**APPENDIX F - IMPACT ASSESSMENT**

The following table serves as a summary of the methodology used to calculate and rate the identified environmental impacts:

**Table 1: Impact Rating Methodology**

|  |
| --- |
| Potential environmental impacts and key issues were identified through a site visit, specialist studies, GIS and desktop studies and consultation of interested and affected parties. The significance of each of the potential impacts was calculated in order to determine to what extent the potential environmental impact have to be mitigated. The predicted impacts were divided into the following categories:Negligible:The impact is not significant and does not require any mitigation.Low:The impact has a low significance which may require partial mitigation.Moderate:The impact is of importance and as a result might have a negative impact on the surrounding environment. Mitigation is there for required in order to reduce the negative impacts to tolerable levels.High:The impact is of high importance and as a result might have a major impact on the surrounding environment. Mitigation measures needed to reduce the negative impacts to tolerable levels is vital in order to make the proposed development feasible.The following factors were evaluated when determining the significance of the impacts:**Longevity/ Duration** Short term: The duration of the impact will be over a short period of time.Medium term: The duration of the impact will be over a medium period of time. Normally not longer than the last phase of the proposed project through implementation of adequate mitigation measures.Long term: The duration of the impact will be over a long period of time. Normally throughout the operational phase of the proposed project through implementation of adequate mitigation measures.Permanent: The impact will be permanent and will not even be addressed through implementation of adequate mitigation measures.**Intensity/ Magnitude**Low:Natural processes are not affected or disturbed as a result of the impact.Medium:Natural processes are affected or disturbed as a result of the impact, however continues in an altered manner.High:Natural processes are affected or disturbed in such a manner that it is permanent. Natural processes are ceased as a result of the impact.**Probability**Improbable:The possibility of the impact occurring is very low to negligible. Probable: The possibility of the impact occurring is still low, however must be taken into account during development of mitigation measures.Highly Probable: The possibility of the impact occurring is highly likely.Definite: The possibility of the impact occurring is certain.**Significance**Negligible: The implication of the impact is negligible. Low: The implication of the impact is low and limited mitigation will be required. Moderate: The implication of the impact is moderate and specific mitigation measures will be required.High: The implication of the impact is high and extensive mitigation measures will be required. |

**Table 2: Impact Rating Scores**

|  |  |  |
| --- | --- | --- |
| Aspect | Description | Weight |
| Scale | Local | 1 |
|  | Site | 2 |
|  | Regional | 3 |
| Duration | Short term | 1 |
|  | Medium term | 3 |
|  | Long term | 4 |
|  | Permanent | 5 |
| Magnitude/Severity | Low | 2 |
|  | Medium | 6 |
|  | High | 8 |
| Probability | Improbable | 1 |
|  | Probable | 2 |
|  | Highly Probable  | 4 |
|  | Definite | 5 |
| Significance | Sum (Scale, Duration, Magnitude) x Probability |
|  | Negligible | <20 |
|  | Low | <40 |
|  | Moderate | <60 |
|  | High | >60 |

**Table 3: Impact Rating Colour Codes**

|  |  |
| --- | --- |
| Colour | Significance |
|  | Impact of high significance |
|  | Impact of moderate significance |
|  | Impact of low significance |
|  | Impact Negligible |

**ALTERNATIVE S1 (Preferred Alternative)**

**TABLE 4: IMPACT IMPACTS ANTICIPATED DURING THE PLANNING AND DESIGN PHASE OF THE PROPOSED ACTIVITY (PREFERRED LAYOUT DESIGN ALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM** |
|  | **Direct Impacts:** |
|  | No direct impacts are anticipated. |  |  |  |
|  | **Indirect Impacts:** |
|  | No indirect impacts are anticipated. |  |  |  |
|  | **Cumulative Impacts:** |
| **1** | **WATER RESOURCE DEPLETION:**Water is used to grow trees from which paper is used, therefore wasting paper results in an increase in water consumption.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 4 | 32 |
| WM | 3 | 3 | 2 | 2 | 16 |

 | **LOW (32)** | * Plans and drawings must rather be communicated electronically prior to finalisation of the design plans/ drawings in order to ensure all details are correct prior to printing, this will ensure that no re-prints are required and will save paper.
* Any waste paper should be recycled.
 | **NEGLIGBLE (16)** |
| **2** | **LOSS OF HABITAT/ BIODIVERSITY**Materials used in the planning and design phase, especially paper used for the printing of drawings and design plans might be used wastefully, resulting in an increased volume of waste going to landfill, thereby increasing the area of land needed for landfill space.Natural resources used for the development could result in loss of habitats (e.g. mining for minerals).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 2 | 4 | 40 |
| WM | 3 | 5 | 2 | 2 | 20 |

