

3. Impact assessment for the preferred alternative:

3.1. Ecological impacts:

The ecological impact assessment takes into consideration the site's natural condition and any sensitivities, in terms of habitat diversity, species diversity and ecological diversity. The flora impact assessment refers to the vegetative component of the assessed area and focuses on the degree of infestation by exotics, vegetation structure, endemics, and protected species. The fauna impact assessment refers to the animal component and focuses on the available habitats, resources and protected species.

Habitat loss							
Impact	Loss of habitat and species diversity as a result of construction and the removal natural elements.						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> Physical clearance. Construction of internal roads. Trampling Off roading 		<ul style="list-style-type: none"> Habitat fragmentation leading to edge effects. Illegal harvesting of plant material. Habitat degradation. 				
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	4	5	2	4	5	20
Mitigation	<ul style="list-style-type: none"> Removal of indigenous vegetation should be kept to a minimum. Disturbance related activities must be restricted to the authorised development site. Vehicle movement should strictly be kept on designated dirt roads. No off roading or reckless driving should be allowed. Post-construction open areas should be rehabilitated and revegetated with indigenous vegetation. No harvesting of plant material should be allowed. No illicit fires may be allowed during construction. A fire management plan should be drafted and kept on site for all phases of the development. No disturbance related activity may encroach near the wetland / watercourse situated on the site's western boundary. Littering should be prohibited. No burning of any material is allowed on site. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	5	1	3	4	12
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	The operational phase of the solar development is not anticipated to generate any impacts which may lead to habitat loss greater than what was already lost during the construction phase.						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance

	N/A
Additional Notes:	

The environmental impact on habitat loss during constructional phase will be **Medium-high** without mitigation and **Medium** when mitigation measures are applied. The operational phase of the solar development is not anticipated to generate any impacts which may lead to habitat loss greater than what was already lost during the construction phase. However, it remains important for the applicant to be cognisant of activities which may cause damage to the natural environment which exceed the development area. Aspects which may cause damage outside the authorised development area include but are not limited to veld fire's, water pollution, plastic pollution etc. The applicant is to take steps which greatly limit the potential of such adverse impacts to occur. It is necessary to implement monitoring and evaluation procedures to determine the potential of increased risk throughout the phases of this development.

Invasive plant species							
Impact	Proliferation of exotic plant species due to environmental disturbance.						
Activities <i>(Not an all-inclusive list)</i>	<ul style="list-style-type: none"> • Improper eradication methods on existing exotics. • Physical clearance providing opportunity for opportunistic exotics to proliferate. • Accidental spread. • Disruption of ecological balance due to habitat disturbance. • Slow response to infestation eradication. • Landscaping with exotics. 						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	2	3	2	6
Mitigation	<ul style="list-style-type: none"> • Stockpiles need to be eradicated from all vegetation on a three-monthly basis. • Disturbance related activities may not exceed the authorised development boundary. • The appointed ECO should liaise with the contractor and developer and compile an alien invasive species management plan if required. • Exotics may not be allowed to proliferate within the development area. • All invasive species within 30 m of the development area need to be managed in accordance to sustainable management practices. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	1	2
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	2	3	2	6
Mitigation	<ul style="list-style-type: none"> • All open spaces post-construction need to be rehabilitated with indigenous species. • An alien invasive species management plan need to be drafted and implemented. The need for an alien invasive species management plan needs to be proposed by an appointed ECO if required. 						

	<ul style="list-style-type: none"> Landscaping (if required) should solely use indigenous species. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	1	2
Additional Notes:							

The impact regarding the invasion of plant species during constructional phase will be **Low-Medium** without mitigation and **Low** when mitigation measures are applied. This risk assessment for the operational phase will be **Low-Medium** prior to mitigation, and **low** after mitigation and is described as having a low order impact. It is necessary to implement monitoring and evaluation procedures to determine the potential of increase in risk.

Loss of floral and faunal SCC							
Impact	The loss of floral and faunal species of conservation concern as a result of the proposed development.						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> Physical clearance Poaching Reckless / off road driving Isolation of sub-populations Behavioural pattern disruption Construction of internal roads Habitat disturbance, fragmentation. Road collisions Electrification 						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	5	5	2	4	4	16
Mitigation	<ul style="list-style-type: none"> A proper pre-construction walkthrough needs to be conducted to establish the possible occurrence of floral SCC. No protected species may be removed/ damaged/ transported/ collected/ relocated without the relevant permits. Removal permits need to be obtained for all <i>Boscia albitrunca</i> individuals prior to construction. Notice boards depicting information on floral SCC need to be placed across the site. All construction personal need to be informed on floral and faunal SCC. All protected flora need to be demarcated and barricaded. Demarcation netting around protected flora need to be maintained until the relevant permits for removal/ relocation are obtained. Staff should immediately inform the on site environmental representative and a relevant specialist if any floral SCC are observed. Development may only occur within the authorised development boundary. Monitoring for the emergence of exotic species should be conducted on a three-monthly basis. No unnecessary destruction or removal of vegetation may be allowed. During the first few weeks of construction, fencing should be adapted to allow wildlife to migrate to other open spaces. Small movement corridors within fencing should be considered. Wildlife elements such as nests and burrows should carefully be inspected prior to construction. Such elements may only be responsibly removed by a relevant specialist. 						

	<ul style="list-style-type: none"> No hunting, trapping, or killing of fauna is allowed. Animals that get trapped in trenches need to be removed by the on-site environmental officer. The on-site environmental officer should be in possession of the relevant animal handling certificates. Vehicle movement should strictly be contained on designated roads. No off roading must be allowed. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	4	5	1	3	3	9
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	4	5	2	4	3	12
Mitigation	<ul style="list-style-type: none"> Notice boards containing pictures of floral and faunal SCC should remain on site. Movement corridors in fencing should be monitored on a monthly basis and cleared of any blockages. The solar site should be adequately fenced off. Ensure that all cables and connections are insulated to reduce the likelihood of accidental animal electrification. Electric fencing near the ground should not be live to prevent the electrification of small mammals. Monthly inspections and recordings of all mortalities around the perimeter fence should be conducted (only applicable for electrified fencing). Mortalities should be recorded and be reported to the on-site environmental representative. High intensity spotlights should be minimised as far as possible. Light pollution should be minimised by directing spotlights towards the solar farm's interior. No collection of plant material, hunting, killing of fauna are allowed. Vehicle movement should remain within the proposed development area. Disturbance related activities need to be contained within the development site. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	5	1	3	2	6
Additional Notes:	<p>Even though construction is not anticipated to exceed more than 2 years, the loss of any floral or faunal SCC within that period will be permanent. Duration is thus calculated at the maximum threshold. The impact on faunal SCC during the construction phase is considered less significant compared to the floral component as the animals will likely migrate to other open spaces. However, the operational phase will likely have a greater impact on faunal elements compared to floral elements. It is therefore crucial that mitigation measures be strictly implemented and supervised.</p> <p>Floral SCC on site:</p> <ul style="list-style-type: none"> <i>Hoodia gordonii</i> <i>Hoodia officinalis</i> <p>See the EMPr for more details concerning floral SCC.</p>						

The impact assessment related to the loss of floral and faunal species of conservation concern during the construction phase prior to mitigation is considered to be of **Medium-high** significance and **Low-medium** significance post-mitigation. The operational phase will result in a **Medium** impact significance (pre mitigation) and a **Low-medium** impact significance after mitigation measures have been implemented.

