size from particles that are only visible under an electron microscope to soot or smoke particles that are visible to the human eye. PM contributes greatly to deteriorations in visibility, as well as posing major health risks, as small particles (PM10) can penetrate deep into lungs (inhalable fraction), while even smaller particle sizes (PM2.5) can enter the bloodstream via capillaries in the lungs (respirable fraction), with the potential to be laid down as plaques in the cardiovascular system or brain. Health effects include respiratory disease, lung tissue damage, cardiovascular disease, cancer and premature death. Acidic particles may damage buildings, vegetation and acidify water sources.

Total suspended particulates (TSP) include particles of aerodynamic diameter of 30 microns or less and is generally a nuisance as dust fallout. Dust fallout comprises of particulate matter with varying aerodynamic diameters and mass characteristics. Visible dust fallout typically has a high particle size and mass characteristic, and thus a localised impact due to the rapid gravity settling of the larger particles. Nuisance effects can be caused by particles of any size, though are generally associated with particles greater than 20 microns. Large dust particles fall out of the air relatively close to the source and form dust layers on furniture, motor vehicles, etc.

5.1.1.2 Gaseous Emissions from Battery Energy Storage Systems

BESS loss of containment due to corrosion or fires, or during maintenance procedures poses risks to ambient air quality.

In the case of lithium-ion batteries, the following emissions are of concern:

- When exposed to water (including humidity), lithium emits flammable gases.
- Most lithium-ion batteries contain organic electrolytes (e.g., lithium perchlorate, acetonitrile), that are combustible, with associated emissions.

- Additional heavy metals (such a cobalt and manganese) within the battery can be emitted to atmosphere under upset conditions (a containment breach or thermal runaway fire conditions).

In the case of lead-acid batteries, the following emissions are of concern:

- Overcharging of lead-acid batteries can result in the emissions of hydrogen (H_2) and hydrogen sulphide (H_2S). H_2 does not have health implications but has explosion risks. H_2S has a rotten egg smell. Concentrations of H_2S high enough to cause health impacts are not expected in the offsite ambient environment.
- Containment loss is the greatest concern in relation to the storage of hazardous chemicals onsite, and is a particular concern with the lead-acid BESS since sulphuric acid is highlight corrosive:
  - Acute exposure to sulphuric acid fumes can cause irritation to eyes and the mucus membranes of the respiratory system;
  - Toxic fumes of molten lead. Ambient lead is regulated under the NAAQS due to well established health implications of chronic exposure;
- Fugitive emissions of other gases (e.g. H_2S and SO_x) pose further risks; and
- Depending on the metal alloy composition in lead-acid batteries, arsine (arsenic hydride, AsH_3) and stibine (antimony hydride, SbH_3) can also be emitted.

5.1.2 Potential Emissions During Project Phases

5.1.2.1 Development and Planning Phase

No significant project-related emissions are expected during this phase of the Project beyond vehicle exhaust emissions associated with travel to view the proposed Project site, and dust generated during geotechnical investigations of the project site, e.g. any drilling activity.

5.1.2.2 Construction Phase

The PM emissions associated with the construction will be of a temporary nature. Emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions.

The following possible sources of PM emissions have been identified for the construction phase:

- Vehicle activities associated with the transport of equipment to the site.
- Preparation of the surface area prior to development.
- The removal of construction equipment from site after the set-up of new infrastructure.

Vehicles travelling to and from the site will emit PM and gases, such as NO_2. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of key transportation routes.

5.1.2.3 Operational Phase

If areas exposed during the construction phase are promptly revegetated, emissions during the operational phase of the facility are expected to be insignificant. Sources of potential emissions are:

- Exposed areas: Areas left exposed after construction can result in emissions of PM particularly during periods of high wind speeds, or due to wheel entrainment of PM if vehicles travel over these areas.

- Vehicular traffic: Vehicles travelling to and from the site will emit PM and gases. Expected vehicle volumes, however, will not result in any significant impact on local air quality beyond the direct vicinity of the main access road and access gate.

5.1.2.4 Decommissioning and Closure Phase

Marula is considering measures for structures to remain post-mining for use by communities. This will be considered and confirmed as part of the Project. However, if existing structures are demolished, the following activities need to be considered:

- Breakdown of structure,
- Rubble removal.
- Filling and levelling.
- Topsoil replacement.
- Land and waste piles prepared for revegetation.

Possible sources of particulate emissions during the closure and post-closure phase include:

- Smoothing of areas by bulldozer.
- Grading of sites.
- Transport and dumping of material for void filling.
- Infrastructure demolition.
- Infrastructure rubble piles.
- Transport and dumping of building rubble.
- Transport and dumping of topsoil.
- Preparation of soil for revegetation – ploughing and addition of fertiliser, compost etc.