 | **MODERATE (40)** | * Plans and drawings must rather be communicated electronically prior to finalisation of the design plans/ drawings in order to ensure all details are correct prior to printing, this will ensure that no re-prints are required and will save paper.
* All waste paper should be recycled.
* Identify environmentally friendly technologies, processes and materials in the design of the development.
 | **LOW (20)** |
| **3** | **GLOBAL WARMING**Means of travel for meetings results in carbon emissions, thus contributing towards global warming.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 4 | 36 |
| WM | 3 | 4 | 2 | 2 | 18 |

 | **LOW (36)** | * Travel for meetings should be limited as far as possible. Communication via telephone and email should be encouraged over physical meetings.
 | **NEGLIGIBLE (18)** |
| **4** | **JOB CREATION (POSITIVE IMPACT)**The development has the potential to provide new job opportunities and this opportunity should be maximised as far as possible.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 2 | 16 |
| WM | 3 | 3 | 6 | 4 | 48 |

 | **NEGLIGIBLE (16)** | * Identify and employ local contractors, suppliers and services as far as reasonably possible.
* Ensure that employees are recruited from the local communities as far as possible.
 | **MODERATE (48)****(POSITIVE)** |

**TABLE 5: IMPACTS ANTICIPATED DURING THE CONSTRUCTION PHASE OF THE PROPOSED ACTIVITY (PREFERRED LAYOUT DESIGN ALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM** |
|  | **Direct Impacts:** |
| **1** | **LOSS OF FLORA BIODIVERSITY & HABITAT DESTRUCTION OR MODIFICATION**This impact is rated as low to negligible due to degraded/ modified state of the natural environment. Three vegetation units were identified on the site by the specialist:1. Cultivated land with zero sensitivity and only a few pioneer grasses and exotic weeds;
2. Degraded grassland with a low sensitivity; and
3. The artificial stormwater canals representing degraded areas with a medium to low sensitivity with limited ecosystem and hydrological functionalities.

This impact assesses the impact on flora species on site as a result of a loss of biodiversity and habitat through clearing of natural vegetation for the site and servitudes.This impact will be less than the alternative layout design, as a 5 meter buffer zone has been incorporated into the preferred alternative’s layout design.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 2 | 4 | 36 |
| WM | 2 | 5 | 2 | 2 | 18 |

 | **LOW (36)** | An important aspect relating to the proposed development should be to protect and manage the biodiversity (structure and species composition) of the Central Sandy Bushveld vegetation type which are represented in the project area. The following general management measures and guidelines should be implemented: * All development activities should be restricted to specific recommended areas and should be approved by the ECO.
* Ensure that the 5 meter buffer zone between the development footprint and the artificial temporary wetland is clearly demarcated.
* The few taller than 3m indigenous trees along the proposed underground power cable servitude provide resting/perching sites for larger birds like vultures, birds of prey, arboreal reptiles and mammals that might occur/pass through the area and should preferably be preserved. These larger trees should be protected as far as possible and be incorporated as part of the landscaping of future development in the area.
* Construction vehicles and plant must not be allowed to operate outside of the site boundary and designated access routes.
* Construction vehicles must be restricted to using existing roads and access routes as far as practically possible in order to reduce the impact on natural vegetation.
* The collection of firewood or plants for medicinal purposes is prohibited, unless they have specifically been earmarked for removal for construction purposes.
* Training must be given to all employees of contractors, sub-contractors and service providers who will be operating on site in order to ensure that all employees know their roles and responsibilities in managing the environmental impact.
 | **NEGLIGIBLE (18)** |
|  |  |  | * A rehabilitation plan should be developed and implemented based on the EMPr requirements as part of the solar plant developments which should be approved by the ECO.
* Rehabilitate and re-vegetate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.
* Institute an alien invasive species eradication/control programme for early intervention if such species are detected, so that their spread to surrounding natural ecosystems can be prevented.
 |  |
| **2** | **LOSS OF FAUNA BIODIVERSITY & HABITAT** Negative impact on fauna species on site as a result of irresponsible behaviour of individuals such as poaching and fires.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 6 | 2 | 26 |