The loss of floral and faunal SCC is a serious ecological theme, and mitigation measures must be strictly implemented and supervised throughout all phases of the development.

Loss of ecological support areas (ESA)							
Impact	The loss of ESA areas due to the proposed development						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> Physical clearance Construction of internal roads 		<ul style="list-style-type: none"> Habitat fragmentation Habitat disturbance 				
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	2	3	4	12
Mitigation	<ul style="list-style-type: none"> Removal of indigenous vegetation should be kept to a minimum. Disturbance related activities must be restricted to the authorised development site. Vehicle movement should strictly be kept on designated dirt roads. No off roading or reckless driving should be allowed. Post-construction open areas should be rehabilitated and revegetated with indigenous vegetation. No harvesting of plant material should be allowed. No illicit fires may be allowed during construction. A fire management plan should be drafted and kept on site for all phases of the development. No disturbance related activity may encroach near the wetland / watercourse situated on the site's western boundary. Littering should be prohibited. No burning of any material is allowed on site. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	4	8
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	No anticipated activities restricted to the operational phase are considered to have a notable adverse impact on the loss of CBA/ESA areas greater than what was already lost during the construction phase.						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Additional Notes:							
	The applicant and operational team is to remain cognisant of operational activities which may cause accidental events such as veld fire. The lack of dense vegetation lowers the overall probability of runaway veldfires, however, this should not discourage responsible operational procedures.						

According to the CBA technical guidelines¹ “An ESA is an area that must remain in at least fair ecological condition in order to: meet biodiversity targets for ecological processes that have not been met in CBAs or protected areas; meet biodiversity targets for representation of ecosystem types or species of special concern when it is not possible to meet them in CBAs; support ecological functioning of a protected area or CBA (e.g. protected area buffers); or a combination of these. ESAs can meet biodiversity targets for terrestrial or aquatic features, or both. All ecological processes important for the long-term persistence of ecosystems and species should be adequately included in the portfolio of protected areas, CBAs and ESAs.” The proposed site’ alignment within an ESA is likely attributed to the vast open, natural landscape and due to the undulating terrain possessing a fairly rich surface drainage theme.

To some extent, the site's alignment within an ESA zone promotes a conservative approach to land use change; however, considering the landscape is not unique, other open areas with a similar composition and vegetation structure in the immediate area may provide the same supporting role. Development of the proposed Wonderpan solar facility will result in the loss of approximately 130 ha of naturally functioning karoo ecosystem. Therefore, the impact assessment concluded the loss of an ESA due to the proposed development be of **Medium** significance (Construction phase, pre mitigation). The implementation of adequate mitigation measures during the construction phase will result in a **Low-medium** impact significance score.

Loss of avifaunal priority species							
Impact	The displacement, or loss of priority avifaunal species due to the proposed development.						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> Road mortalities Entrapment Habitat loss and fragmentation due to clearing 	<ul style="list-style-type: none"> Collisions with infrastructure Electrocution 					
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	4	3	2	3	4	12
Mitigation	<ul style="list-style-type: none"> Development should be restricted to the authorised footprint. The use of existing roads should be prioritised. Conduct a pre-construction inspection (avifaunal walk-through) to record the status of nests of SCC on the existing Burchell – Cuprum 132kV high voltage line. If a nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of birds during the construction period. Disturbance should be restricted to an absolute minimum. Construction of the power line using an approved bird friendly pole/tower design in accordance with the Eskom Distribution Technical Bulletin relating to bird friendly structures. The avifaunal specialist must sign off on the final design. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance

¹ Technical Guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning (2017) published by SANBI.

	Negative	2	2	1	2	3	6
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	4	2	3	3	9
Mitigation	<ul style="list-style-type: none"> Increasing the perimeter fence's spacing between at least the top two wires (to a minimum of 30cm) and ensuring they are correctly tensioned will reduce the snaring risk for owls. If possible, a single perimeter fence should be used. Mortality monitoring should be conducted on a monthly basis. These mortalities need to be recorded and reported to the environmental officer. Reactive mitigations need to be implemented when above than normal mortalities are recorded. All open electrical wires need to be insulated to prevent electrocution. Eskom approved bird flight diverters should be installed on the 132kV overhead line according to the applicable Eskom Engineering Instruction. These devices must be installed as soon as the conductors are strung 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	4	1	2	2	4
Additional Notes:	See the specialist's report for a detailed breakdown of all impacts and mitigations relevant to the avifaunal theme.						

The construction of additional infrastructure especially those associated with PV solar developments present a significant risk to avifaunal elements. Birds may get entrapped, electrocuted, or collide with infrastructure. To prevent or at least minimise the impacts generated by similar developments, the proponent and its appointed contractor need to apply the relevant mitigation measures. The construction phase is anticipated to generate a **Medium** impact prior to the implementation of mitigation measures. Impact significance lowers to a **Low-medium** order after the implementation of mitigation measures. The operational phase is anticipated to generate a **Low-medium** impact pre-mitigation and a **Low** order impact after the implementation of mitigation measures. See the specialist's report for a detailed breakdown of all impacts and mitigations relevant to the avifaunal theme.

Cumulative impact							
Impact	The cumulative impact on the receiving environment's ecology regarding the proposed development total footprint assessed in conjunction with other renewable developments in a 30 km radius.						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	2	2	5	10
Mitigation	<ul style="list-style-type: none"> Development should be restricted to the authorised development boundary. Vegetation clearance should be kept to an absolute minimum. Revegetation and rehabilitation of open areas post construction. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance

	Negative	1	3	1	2	4	8
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	The cumulative impact during the operational phase is considered insignificant as no notable additional impacts is anticipated within the area's ecology with respects to the proposed development measured against other renewable developments.						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Additional Notes:							

The cumulative impacts of renewable energy developments should always be compared to similar developments in the region. This is especially important considering the nature of solar developments typically results in large-scale clearings of the environment.

The South African Renewable Energy EIA Application Database (REEA, 2021) indicates six other solar developments within a 30 km radius around the proposed Wonderpan site (Figure below). Provided the mentioned solar projects, including the Wonderpan solar site, are all developed, 2967 ha will be transformed, making up 1.05% area of the 30 km radius zone. Therefore, the cumulative impact of habitat loss generated by renewable energy production is considered to be **Low-medium** before mitigation and **Low-medium** after mitigation.