Decommissioning of BESS can also result in emissions to the atmosphere due to containment. As such, the decommissioned components should be removed from site as soon as possible and transferred to an appropriate recycling facility. While there are recycling options for lead-acid batteries in South Africa, opportunities for the recycling of lithium-ion batteries needs further investigation.

6. IMPACTS ON THE SOCIO-ECONOMIC ENVIRONMENT

6.1 ISSUE: DEVELOPMENT OF A RENEWABLE ENERGY FACILITY

The establishment of a clean, renewable energy facility would reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

6.1.1 Source of impact

Activities that will likely impact the socio-economic environment is described in the table below.

Project phase	Activity/infrastructure
Construction and operational	• Establishment of new roads and upgrade of existing roads. • Earthworks for temporary infrastructure including laydown areas. • Visual impact of the PV Facility on the landscape and sense of place. • Excavation and levelling of the PV facility footprint. • Trenches for cables and erection of powerlines. • Influx of people into the area that impact on heritage sites. • Excavations during construction of the sub stations.

6.1.2 Impact Assessment

South Africa is one of the highest per capita producers of carbon emissions in the world. While the overall contribution to South Africa's total energy requirements of the proposed project is relatively small, it would help to offset the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on ESKOM as a power utility, the benefits associated with an REIPPPP based on renewable energy are regarded as an important contribution.

The development of a clean, renewable energy project is considered to be a national, long-term impact of high intensity. The significance of this potential impact is, therefore, assessed to be **VERY HIGH (POSITIVE)** before and after mitigation (see Table 25).

There would be no difference in the impact of either technology alternative.

Table 25: Development of a renewable energy facility (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Very High +	Very High +

Probability	Definite	Definite
Significance	**Very High +**	**Very High +**
Additional Assessment Criteria		
Degree to which impact can be reversed	Reversable.	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be avoided	N/A	
Degree to which impact can be mitigated	N/A	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Medium**

6.1.2.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To enhance the positive economic impacts and limit the negative economic impacts and to enhance the sustainability of the project into the future by building capacity.
Management outcome	• Control through the monitoring of socio-economic conditions • Remedy through emergency response procedures • Control through good communication, recruitment and procurement processes • Communication with local police force to combat crime
Mitigation measures	
Monitoring	Please refer to Section 36 of the main report for monitoring

7. VISUAL IMPACT ASSESSMENT

The proposed Project components and related activities have the potential to alter the landscape character of the site and surrounding area through the establishment of infrastructure. As a baseline, this section provides an understanding of the visual aspects (such as landscape character, sense of place, scenic quality, and sensitive views) of the proposed Project footprint against which to measure potential change as a result of Project infrastructure and activities.

7.1 ISSUE: CHANGE TO THE LANDSCAPE CHARACTERISTICS

The proposed development would potentially alter the visual landscape/ rural character of the site, which would have a visual impact in the immediate surrounding area and along the N1 national road, Boundary Road, local roads to the north, west and south of the Project site, and homesteads that are present within this area.

7.1.1 Source of impact

Activities that will likely impact the visual environment is described in the table below.

Project phase	Activity/infrastructure
Construction	• Clearance of vegetation in line with Marula's biodiversity management plan. • Establishing a contractor's camp (for equipment, offices etc). • Installation of perimeter fencing and levelling of the site and preliminary earthworks. • Stripping and stockpiling of soil resources in line with soil conservation procedure. • Cleaning, grubbing and bulldozing activities. • Establishing access and internal roads. • Digging trenches and foundations.
Closure	• Removal of equipment and disassembly of construction camp.

7.1.2 Impact assessment

A contrast rating is undertaken to determine if the VRM Class Objectives are met. The suitability of a landscape modification is assessed by comparing and contrasting the existing receiving landscape to the expected contrast that the proposed landscape change will generate. This is done by evaluating the level of change to the existing landscape by assessing the line, colour, texture and form, in relation to the visual objectives defined for the area.

The following criteria are utilised in defining the Degree of Contrast (DoC):

- None: The element contrast is not visible or perceived.
- Weak: The element contrast can be seen but does not attract attention.
- Moderate: The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- Strong: The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

Table 26: Contrast Rating Key Observation Points Table

	Exposure			Landscape Elements					
Key Observation Point	**Distance**	**Exposure**	**Mitigation**	**Form**	**Line**	**Colour**	**Texture**	**Degree of Contrast**	**Visual Objectives Met?**
Southern grouping (Very High proximity)	50 m – 100 m	Very High	W/Out	S	S	S	S	S	N
			With	M	S	S	M	M	Y
Southwestern & Eastern Grouping (High proximity)	370 m – 480 m	Very High	W/Out	M	S	S	S	M	N
			With	W	S	M	M	M	Y

** S = Strong, M = Medium, W = Weak, N = None*

7.1.2.1 Southern grouping (Very High proximity)

The very close proximity of the PV panels will generate Strong levels of visual contrast as seen from the adjacent residential settlements, especially given the slightly elevated position of the dwellings that allow for an overlooking of the PV arrays, creating a large 3D space. With mitigation and allowing a 250 m buffer from the residential settlements, the Line and Colour contrast would still be strong, but the landscape change would appear more two dimensional, with the continued growth of bushveld vegetation around the development site, allowing for some ground level (near ground level) screening. The setback also allows the proposed PV structures to be viewed as a component of the midground mining landscapes, where there is a higher Visual Absorption Capacity created by the structure forms, lines and textures. Given the significance of the rural, tribal settlement pattern, mitigation is strongly recommended.