 | **MODERATE (52)** | * The construction footprint and laydown must be clearly demarcated prior to the commencement of de-bushing in order to avoid unnecessary damage to vegetation.
* Maintain proper firebreaks around entire development footprint.
* Educate construction workers regarding risks and correct disposal of cigarettes.
* The few taller than 3m indigenous trees along the proposed underground power cable servitude provide resting/perching sites for larger birds like vultures, birds of prey, arboreal reptiles and mammals that might occur/pass through the area and should preferably be preserved. These larger trees should be protected as far as possible and be incorporated as part of the landscaping of future development in the area.
* Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
* Construction vehicles and plant must not be allowed to operate outside of the site boundary and designated access routes.
* Construction vehicles must be restricted to using existing roads and access routes as far as practically possible in order to reduce the impact on natural vegetation and possible disturbances to fauna.
* Any animal species found on the site must be relocated to an area of safety and released into natural habitat.
* No animals may be injured or killed purposefully or through negligence.
* No animals may be trapped or kept as pets.
* Hunting of animals is prohibited.
* Should any sensitive faunal species be observed which might be impacted on the ECO must be informed immediately in order to deal with it timeously.
* Training must be given to all employees of contractors, sub-contractors and service providers who will be operating on site in order to ensure that all employees know their roles and responsibilities in managing the environmental impact.
 | **LOW (26)** |
| **3** | **LOSS OF AVIFAUNAL BIODIVERSITY**There are no overhead power lines included in the preferred layout design alternative as the underground power cable will be installed in a conduit underground, and therefore the impact rating is less than for the alternative layout design. There will still however be a limited impact on avifauna.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| c | S | D | M | P | S |
| WOM | 1 | 3 | 2 | 4 | 24 |
| WM | 1 | 3 | 2 | 2 | 12 |

 | **LOW (24)** | * The protection of different habitat types in the area will be important to ensure the survival of the different birds due to each species’ individual needs and requirements. Sufficient natural corridor sections should be protected around the proposed development footprints to allow avifauna to move freely between the different microhabitats in the study area.
* The few taller (>3m) indigenous trees within this area also provide resting/perching sites for larger birds like vultures and birds of prey might occur/pass through the area and, other than the proposed footprint area for the development, should preferably be preserved. These larger trees should be protected as far as possible and be incorporated into the proposed energy development. A monitoring programme needs to be implemented by a specialist if any rare species are confirmed on the property as recommended in the ecological specialist report.
* The clearing and damage of plant growth should be restricted to the site footprint.
* Clearly demarcate the entire development footprint prior to initial site eastablishment and prevent construction personnel from leaving the demarcated area.
* Monitoring should be implemented during the construction phase of the PV Power Plant to ensure that minimal impact is caused to the fauna of the area.
* Landscape management at the site needs to consider different objectives, including
* Maintaining pre-existing land uses;
* Conserving and restoring natural habitats;
* Managing land for priority species;
* Hunting of birdlife should be prohibited on site.
* Facilitating post-construction monitoring. For best results, vegetation management should be carefully planned in advance, and recorded within the project’s Environmental Management Programme.
 | **NEGLIGIBLE (12)** |
| **4** | **IMPACT ON AVIFAUNA MOVEMENTS** **Disturbance through human activities, noise and fires**Construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. An increase in human activity on the site and surrounding areas is anticipated, especially during the construction phase of the underground power cable. Birds will move out of the area during construction activities as a result of noise disturbance. The presence of construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires which might cause loss of bird diversity when ground-living birds are killed in the fires or their nests destroyed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 3 | 6 | 5 | 55 |
| WM | 2 | 3 | 2 | 5 | 35 |

 | **MODERATE (55)** | * Care should always be taken to disturb the receiving environment as little as possible. Careful control of construction workers movements must be maintained at all times.
* Staff that will stay on site should be accommodated in one location of the site to ensure that the impact will be minimal on the larger area.
* Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.
* Construction activities must be restricted to working hours Monday to Saturday, unless otherwise approved by the appropriate competent person in consultation with the affected residents.
* Educate workers regarding the occurrence of important resources in the area and the importance of protection.
* Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g. courtship, nesting) seasons. In addition, control pets to avoid harassment and disturbance of wildlife.
* Camp fires at the construction laydown area must be strictly controlled to ensure that no veld fires are caused.
* Noise levels will be kept within acceptable limits by limiting of speed of haulage vehicles/tippers.
* Compliance with appropriate noise legislation must take place.
 | **LOW (35)** |
| **5** | **LOSS OF BIODIVERSITY AND NATURAL HABITAT**Potential negative impact on fauna and flora species as a result of poor **waste** management.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 1 | 6 | 4 | 40 |
| WM | 3 | 1 | 6 | 1 | 10 |