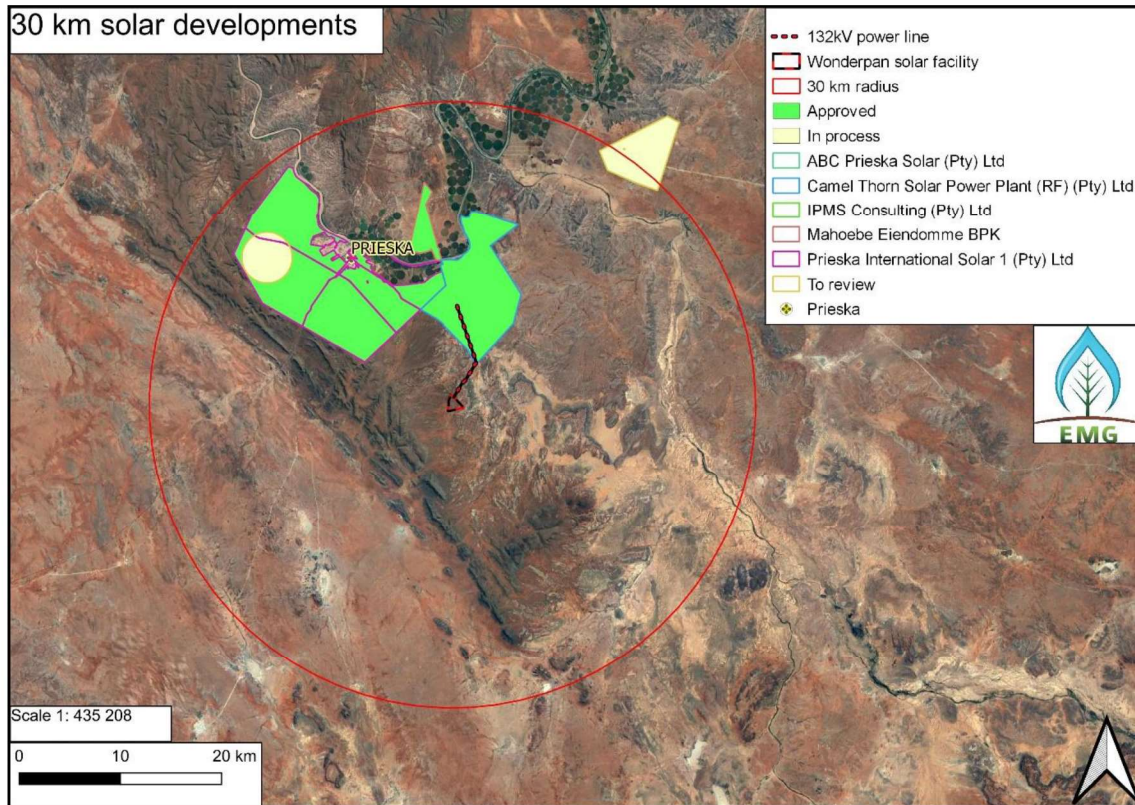


Figure 1 Map indicating the farms on which the six solar developments which are either in process (yellow) or have been authorised (green) within a 30 km radius around the proposed Wonderpan site.

The overall environmental impact arising from the proposed development regarding ecological aspects were calculated to be of **Moderate** significance (pre mitigation). After implementing adequate mitigation measures, the overall impact significant lowered to a **Low-medium** order. It's important to note that two ecological themes were greatly influential in raising the overall impact significance. Mitigation measures especially focusing on activities associated with habitat loss and the potential loss of floral SCC should be strictly implemented and monitored.

3.2. Heritage:

The heritage theme involves culturally significant finds including, but not limited to fossils, artefacts and certain culturally relevant infrastructure. Details concerning the heritage theme is discussed in detail within the Phase 1 Heritage Impact Assessment.

Artefacts and Fossils	
Impact	Destruction of any archaeological artefacts or fossils
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> Excavation within lower geological strata. Illegal collecting of loose chance finds (e.g. Stone age artefacts)
Constructional Phase	

Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	1	2	2	4
Mitigation	<ul style="list-style-type: none"> SAHRA and a qualified archaeologist be consulted immediately in the event of accidental archaeological exposure. In the unlikely event of accidental archaeological exposure, all excavations should stop immediately. No loose chance finds such as stone age artefacts (arrow heads, stone flake blades etc.) may be collected. The on site environmental representative should consult the appointed ECO regarding any such discoveries. All construction debris/ waste should be removed from site and may not be deposited in on-site excavated waste pits. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	1	2	1	1	1	1
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	3	2	2	2	4
Mitigation	<ul style="list-style-type: none"> No loose chance finds such as stone age artefacts (arrow heads, stone flake blades etc.) may be collected. The on site environmental representative should consult the appointed ECO regarding any such discoveries. No unauthorised excavations, post construction may be allowed. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	1	2	1	1	1	1
Additional Notes:	According to the Phase 1 HIA report : <i>“Both solar and powerline footprints are assigned an archaeological site rating of Generally Protected C (Low significance), but it is noted that the potential occurrence of isolated and unmarked graves, subsurface burial cairns or intact subsurface archaeological finds not recorded during this survey can never be excluded.”</i> The applicant and contractor should remain cognisant of this statement. Responsible excavation and other construction related activities which reduces the likelihood of impacting heritage resources should always be implemented.						

The proposed development’s impact on subsurface heritage resources and surface artefacts during the construction phase is calculated to be of **Low** significance (pre-mitigation). The post mitigation impact significance remains **Low** for the construction phase. It’s not anticipated that any post-construction excavations taking place, and as such the likelihood of further impact subsurface heritage resources remains **Low**. The odd chance of finding loose surface scatters such as stone age arrow heads and stone flake knives were regarded by the HIA specialist as being of **Low significance**. Nonetheless, a conservative approach needs to be retained as this prevents heritage resources from being viewed in a casual light.

The overall impacts on archaeological components will be of **Low** order prior to any mitigation and **Low** after mitigation. These low scores are attributed to the low likelihood of finding fossils and artefacts of historical significance and the absence of

above ground evidence of historically significant structures. Mitigation measures as indicated should be implemented.

3.3. Water resources:

The water resource theme includes all aspects of freshwater including surface and groundwater resources. Water quality and quantity are two crucial components that are evaluated.

Surface and ground water quality							
Impact	The pollution of surface and groundwater resources due to the proposed development.						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> • Removal of riparian vegetation • Soil erosion • Disturbance of stream banks • Accidental oil spills and other forms of water pollution 						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	4	3	2	3	4	12
Mitigation	<ul style="list-style-type: none"> • The stream system including the riparian zone as delineated situated adjacent to the solar footprint should be completely excluded from the development footprint in order to ensure no impacts on it occur. • This stream system should be regarded as a no-go area. • A stormwater management plan should be implemented to avoid the increased runoff from eroding soils. • Soil erosion prevention should be implemented. • Power line pylons may not be placed within watercourses. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	2	1	2	3	6
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	5	2	3	2	6
Mitigation	<ul style="list-style-type: none"> • A monitoring programme should be drafted and maintained by the operational team in liaison with the appointed ECO. This monitoring programme should monitor changes in the various watercourses which'll be affected by the development. • Any observable impact on watercourses needs to be attended too immediately. The onsite environmental representative in liaison with the ECO should recommend appropriate management options. • No pollution causing activity may occur near streams. • Stormwater drains, culverts, canals etc. should all be monitored on a monthly basis. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	1	3	1	2	2	4
Additional Notes: The original powerline layout was changed to limit the number of stream crossings and where applicable cross streams perpendicular to its flow direction.							