7.1.2.2 Southwestern & Eastern Grouping (High proximity)

Although there is a 400 m buffer between the receptors and the PV development site, the elevated perspective views overlooking the site, will still result in predominantly strong levels of visual contrast. This will be more noticeable from the western, elevated settlements, where a wide area view creates very strong colour, texture and line contrast. With mitigation, the proposed PV development is located on closer visual proximity to the mine, where there is a higher Visual Absorption Capacity created by the structure forms, lines and textures. Given the significance of the rural, tribal settlement pattern, mitigation is strongly recommended.

The scoping phase findings made recommendation for a setback of 250 m from the western and southern village settlements to buffer the visual intrusion to some degree, allow for the existing bushveld vegetation around the site to provide some visual screening, as well as allow for the continued communal land uses in areas of close proximity to the tribal settlements. This recommendation was included in the design phase, and the 250 m buffer excluded from the development. As the surrounding landscape is strongly defined by existing mining features, the proposed PV Project would be viewed against this backdrop, and the remaining landscape resources would not be significantly degraded.

By way of alternative assessment, the mitigated layout that includes the 250 m setback from the rural settlements, was compared and contrasted against the full development layout without the 250 m setback (unmitigated scenario).

Table 27: Change to the landscape characteristics (construction phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Full Development Area**	**With Mitigation**
Intensity	Very high	Medium
Duration	Very Short-term	Very Short-term
Extent	Local area, far beyond site	Local area, far beyond site
Consequence	Medium	Low
Probability	Very high	High

Significance	**Medium**	**Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	The PV landscape change is partially reversable as the panels can be removed, but the existing bushveld vegetation would be lost.	
Degree to which impact may cause irreplaceable loss of resources	High in that the existing rural, tribal settlement pattern that is a key component of the cultural landscape, would be degraded with loss of common land in close proximity to the southern located settlements.	
Degree to which impact can be avoided	Low: With the high levels of visual intrusion can be reduced with the settlement setback, some degree of visual intrusion will remain.	
Degree to which impact can be mitigated	Medium to High: The high levels of visual intrusion can be reduced with the settlement setback. This will allow for the PV landscape change to be seen against the existing mining landscape and where there is a higher VAC level.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible: It is possible that the development without mitigation could set a regional negative precedent for inappropriate development in tribal settlements. Retaining the setback buffer would allow existing communal lands around the settlements to be retained for subsistence farming/ communal grazing.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High	**Medium**

Table 28: Change to the landscape characteristics (operational phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Full Development Area**	**With Mitigation**
Intensity	Very high	Medium
Duration	Long-term	Long-term
Extent	Local area, far beyond site	Local area, far beyond site
Consequence	Very high	High
Probability	Very high	Medium
Significance	**Very high**	**Medium**
Additional Assessment Criteria		
Degree to which impact can be reversed	The PV landscape change is partially reversable as the panels can be removed, but the existing bushveld vegetation would be lost.	
Degree to which impact may cause irreplaceable loss of resources	High in that the existing rural, tribal settlement pattern that is a key component of the cultural landscape, would be degraded with loss of common land in close proximity to the southern located settlements. Without mitigation, Glint and Glare impacts could create visual discomfort to western village settlements.	
Degree to which impact can be avoided	Low: With the high levels of visual intrusion can be reduced with the settlement setback, some degree of visual intrusion will remain.	
Degree to which impact can be mitigated	Medium to High: The high levels of visual intrusion can be reduced with the settlement setback. This will allow for the PV landscape change to be seen against the existing mining landscape and where there is a higher VAC level.	