 | **MODERATE (40)** | * Waste must be placed in waste bins as soon as waste is generated on the site.
* No littering or uncontained waste will be allowed on site.
* Hazardous waste such as waste contaminated with hazardous chemical substances and broken PV solar panels must be placed in bins specifically provided for hazardous waste only.
* Toilets must be provided on site at a ratio of no less than 1 per 15 persons.
* General waste must be disposed of at a licensed waste landfill facility.
* Hazardous waste must be disposed of at a licensed hazardous waste disposal site.
* Sewage must be disposed of at a licensed waste water treatment facility, and a letter stating that sewage from the site or sewage collected by the toilet servicing company may be and is being disposed of at the facility.
* Should chemical toilets be used on site they must be emptied regularly to ensure that toilets do not over flow.
* Safe disposal certificates must be obtained for all waste streams and must be kept on file on site as proof of proper disposal (in accordance with the National Environmental Management Waste Act (Act 36 of 1998).
 | **NEGLIGIBLE (10)** |
| **6** | **HABITAT FRAGMENTATION (including avifauna)**The development will have a relatively small impact on the natural movement patterns and fragmentation especially on avifauna habitats. Such impacts would however be temporary in the solar plant site.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 5 | 2 | 2 | 18 |

 | **LOW (26)** | * Use existing facilities (e.g., access roads) to the extent possible to minimize the amount of new disturbance.
* Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to sensitive bird habitats (trees and the temporary artificial wetland areas such along the drainage line north of the site) during construction.
* During construction, sensitive habitats such as drainage lines and other water courses must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
* Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.
 | **NEGLIGIBLE (18)** |
| **7** | **SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES**Potential negative impact on fauna and flora species as a result of lack of control of weeds and alien invasive vegetation.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 6 | 5 | 70 |
| WM | 3 | 5 | 6 | 2 | 28 |

 | **HIGH (70)** | * Weeds and alien vegetation must not be allowed to propagate on the site.
* Weeds and alien invasive vegetation must be eradicated prior to the plants coming into flower, in order to prevent them from spreading over the site and invading/ taking over the surrounding natural vegetation in the area.
* All Category 1 declared weeds, as well as other species which can invade natural vegetation, must be removed on an on-going basis. The contractor must liaise with the ECO for further guidance in this regard.
* Institute a monitoring and eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.
* Rehabilitate and re-vegetate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.
 | **LOW (28)** |
| **8** | **LOSS OF AND DAMAGE TO TOPSOIL*** Potential impact on soil as a result of vegetation clearance and poor waste management.
* Potential impact on topsoil as a result of poor stockpiling and management.
* Loss of topsoil as a result of erosion.
* Disturbance of soils (Soil compaction, erosion and crusting).
* Sterilisation of soil (soil stripping).
* Soil contamination due to fuel or oil spillages from vehicles during the construction phase of the solar plant.
* Loss of current and potential agricultural land.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 6 | 2 | 26 |

 | **MODERATE (52)** | * Vegetation clearance must be kept to a minimum in order to minimise erosion during rainy periods.
* Soil should be handled when dry during removal and placement to reduce the risk of compaction.
* Maintain topsoil stockpiles in a weed free condition.
* Topsoil should not be compacted in any way, nor should any object be placed or stockpiled upon it.
* Stockpile topsoil for the minimum time period possible i.e. strip just before the relevant activity commences and replace as soon as it is completed.
* Topsoil shall be stockpiled outside of drainage lines or storm water trenches and stockpiles shall not exceed 2.0 meters in height.
* Topsoil and subsoil must be stockpiled separately.
* Topsoil stockpiles must be protected from water and wind erosion through adequate mitigation measures such as vegetation cover, berms or silt traps to trap sediment run-off, and watering during periods of high winds, etc.
* Avoid stripping of topsoil and subsoil during periods of high wind.
* Rehabilitate plant cover as a continual process, to maximize viability of the natural seedbank and reduce loss of topsoil during storage so as to prevent dust and loss of topsoil.
* Monitor rehabilitation success by comparing data from the servitude with that of surrounding habitats.
* No waste shall be permanently stored or buried on site.
* Storm water must be managed in order to prevent erosion.
* The main objective of the development in terms of the hydrological regime of stormwater should be to control stormwater on site. An engineer should address this in a detailed stormwater management plan. A small buffer of 5 meters should be implemented to ensure the integrity of the stormwater canal is kept intact.
* Effluent discharge and oil and fuel spillages must be cleaned up immediately along with the necessary remediation actions.
* A storm water management plan should be developed and implemented in order to ensure effective storm water management and erosion control.
* Earthen berms or sand bags, should be used to create a barrier at the upslope side of the site or any exposed embankments or slopes to prevent storm water from flowing down the slopes and thereby preventing erosion.
 | **LOW (26)** |
|  |  |  | * Earthen berms or sand bags or silt fences can also be put in place at the down-slope side of exposed slopes or embankments to trap sediment run-off.
* Exposed soil surfaces should be protected, especially on sloped gradients.
* G5 Material can be spread over the ground, especially in the site camp.
* No storm water shall flow through waste storage areas.
* Diversion berms should be constructed in order to divert any storm water away from cement mixing areas, waste storage areas and workshops where applicable and also to contain any contaminated water associated with these areas.
* Disturbed areas must be rehabilitated as soon as possible in order to prevent erosion and loss of topsoil.
* In the event of erosion occurring, the contractor must commence with remedial action as soon as possible.
* During construction, sensitive soils with high risk of compaction (e.g. clayey soils) must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
* Have both temporary (during construction) and permanent erosion control plans.
* Temporary control plans should include: 1. Short term seeding or mulching of exposed soil areas (particularly on slopes); 2. Limitations on access for heavy machinery and the storage of materials to avoid soil compaction.
* Permanent erosion control plans should focus on the establishment of stable native vegetation communities.
 |  |
| **9** | **SOIL POLLUTION**Possible contamination of soil during the construction phase, due to inadequate storage and handling of hazardous substances.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 1 | 4 | 6 | 4 | 44 |
| WM | 1 | 1 | 6 | 1 | 8 |