It's not foreseen that any significant adverse groundwater impacts arise due to the proposed development. Such impacts cannot be entirely excluded as accidental events such as oil spillages may still occur. Depending on the size of hazardous spill impacts on groundwater resources might range from low to severe. It is therefore crucial that the developer exercise avoidance mitigation to avoid serious environmental risks. The proposed development's impacts on water resources is anticipated to have a higher probability of adversely affecting surface water resources. Layout alterations have already been implemented which ultimately lowered the anticipated risk. During the construction phase, it is estimated the impact on surface water quality is of **Medium** significance (no mitigation). By implementing adequate mitigation measures this impact gets reduced to a **Low-medium** order. The development's operational phase is anticipated to generate a **Low-medium** impact without mitigation and a **Low** impact significance with mitigation measures applied. Mitigation measures will significantly reduce the overall impact on water resources and should therefore be implemented. Continual monitoring as advised throughout the development's operation remains important.

The overall impact generated by the proposed development on water resources prior to implementing mitigation measures is calculated to be of **Low-medium** order significance. Adequate mitigation measures will lower the overall environmental impact to a **Low** impact significance.

3.4. Aesthetics:

The aesthetic theme is focused on the alteration of the visual characteristics of the area and overall impact on landscape appreciation. Landscape appreciation is inherently subjective with few metrics allowing for an objective impact assessment. However, several aspects concerning visual impacts associated with solar developments may be objectively assessed. These include, glare, development size, topographic alteration, aesthetic deterioration due to construction, and line of sight distance.

Construction of Infrastructure							
Impact	The alteration of landscape appreciation, visual deterioration and visual impacts from the solar array.						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> • Construction • Generation of construction debris / waste • Temporary waste dump areas • Glare from solar array • Removal of vegetation • Alteration of the overall landscape perspective 						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	1	2	4	8

Mitigation	<ul style="list-style-type: none"> • Construction debris should be removed regularly and not allowed to pile up. • A designated construction waste area should be placed. • All domestic waste and construction debris should be removed to a designated waste landfill site. • Construction should finish as quickly as possible. • Panel height needs to be restricted to the lowest minimum thresholds to minimise glare. • All open spaces after construction need to be revegetated. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	3	6
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	5	2	3	4	12
Mitigation	<ul style="list-style-type: none"> • Indigenous tall growing evergreen trees need to be planted along the N10 to obscure direct visual impact. • All operational activities should strictly be concentrated on the proposed site. • Rehabilitation of all open spaces after construction. • If glare becomes an apparent issue, panel tilt needs to be adjusted. • Warning road signs need to be installed warning road users of a potential medium-high glare zone. • Shaders on the road facing side of solar panels should be considered if other mitigation measures prove to be less effective. • In the unlikely situation that all previous measures prove ineffective, panel tilt should become fixed facing away from the N10. • A complaints register needs to remain on site in which all complaints raised by the general public is to be filed. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	5	2	3	3	9
Additional Notes:							

The proposed development's construction phase is likely to generate a **Low-medium** visual impact without mitigation and a **Low-medium** impact post mitigation. Impacts on aesthetics and overall landscape appreciation within the construction phase is considered less significant compared to the facility's operation phase. Operational pre mitigation aesthetic impacts were calculated to be of **Medium** significance which lowered to a **Low-medium** impact significance when applying mitigation. Several tiers of visual obscurity mitigations have been presented. Before final completion of construction, the appointed ECO should recommend the appropriate mitigation measures to be implemented during the operational phase. This approach prevents any unnecessary expenditure to be placed on the developer whilst retaining an overall low visual impact. Continual monitoring is required throughout all phases of this development.

3.5. Air quality and noise:

Noise and air quality assessments are based upon the type of equipment being used during a specific activity and the degree of disturbance that will occur. Air quality is further impacted by emissions emanating from the proposed development.

Air quality							
Impact	Additional air pollution introduced due to the mobilisation of vehicles and land clearance.						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> Elevated dust emissions due to increased vehicle movement Vegetation clearance and the construction of internal dirt roads. 						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	2	3	3	9
Mitigation	<ul style="list-style-type: none"> Watering bare surfaces and excavations to promote dust suppression Enforce speed limit of 30km/h and optimization of working schedule to reduce vehicle mobilization. Limit the amount of vegetation clearance. The construction of new dirt roads should be restricted by prioritising existing roads. Development to remain within the authorised area. Construction needs to finish as quickly as possible. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	2	4
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Positive	3	5	2	3	5	15
Mitigation	No mitigation is required as the overall impact on air quality for the Wonderpan solar facility is considerate positive.						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Additional Notes:	The Wondepan solar facility's green energy production will not directly feed into the electrical grid, rather it will feed into the proposed chemical plant which'll produce alternative energy sources in the form of green hydrogen and green ammonia. The indirect benefits towards the air quality theme are derived from the avoidance of requiring electricity from the national grid to supply the chemical plant where the alternative green energy resources will be produced.						

The proposed development is not anticipated to significantly affect air quality during its operational phase. Therefore, impacts on air quality was only assessed for the construction phase. During the construction phase of the proposed development a **Low-medium** impact significance on air quality is calculated without mitigation. The adequate implementation of mitigation measures will lower the overall impact to a **Low** order impact significance.

Noise and vibrations							
Impact	Vehicles and equipment utilized						
Activities (Not an all-inclusive list)	<ul style="list-style-type: none"> Noise generated through construction related activities. Vibrations generated due to the utilisation of construction equipment. 						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	2	3	3	9
Mitigation	<ul style="list-style-type: none"> Working schedule for activities with high noise levels will be limited to 08:00 AM to 17:00 PM. Machinery should be serviced regularly during the construction stage. Equipment should be regularly serviced. Construction to remain within the authorised footprint. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	2	4
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	The operational activities contained within a solar farm typically does not generate any significant levels of sound/ vibrations.						
Mitigation	N/A						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Additional Notes:							

The proposed development's impact on local noise levels during the construction phase is calculated to be of **Low-medium** order significance without mitigation. By implementing proper mitigation measures, the overall impact on this theme decreases to a **Low** order significance.

The anticipated impact on local noise and air quality is calculated to be of **Low** order significance without mitigation and **Low** after the implementation of mitigation measures. The direct impacts on the local community concerning noise and air quality generated by solar farms is typically considered insignificant.