Cumulative Impact		
Extent to which a cumulative impact may arise	Possible: It is possible that the development without mitigation could set a regional negative precedent for inappropriate development in tribal settlements. Retaining the setback buffer would allow existing communal lands around the settlements to be retained for subsistence farming/ communal grazing.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High	**Medium**

Table 29: Change to the landscape characteristics (decommissioning phase)

Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Very Short-term	Very Short-term
Extent	Local area, far beyond site	Local area, far beyond site
Consequence	Low	Low
Probability	High	Medium
Significance	**Low**	**Very Low**
Additional Assessment Criteria		
Degree to which impact can be reversed	The PV landscape change is partially reversable as the panels can be removed, but the existing bushveld vegetation would be lost.	
Degree to which impact may cause irreplaceable loss of resources	High in that the existing rural, tribal settlement pattern that is a key component of the cultural landscape, would be degraded with loss of common land in close proximity to the southern located settlements.	
Degree to which impact can be avoided	Low: The high levels of visual intrusion can be reduced with the settlement setback, some degree of visual intrusion will remain.	
Degree to which impact can be mitigated	Medium to High: The high levels of visual intrusion can be reduced with the settlement setback. This will allow for the PV landscape change to be seen against the existing mining landscape and where there is a higher VAC level.	
Cumulative Impact		
Extent to which a cumulative impact may arise	Possible: No effective rehabilitation and restoration of the site is likely to result in long term landscape degradation. With mitigation and rehabilitation and restoration, cumulative effects would be limited.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium	**Low**

7.1.2.3 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To limit negative visual impacts.
Management outcome	• Limit Project Footprint • Manage through visual controls • Rehabilitation
Mitigation measures	
All Phases	• Post construction, the laydown areas and other construction areas no longer needed for operational management, should be ripped (0.5 m depth) to restore compacted topsoil, and then rehabilitated to natural vegetation under the supervision of the rehabilitation specialist.
Construction	• Restrict height of PV panels to 5 m (recommendation). • Topsoil excavated from the site should be stockpiled and utilised for rehabilitation of the site after construction.
Construction and Operational	• Littering should be a finable offence. • Fencing around the laydown should be diamond shaped to catch wind-blown litter. The fences should be routinely checked for the collection of litter caught on the fence. • Signage on the road should be moderated in size and use natural colours, while still providing effective directions.
Decommissioning and closure	• All structures not required for agricultural purposes post-closure should be removed and where possible, recycled or reused. • Building structures should be broken down (including building foundations).
Monitoring	Please refer to Section 37 of the main report for monitoring.

8. CULTURAL HERITAGE

8.1 ISSUE: LOSS OF CULTURAL HERITAGE RESOURCES

8.1.1 Description of Impact

Impacts to heritage resources without mitigation within the Project footprint will be permanent and negative and occur during the pre-construction and construction activities. It is assumed that the pre-construction and construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can impact on heritage features and impacts include destruction or partial destruction of non-renewable heritage resources. Impacts during the operational phase is considered to affect the cultural landscape and sense of place.

Due to the low significance of the heritage resources (MP001 and MP002) outside of the footprint area, impact to known tangible heritage resources will be low. Potential impact could occur on intangible features that could affect the sense of place, the extent of the impact should be confirmed through social consultation.

8.1.2 Source of Impact

The project activities/ infrastructure likely to result in changes in access to healthcare include:

Project phase	Activity/infrastructure
Construction and operational	• Establishment and operations of solar PV facility.

8.1.3 Impact Assessment

It is assumed that the construction phase involves the removal of topsoil and vegetation as well as the establishment of infrastructure. These activities can have a negative and irreversible impact on heritage features if any occur. Impacts include destruction or partial destruction of non-renewable heritage resources.

No impacts are expected during the operational phase.

Table 30: Loss of cultural heritage resources (construction phase)

Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Low	Low

Type of Impact	Direct	
Probability	Very Low	Very Low
Significance	Insignificant	Insignificant
Degree to which impact can be reversed	Impacts to heritage resources are always Irreversible	
Degree to which impact may cause irreplaceable loss of resources	The impact will not cause irreplicable loss of resources as no heritage resources occur in the footprint area.	
Degree to which impact can be avoided	High – with the implementation of a chance find procedure.	
Degree to which impact can be mitigated	High -	
Cumulative impact		
Nature of cumulative impacts	The proposed Project will have a low cumulative impact as no significant heritage resources will be adversely affected.	
Rating of cumulative impacts	**Low**	**Low**
Residual impact		
Residual impact discussion	Although surface sites can be avoided or mitigated, there is a chance that completely buried sites would still be impacted on, but this cannot be quantified.	

8.1.3.1 Management objectives, outcomes and mitigation measures

The table below outlines the management objectives, outcomes and mitigation measures for the proposed Project.

Management objective	To prevent the loss of heritage and cultural aspects in the area
Management outcome	Implementing monitoring and management procedures as per the EMPr
Mitigation measures	
All phases	• Based on the current lay out recorded heritage features are avoided. Known features should be indicated on development plans and avoided during construction. • It is recommended that the social consultation team should liaise with the local community on the occurrence of intangible heritage features and potential burial sites. • Regular monitoring of the development footprint by the ECO to implement the Chance Find Procedure for heritage and palaeontology resources in case heritage resources are uncovered during construction.
Monitoring	Please refer to Section 37 of the main report for monitoring.