 | **MODERATE (44)** | * Hazardous chemical substances must be kept either in a bunded area or inside drip trays during both storage and when being used on site so as to prevent soil contamination should the container be knocked over or be leaking.
* Drip trays or bunded areas must be designed to contain 110% of the total volume of chemicals to be stored in the bunded area/ drip tray.
* Chemical storage areas must have a roof constructed over it, wherever possible, in order to prevent rain water ingress which would result in unnecessary contaminated waste water requiring disposal.
* Smaller spillages within the drip tray must be cleaned up immediately when they occur, utilising the emergency spill kit.
* Drip trays must be used when taking chemical containers out of the storage area to be used on site.
* Drip trays must be used when re-fuelling and under plant and machinery that are known to be leaking oil.
* Drip trays are to be used when doing any maintenance work on vehicles or plant and equipment.
* Drip trays should be emptied into a holding tank and returned to the supplier or disposed of as hazardous waste.
* Servicing of plant should take place off site at a proper workshop with an impermeable concrete floor.
* Spill kits should be on-hand to deal with spills immediately. Construction workers responsible for refuelling must be trained on the handling of spill kits.
* An emergency response plan to address spillages should be developed, implemented and communicated to all staff.
* All construction vehicles should be inspected for oil and fuel leaks regularly and frequently.
* Should maintenance or emergency repairs of plant and vehicles need to be done on site then drip trays must be used to trap and contain any hydrocarbon spillages.
* Contaminated materials and waste must be disposed of at a registered hazardous waste disposal site and records of waste safe disposal certificates must be kept.
* Regular site inspections to be conducted in order to identify areas of concern with regards to surface and ground water related impacts. Such incidents must be reported to the ECO and attended to as soon as possible.
 | **NEGLIGIBLE (8)** |
|  |  |  | * Hazardous substances such as paint, cement, fuels or detergents shall be stored in sealed, lockable containers when not in use.
* Any spillages occurring must be cleaned up as soon as possible with the use of spill kits and disposed of at a registered waste disposal facility, along with implementation of the necessary remedial actions. Spill remains must be disposed of at a registered hazardous waste disposal site as soon as possible.
* Refuelling of plant and machinery must take place with the use of a drip tray, in order to avoid any spillages during refuelling.
* Any significant spills or pollution of ground and surface water resources should be reported to the Department of Water Affairs as soon as possible.
 |  |
| **10** | **IMPACT ON SURFACE WATER QUALITY** Improper waste disposal and lack of waste management controls may result in surface water pollution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 2 | 18 |
| WM | 3 | 4 | 2 | 1 | 9 |

 | **NEGLIGIBLE (18)** | * Ablution facilities may not be situated closer than 100m from water courses including drainage lines.
* All chemicals and hazardous substances must be stored in bunded areas or drip trays outside of 100 meters of any water course or drainage lines.
* Waste must be placed in waste receptacles immediately upon being generated, and all waste must be disposed of at a licensed waste treatment facility according to the waste types.
* Safe disposal certificates must be obtained from the relevant services providers for all waste removed on site, including but not limited to sewerage, general and hazardous waste.
 | **NEGLIGIBLE (9)** |
| **11** | **IMPACT ON GROUND WATER QUALITY** Improper waste disposal and lack of waste management controls may result in ground water pollution.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 2 | 18 |
| WM | 3 | 4 | 2 | 1 | 9 |

 | **NEGLIGIBLE (18)** | * Sufficient ablution facilities shall be provided. 1 portable toilet for every 15 employees will be available on site.
* A contractor shall be appointed to empty temporary ablution facilities on a regular basis in order to avoid spillages.
* Should portable toilets be used on site the sewage must be disposed of at a licensed waste water treatment facility (sewage works), and a letter stating that sewage from the site may be and is being disposed of at the facility must be obtained and kept on site.
* SDC’s must be obtained and kept on file on site as proof of proper disposal.
 | **NEGLIGIBLE (9)** |
| **12** | **IMPACT ON SURFACE WATER QUANTITY**Depleting water reserves and reducing the quantity of water available for downstream users.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 6 | 4 | 48 |
| WM | 3 | 3 | 2 | 2 | 16 |