3.6. Socio-economic:

Socio-economic impacts focusses on the effects the development will have on the economic drivers in the surrounding area as well as emphasising the integration of economic development concerning the needs of the people.

Job creation and the influx of job seekers

Impact	Impacts associated with the need for locally appointed construction/ operation workers.						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Positive	3	3	2	3	5	15
Mitigation	No mitigation is required for impacts that generally produce a positive impact.						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Positive	2	5	2	3	4	12
Mitigation	x						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	N/A						
Additional Notes:	The proposed Wonderpan solar facility will create a great deal of jobs during both construction and operational phases. According to the Siyathemba Local Municipality's IDP (2022/23), it wishes to utilise IPPP facilities to aid in growing the local socio-economic profile of the municipality. Other benefits to the local community include, skills training and local economic growth.						

The proposed Wonderpan solar facility's construction and operation provides for several socio-economic benefits such as local job creation, boosting local spending, skills training, and revenue contribution towards local economic growth within the Syathemba Local Municipality. It is therefore considered that both construction and operation phases of this project will have a **Medium** positive impact on the local socio-economic sphere.

3.7. Waste:

Waste management refers to the types of waste being generated by the proposed development. This theme also investigates environmental impacts generated by the development concerning specific waste management strategies employed throughout all phases of the project.

General solid waste							
Impact	General solid waste pollution						
Activities (Not an all-inclusive list)	General construction waste such as plastic items, cement bags, construction scrap etc. Designated temporary construction waste dump area. General operational waste (plastic items, paper, broken panels / equipment etc.) Waste removal management.						
Constructional Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	3	2	3	3	9

Mitigation	<ul style="list-style-type: none"> • Reduce, reuse and recycle strategy needs to be implemented. • Waste receptacles must be made available, and all waste shall be adequately stored and removed. • All waste management strategies employed by the contractor should comply with environmental / waste management legislation. • Waste that can easily be dispersed by wind should be appropriately discarded in bins with lids. • Waste should be regularly removed from the site to a registered landfill. • The contractor should develop and comply to a on-site specific waste management plan. • No waste may be buried in an on-site waste pit. • No burning of waste material on site. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	2	4
Operational Phase							
Before Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	3	5	2	3	3	9
Mitigation	<ul style="list-style-type: none"> • General waste should be transported to a designated waste storage area and may not be burned. • Waste should be transported to a registered landfill site. • General waste should also be removed from the site and not pile up. • PV panels which have reached their end of life cycle should be recycled and not dumped at a landfill site. 						
After Mitigation	Status	Severity	Duration	Extent	Consequences	Likelihood	Significance
	Negative	2	2	1	2	2	4
Additional Notes:	<p>Much contemporary research has been placed on the long-term end point for solar facility's which's PV panels had reach their end-of-life cycle. Due to the ever-increasing need for solar facilities, it's anticipated that in the coming years hundreds of solar facilities will need to either be decommissioned or entirely replace their PV array with new solar panels. The environmental impact thereof is still uncertain. Therefore, the developer should seriously consider staying up to date with the newest legislation concerning E-waste recycling.</p>						

The proposed development's environmental impact concerning waste production will have an anticipated **Low-medium** impact significance during the construction phase (no mitigation). This impact is reduced to a **Low** order impact significance when adequate mitigation measures are applied. Operational phase environmental impacts are considered **Low-medium** before mitigation and **Low** after mitigation measures are implemented.

Uncertainty regarding the end-of-life cycle of PV panels remain. The ever-increasing need for renewable energy production facilities has only recently birthed the uncertainties regarding the end point for all the PV panels which within an approximate 20 years, reach their end of life. By this point the energy production efficiency of PV panels becomes a financial liability which typically results in large scaled replacement

of PV panels. Currently, no legislation exists for the large scaled removal of E-waste (PV panels). Therefore, the proponent and operational team is urged to remain cognisant of updates to legislation and best practice for PV panel recycling.

3.8. No go alternative:

The no-go alternative assumes that the proposed project will not go ahead i.e. it is the option of not constructing the proposed development. This alternative would result in no environmental impacts on the site or surrounding local area. It provides the baseline against which other alternatives were compared. The following implications will occur if the “no go” alternative is implemented:

- No benefits will be derived from the implementation of an additional land-use.
- The chemical plant, which’s already authorised by the DAERL will opt to receive its electricity from ESKOM’s grid.
- This will further enforce more strain on the already outdated electrical grid.
- Considering the national grid is largely supplied by non-renewable energy production facilities (90% coal based), the no go option will indirectly result in more carbon dioxide emissions.
- The authorisation refusal of this solar plant will indirectly create a precedence which will deter future renewable energy developments in the area.
- Socio-economic benefits such as job creation, skills development, and local economic growth will be lost.
- Local economic benefits arising through the REIPPP will not be realised.

Besides the above mentioned, the following benefits might occur if the no go alternative is implemented:

- No vegetation will be removed and or disturbed.
- The ecology will remain largely intact.
- No change/ alteration to the existing landscape.
- No additional waste will end up in landfill sites.

While the no go alternative will not generate any negative environmental impacts, it will surely remove any socio-economic benefit the local community will receive. The no go alternative will also not aid the government in addressing climate change, reaching its greenhouse gas emission targets, and will further place more strain on the existing electrical grid. Therefore, the no go alternative is not considered the preferred alternative.

Appendix G
Environmental Management Plan

Environmental
Management
Group (Pty) Ltd.