 | **MODERATE (48)** | * Abstraction of water for construction and operational activities may only take place from approved sources.
* All water uses on site must comply with the provisions of the National Water Act (Act 36 of 1998).
 | **NEGLIGIBLE (16)** |
| **13** | **POLLUTION DUE TO WASTE**Poor waste management might have a negative impact on surrounding water resources, ecological resources and soil.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 6 | 4 | 52 |
| WM | 3 | 4 | 6 | 1 | 13 |

 | **MODERATE (52)** | * A sufficient number of waste bins and skips shall be provided on site in order to manage waste effectively. These bins and skips shall be placed in strategic points around the site.
* Waste separation shall be implemented according to the different types of waste generated. General waste and hazardous waste must not be mixed together.
* Waste to be removed from site regularly and disposed of at a registered waste disposal site. Safe waste disposal certificates must be obtained and kept on record.
* Burning of waste on site is prohibited.
* Littering is prohibited.
* An integrated waste management approach must be implemented on site meaning that waste must be reduced, recycled and re-used as far as practically possible.
* Waste management must be monitored on a daily basis.
 | **NEGLIGIBLE (13)** |
| **14** | **VISUAL IMPACT** Visual Impact to surrounding areas as a result of construction.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 2 | 18 |
| WM | 3 | 4 | 2 | 1 | 9 |

 | **NEGLIGIBILE (18)** | * Keep disturbed areas to a minimum.
* No clearing of land to take place outside the demarcated footprint.
* Only indigenous plant species to be introduced and planted in an organic manner and location which would not cast shadows on the PV panels.
* Utilise existing roads and tracks to the extent possible.
 | **NEGLIGIBILE (9)** |
| **15** | **IMPACT ON SENSE OF PLACE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 2 | 4 | 36 |
| WM | 2 | 5 | 2 | 2 | 18 |

 | **LOW (36)** | * Keep disturbed areas to a minimum.
* No clearing of land to take place outside the demarcated footprint.
* Only indigenous plant species to be introduced and planted in an organic manner and location which would not cast shadows on the PV ‘strings’.
* Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits.
* Utilise existing roads and tracks as far as possible.
 | **NEGLIGIBILE (18)** |
| **16** | **VISUAL IMPACT OF LIGHTING**Lighting installed for security or night operations may impact on the surrounding areas.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 4 | 6 | 2 | 24 |
| WM | 1 | 4 | 2 | 2 | 14 |

 | **LOW (24)** | * Outdoor lighting must be strictly controlled so as to prevent light pollution.
* All lighting must be installed at downward angles.
* Sources of light must as far as possible be shielded by physical barriers.
* Consider the application of motion detectors to allow the application of lighting only where and when it is required.
* Only minimum wattage light fixtures must be used.
 | **NEGLIBIBLE(14)** |
| **17** | **VISUAL IMPACT OF REFLECTION AND GLARE**The Solar panels may create a reflection or a glare.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 4 | 6 | 2 | 24 |
| WM | 2 | 4 | 2 | 1 | 8 |

 | **LOW (24)** | * Install all steel structures and columns at right angles to the sun.
* Prevent the use of reflective steel columns and structures in the designs.
* The steel components within the substation should not be painted but be galvanised and allowed to oxidise naturally over time. The grey colour produced in this process will help to reduce the visual impact.
 | **NEGLIBIBLE (8)** |
| **18** | **NOISE**Potential noise impact associated with the noise generated during the construction phase.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 3 | 6 | 4 | 44 |
| WM | 2 | 3 | 2 | 4 | 28 |

 | **MODERATE (44)** | * Construction activities must be restricted to between 7h00 and 17h00.
* All activities on site, as well as construction vehicles and machinery must comply with National Noise Legislation, Provincial Noise Regulations and Local Noise By-laws.
* Appropriate silencing measures must be taken should noise levels exceed 85 decibels at the perimeter of the construction area.
* Playing of loud music on site will not be permitted.
 | **LOW (28)** |
| **19** | **ARCHAEOLOGICAL LOSS / LOSS OF HERITAGE RESOURCES**Possible loss of heritage sites or artefacts of archaeological importance. An Archaeological impact assessment was done, and it was found that no heritage resources occur on the site, and the desktop study also found that heritage or paleontological resources were very unlikely to occur in the region. However, heritage resources such as graves may still be found once excavations of earthworks commence and mitigation measures must therefore be implemented should there be any findings.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 5 | 6 | 1 | 13 |

 | **LOW (26)** | * Should any archaeological artefacts or remains be exposed during excavation, work shall cease immediately and the Environmental Control Officer shall be notified and this must also be reported to the Provincial Heritage Authority and specialist.
* A qualified archaeologist must verify the importance of the remains before construction activities continues and decide on the way forward.
* No archaeological artefacts shall be disturbed or removed from site prior to the necessary consultation with the regulatory authorities and permits required.
* Contractors should be briefed on the nature of possible heritage remains in the area prior to the commencement of construction activities.
* Construction activities should be in line with the provisions of the National Heritage Resources Act (Act 25 of 1999).
 | **NEGLIGIBLE (13)** |
| **20** | **TRAFFIC**Traffic impact will be low to negligible as construction plant and vehicles will not be travelling on public roads, apart from delivering and collecting plant and equipment before and after construction which is not expected to significantly affect traffic flow.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 4 | 36 |
| WM | 3 | 1 | 2 | 2 | 12 |

 | **LOW (36)** | * Construction and delivery vehicles must avoid moving around during periods of peak traffic as far as possible.
* Contractors and construction personnel must adhere to traffic rules at all times, including prescribed speeding limits.
* Access and entry points must be situated strategically in order to have a minimal impact on existing traffic volumes.
* Construction vehicles must make use of existing access roads as far as possible.
* All vehicles shall be roadworthy.
* Repair damage to construction access roads within 24 hours of its identification; and
* Access and haul roads shall be clearly demarcated and vehicle movement confined to the demarcated areas only.
* Large trucks or delivery vehicles with heavy loads should travel outside of peak traffic times.
 | **NEGLIGIBLE (12)** |
| **21** | **AIR QUALITY**Construction activities might increase the levels of ambient dust to the surrounding areas during the construction phase. However it is anticipated that this will only be temporary.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 3 | 6 | 4 | 44 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **MODERATE (44)** | * Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
* No water may be sourced from a watercourse for dust suppression or any other construction activities without the required approval.
* A speed limit (preferably 40 km/hour) should be enforced on dirt roads.
* Activities on site must be in line with the provisions of the National Environmental Management Air Quality Act (Act No. 39 of 2004).
* No open fires will be allowed on site and burning of waste is prohibited.
* Disturbed areas must be rehabilitated as fast as possible in order to reduce dust from exposed soil surfaces.
* Complaints received from interested and affected parties must be logged in the I&AP register and attended to appropriately and as soon as possible.
* Control of waste to minimize odour’s and gasses.
* Control of hazardous substances to minimize gasses and odours.
 | **NEGLIGIBLE (14)** |
| **22** | **SAFETY, SECURITY AND FIRE HAZARDS*** Construction personnel on site may contribute to an increase in the risk for fires and crime in the area.
* The influx of construction personnel during the construction period might have an impact on the general safety in the areas, however due to the extent of the planned project it is not anticipated that there will be a significant impact, as the amount of construction personnel will be minimal.
* Open trenches or excavations might have an impact on safety during the construction phase.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 6 | 4 | 48 |
| WM | 3 | 3 | 6 | 1 | 12 |

 | **MODERATE (48)** | * Construction personnel will not be allowed to sleep over on the site, unless it is agreed upon and communicated to the surrounding land owners.
* No open fires will be allowed on site.
* Activities on site shall be according to the provisions of the Occupational Health and Safety Act, 1993 (Act No.85 of 1993) and the National Building Regulations.
* Warning and demarcation signs must be used in order to prevent pedestrians from entering the construction site, open trenches, laydown areas etc.
* Access control should be enforced should it be deemed necessary.
* Construction vehicles should be under the control of competent, trained and experienced personnel.
* The relevant emergency and contact numbers to be visible on site in case of an emergency situation.
* Regular site inspections to be conducted in order to identify areas of concern with regards to safety and fire hazards.
* Open man holes, open excavations and trenches shall either be closed or demarcated with the necessary warning signs.
 | **NEGLIGIBLE (12)** |
| **23** | **LOSS OF AGRICULTURAL LAND**The proposed site is located on land used, until recently, for agricultural activities and there will be a loss of agricultural land, the impact can therefore not be prevented, only reduced.The preferred alternative will use less agricultural land than the alternative layout design and therefore the impact will be less.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 1 | 4 | 2 | 5 | 35 |
| WM | 1 | 4 | 2 | 5 | 35 |