EMG

EMPr FOR:
PROPOSED 60 MW PV
SOLAR FACILITY FOR
PRIESKA POWER
RESERVE,

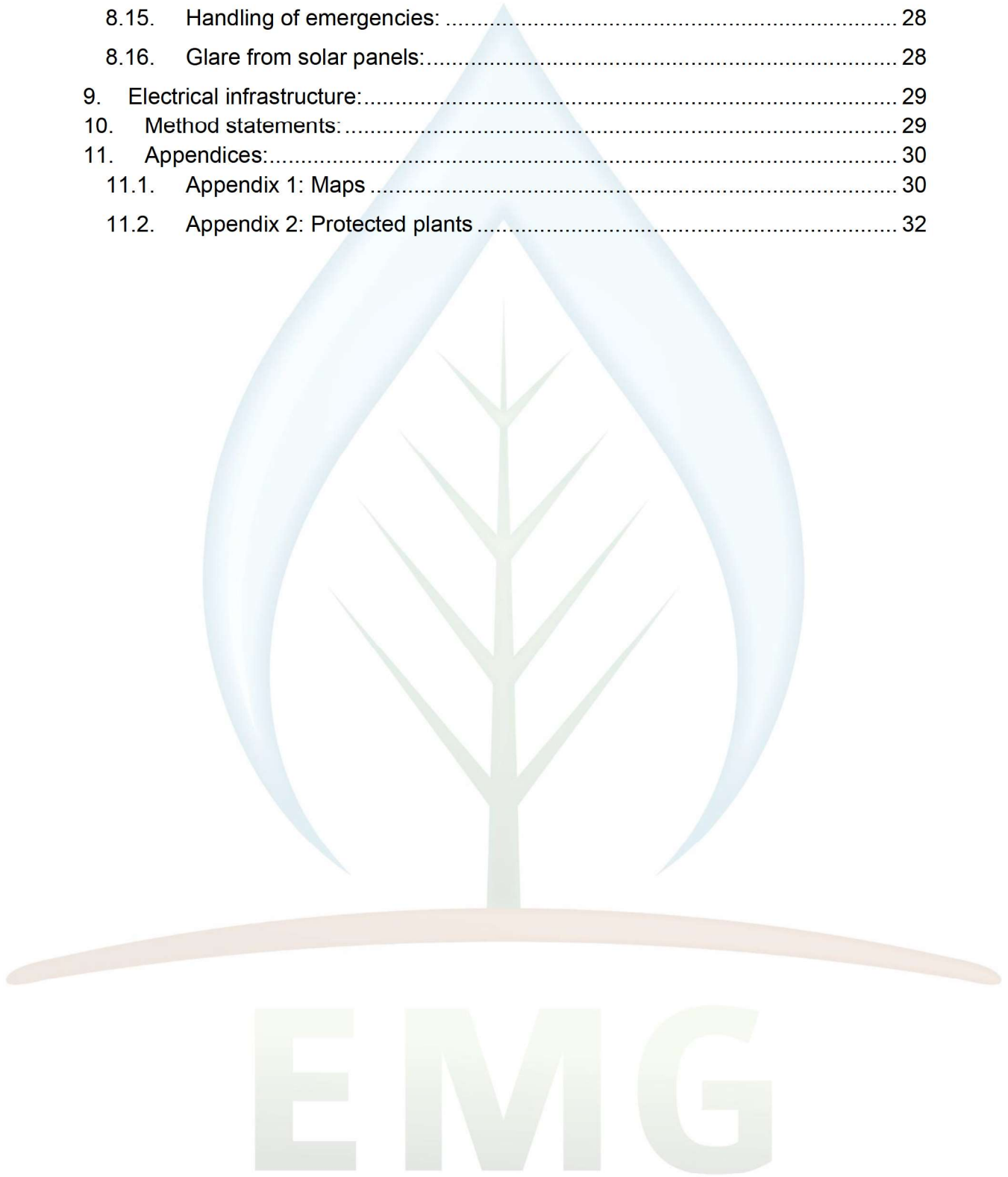
Prieska Power Reserve (Pty) Ltd. ~
Prieska, Northern Cape



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Definitions:

1. **Alien Vegetation:** alien vegetation is defined as undesirable plant growth which shall include, but not be limited to; all declared category 1 and 2 listed invader species as set out in the Conservation of Agricultural Resources Act (CARA) regulations. Other vegetation deemed to be alien shall be those plant species that show the potential to occupy in number, any area within the defined construction area and which are declared to be undesirable.
2. **Aspect:** Element of an organisation's activities, products or services that can interact with the environment.
3. **Auditing:** A systematic, documented, periodic and objective evaluation of how well the environmental management plan is being implemented and is performing with the aim of helping to safeguard the environment by: facilitating management control which would include meeting regulatory requirements. Results of the audit help the organisation to improve its environmental policies and management systems.
4. **Built environment:** Physical surroundings created by human activity, e.g. buildings, houses, roads, bridges and harbours.
5. **Contamination:** Polluting or making something impure.
6. **Corrective (or remedial) action:** Response required addressing an environmental problem that is in conflict with the requirements of the EMP. The need for corrective action may be determined through monitoring, audits or management review.
7. **Degradation:** The lowering of the quality of the environment through human activities, e.g. river degradation, soil degradation.
8. **Ecology:** The scientific study of the relationship between living things (animals, plants and humans) and their environment.
9. **Ecosystem:** The relationship and interaction between plants, animals and the non-living environment.
10. **Environment:** environment means the surroundings within which humans exist and that could be made up of -
 - 10.1. the land, water and atmosphere of the earth;
 - 10.2. micro-organisms, plant and animal life;
 - 10.3. any part or combination of (10.1) and (10.2) and the interrelationships among and between them; and
 - 10.4. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.
11. **Environmental aspect:** an environmental aspect is any component of a contractor's construction activity that is likely to interact with the environment.
12. **Environmental impact:** an impact or environmental impact is the change to the environment, whether desirable or undesirable, that will result from the effect of a construction activity. An impact may be the direct or indirect consequence of a construction activity.

13. **Environmental authorisation:** an environmental authorisation is a written statement from the National Department of Forestry, Fisheries and the Environment (DFFE) that records its approval of a planned development.
14. **Hazardous waste:** Waste, even in small amounts that can cause damage to plants, animals, their habitat and the well-being of human beings, e.g. waste from factories, detergents, pesticides, hydrocarbons, etc.
15. **Land use:** The use of land for human activities, e.g. residential, commercial, industrial use.
16. **Mitigation:** Measures designed to avoid, reduce or remedy adverse impacts



1. Introduction and background:

1.1. Scope:

Environmental Management Group Consultants (EMG), as independent environmental managers and impact assessors, has been appointed by **Prieska Power Reserve** to compile and submit an Environmental Management Programme (EMPr) under the National Environmental Management Act No 107 of 1998, for the **Wonderpan Solar farm and associated 132 kV transmission line development** in Prieska, Northern Cape Province as part of the Environmental Authorisation Process.

This document is compiled in accordance with the Integrated Environmental Management (IEM) philosophy which aims to achieve a desirable balance between conservation and development (DEAT, 1992). IEM is a key instrument of the National Environmental Management Act [NEMA] (Act No. 107 of 1998). NEMA promotes the integrated environmental management of activities that may have a significant effect on the environment, while IEM prescribes a methodology for ensuring that environmental management principles are fully integrated into all stages of the development process. It advocates the use of several environmental management tools that are appropriate for the various levels of decision-making. One such tool is an EMP. The IEM guidelines encourage a pro-active approach to sourcing, collating and presenting information in a manner that can be interpreted at all levels. The basic principles underpinning IEM are that there be:

- 🔹 informed decision-making;
- 🔹 accountability for information on which decisions are taken;
- 🔹 accountability for decisions taken;
- 🔹 a broad meaning given to the term environment (i.e. one that includes physical, biological,
- 🔹 social, economic, cultural, historical and political components);
- 🔹 an open, participatory approach in the planning of proposals;
- 🔹 consultation with interested and affected parties;
- 🔹 due consideration of alternative options;
- 🔹 an attempt to mitigate negative impacts and enhance positive aspects of proposals;
- 🔹 an attempt to ensure that the 'social costs' of development proposals (those borne by society, rather than the developers) be outweighed by the 'social benefits' (benefits to society as a result of the actions of the developers);
- 🔹 democratic regard for individual rights and obligations;
- 🔹 compliance with these principles during all stages of the planning, implementation and decommissioning of the proposals (i.e. from 'cradle to grave');
- 🔹 and the opportunity for public and specialist input in the decision-making process.




The Environmental Impact Assessment Regulations that took effect in December 2014 regulate the procedures and criteria for the submission, processing, consideration and decision on applications for environmental authorisation of listed activities.

The general principles contained within this document apply to all **planning phase**, **construction phase**, and **operational phase** activities regarding the proposed development.

1.2. Overall project background:

Prieska Power Reserve (Pty) Ltd has undertaken feasibility investigations for the flexible production of green hydrogen and ammonia from variable solar and wind energy. Prieska and its surrounding areas prove to have extremely good solar and wind load factors. Prieska Power Reserve (Pty) Ltd developed a model to utilise these load factors to produce green ammonia of which the hydrogen content is derived from the renewable energy sources, solar and wind (energy production).

Planned industries for the power reserve hub proposal in the Prieska area is anticipated to be developed in the following phases.

-  **Phase 1:** Development and construction of several solar photovoltaic (PV) plants and their associated infrastructure with a total combined capacity to produce at least 770MW AC.;
-  **Phase 2:** Development and construction of a wind generation plant with associated infrastructure; and
-  **Phase 3:** Development and construction of an industrial park for green hydrogen and ammonia production.

This report deals with the **Wonderpan PV solar facility** as part of **Phase 1**.

The logo for EMG features the letters 'EMG' in a large, bold, light green font. Above the letters is a stylized tree with a green trunk and branches, and a large, light blue circular shape behind it. Below the tree is a thick, light brown curved line that resembles a horizon or a ground surface.

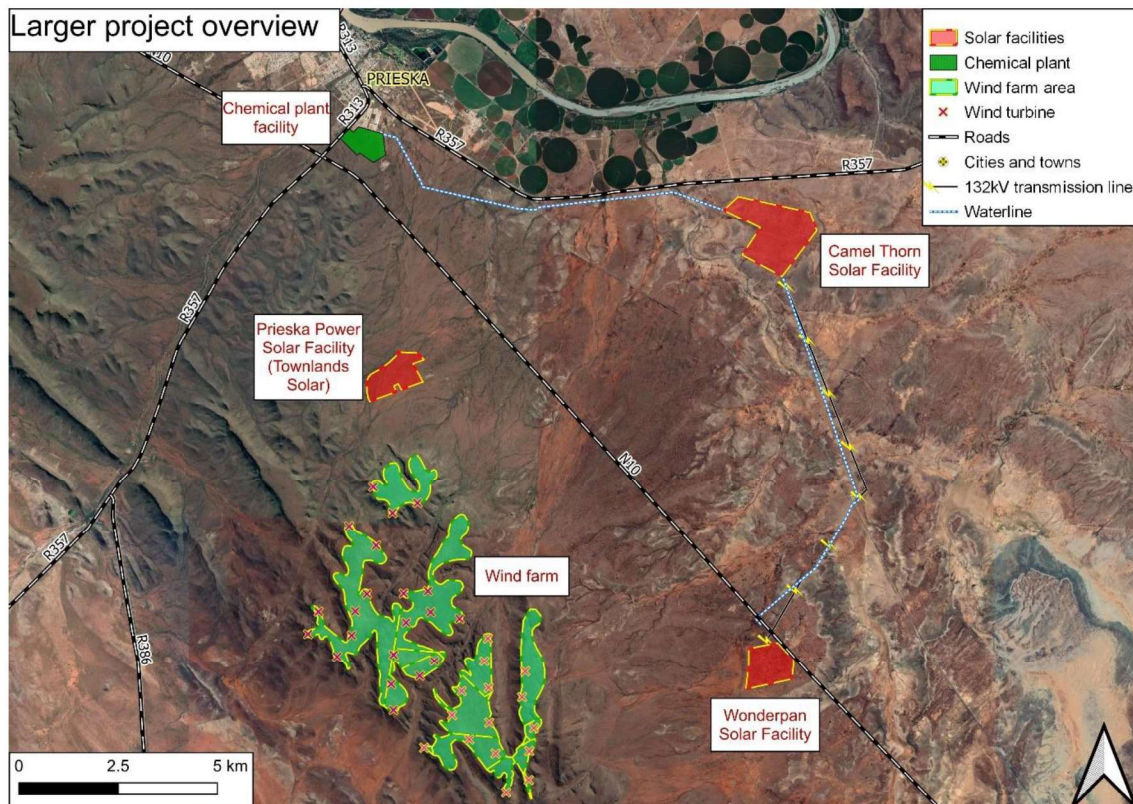


Figure 1 Map indicating a portion of the larger Prieska Power Reserve Hub. Note this project only deals with the Wonderpan Solar facility which form part of phase 1.

1.3. Project description:

The proposed Wonderpan solar facility's footprint will take up 137 ha of the 1526 ha available on farm Karabee 50/4 situated south of the N10. Installed hardware will have the potential to generate 60 MW by PV technology. Renewable energy production will be facilitated through eight (8) blocks of fixed tilt (30° north facing) solar arrays. A small on-site substation and its associated hardware will convert the solar output to AC through eight (8) 7.5MW inverters, whereby the green energy will be relayed via the proposed 132kV transmission line to the Camel Thorn solar facility. The following infrastructure will be developed:

Solar field:

- 🔧 Eight (8) blocks of fixed-tilt panel arrays;
- 🔧 Steel support structure and tracker system on concrete foundations;
- 🔧 Inverter stations as part of the PV field (8 total 7.5MW inverters);
- 🔧 Transformer, switchgear, and related equipment as part of the substations;
- 🔧 Fencing around the site perimeter (2.5m high);
- 🔧 Internal roads.

Associated infrastructure:

- 🔧 Substation complex (33/132kV) including control rooms and grid control yard;

- 🔌 Transmission lines and transmission towers (towards the Camelthorn Solar PV Plant - 13km in length);
- 🔌 Battery energy storage system;
- 🏠 Operations and maintenance buildings;
- 🔌 Access and internal roads;
- 🔌 Perimeter fencing and access control point (gate and security building);

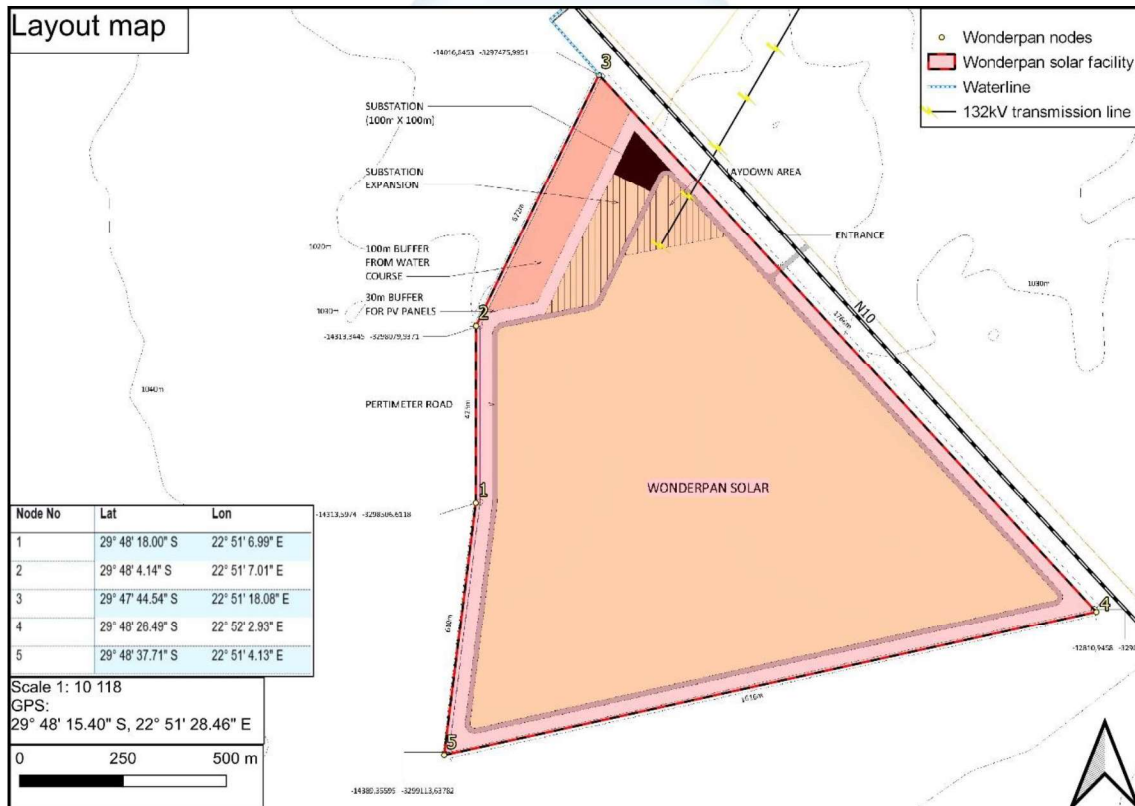


Figure 2 Layout map indicating the proposed Wonderpan Solar facility's site boundary and associated infrastructure.

Table 1 Technical development specifications.

Item / component	Specification
One (1) block	
Generation capacity	7.5 MW DC
Total area required	0.8 ha / MW
PV array information	
Total blocks (full 60 MW)	8 blocks (fixed tilt)
Module output	Canadian solar CS7N-660MS 1500v / 660wat
Average panel height	3 meters
Fixed panel tilt	30° north
Total panels required (full 60MW generation)	± 105 000 units

Inverters	(8) x 7.5 MW inverters
Total PV array area (physical clearance)	104.3 ha
Total Wonderpan solar farm area (site)	137 ha

1.4. Project locality:

The Wonderpan PV solar facility will be situated on Portion 4 of the Farm Karabee 50, located approximately 18 SE of Prieska, which falls within the jurisdictional control of the Siyathemba Local Municipality. The Wonderpan site is accessed via the N10, south of Prieska.

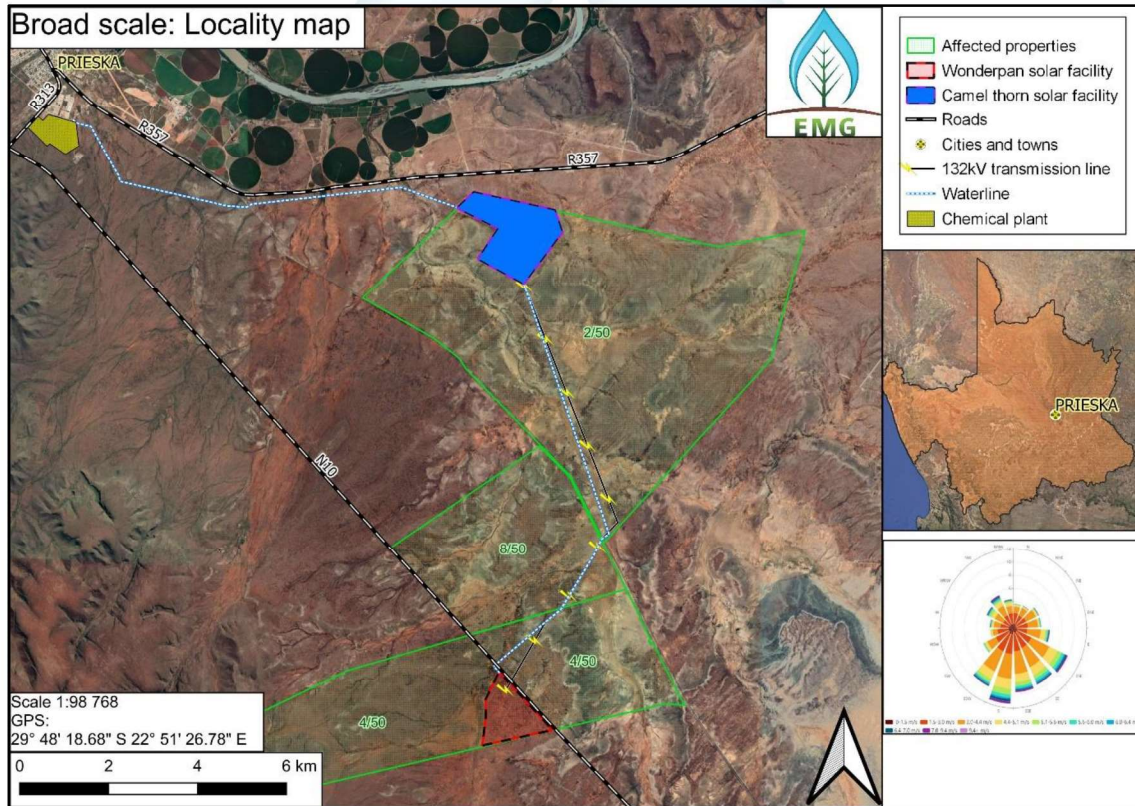


Figure 3 Locality map indicating the proposed development site and its associated infrastructure. **Note this project only deals with the Wonderpan solar site and its associated infrastructure (132kV line and the water supply line).**

Associated infrastructure forming part of the Wonderpan development includes a 132kV transmission line. The mentioned 132kV transmission line traverses through Portions 4, 2, and 8 of Farm Karabee 50 and will ultimately connect the Wonderpan and Camel Thorn solar facilities.

Table 2 Properties affected by the proposed development. Refer to **Figure 3** above.

Proposed infrastructure	Properties	Surveyor General 21 Digit code
132kV transmission line	Portion 2 of the Farm Karabee 50, Prieska Road	C0600000000005000002