 | **LOW (35)** | * The solar farm will be an offset to improve the power generation capacity of the farm which will be used to increase economically viable crop production.
* Corridors should be secured around the solar development footprint areas to ensure the current land use (crop production) can continue in a functional way.
* All development activities should be restricted to specific recommended areas and strict buffer zones should be applied around the sensitive areas such as water courses and drainage lines. The Environmental Control Officer (ECO) should demarcate and control these areas. Unnecessary bulldozing through the crop fields should be avoided. Storage of road-building equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries.
* The site must be clearly demarcated prior to the commencement of construction so as to ensure that no unnecessary disturbances occur to areas outside of the predetermined site footprint.
* Existing access routes must be utilised as far as possible and any vehicles or plant may only utilise predetermined and approved haul routes
 | **LOW (35)** |
| **24** | **SOCIO-ECONOMIC**Temporary employment opportunities will be created during the construction phase of the project which will have a positive socio-economic impact.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 2 | 16 |
| WM | 3 | 3 | 6 | 4 | 48 |

 | **NEGLIGIBLE (16)****(POSITIVE)** | * Locally based contractors and service providers should be utilised for the project in order to encourage local economic growth.
* Where possible the contractor should involve local communities in order to provide them with training and skills development.
* Unskilled work must be sourced from the local communities as far as possible.
 | **MODERATE (48)****(POSITIVE)** |
|  | **Indirect Impacts:** |
|  | **NONE** |  |  |  |
|  | **Cumulative Impacts:** |
| **1** | **SURFACE AND GROUND WATER POLLUTION**Surface water and ground water may become contaminated as a result of sediment laden storm water entering into water resources, or as a result of any chemicals, especially oils entering into these water systems as a result of negligence and lack of planning. This can compound the problem of water pollution in the region.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 6 | 4 | 52 |
| WM | 3 | 4 | 6 | 1 | 13 |

 | **MODERATE (52)** | * A storm water management plan must be developed and implemented and should include erosion control measures.
* Hazardous chemical substances must be provided with and stored and used with secondary containments such as bunded areas or drip trays at all times so as to contain any leakages or accidental spillages of the HCS and thereby reducing the risk of soil and water pollution.
* Hazardous chemical substances and ablution facilities may not be stored near any drainage line or close to any body of water and should be tied down to prevent them from falling or being blown over.
* A spill kit must be available on site.
* An emergency spill response plan should be developed and communicated to the staff on site.
 | **NEGLIGIBLE (13)** |

**TABLE 6: IMPACTS ANTICIPATED DURING THE OPERATIONAL PHASE OF THE PROPOSED ACTIVITY (PREFERRED LAYOUT DESIGN ALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM**  |
|  | **Direct Impacts:** |
| **1** | **WATER RESOURCE DEPLETION**Impact on the quantity of natural water resources as a result of water abstraction.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 4 | 32 |
| WM | 3 | 3 | 2 | 2 | 16 |

 | **LOW (32)** | * Water may only be sourced from permitted sources.
 | **NEGLIGIBLE (16)** |
| **2** | **ENVIRONMENTAL DEGRADATION**Waste which may be generated from the operational phase would mainly consist of broken solar panels.Contamination of soil may occur as a result of poor waste management**.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 6 | 2 | 28 |
| WM | 3 | 5 | 6 | 1 | 14 |

 | **LOW (28)** | * Waste generated during the operational phase of the activity shall be disposed of as soon as possible at a licensed waste disposal site.
 | **NEGLIGIBLE (14)** |
| **3** | **LOSS OF BIODIVERSITY**Fauna on the site might be killed or trapped by individuals for various reasons (fear, pets, negligence etc.)Weeds, alien vegetation and pioneer plant species may propagate in disturbed areas and spread to the surrounding habitat, thereby taking over natural vegetation and altering the habitat.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **LOW (26)** | * No animals may be trapped or killed.
* Should an animal pose a nuisance the local authorities should be contacted to remove the animal from the site.
* Weeds and alien vegetation must be controlled, eradication of these species must be undertaken on an on-going basis.
 | **NEGLIGIBLE (14)** |
| **4** | **LOSS OF HABITAT**The lower vegetation layer underneath the solar panels and the servitudes will have to be cleared (slashed) of excess vegetation at regular intervals in order to allow access to the area for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the solar panels and power line conductors and to minimize the risk of fire which can result in electrical flashovers. These activities have an impact on birds and other small animals breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **LOW (26)** | * Landscape management at the site needs to consider different objectives, including:
* Maintaining pre-existing land uses;
* Conserving and restoring natural habitats; and
* Managing land for priority species.
* Hunting of birdlife should be prohibited on site.
* Facilitating post-construction monitoring. For best results, vegetation management should be carefully planned in advance and recorded within the project’s Environmental Management Plan.
 | **NEGLIGIBLE (14)** |
| **5** | **COLLISIONS WITH SOLAR PANELS**Solar installations often feature areas of reflective panelling. Any vertical, reflective surfaces may confuse approaching birds with the result that numbers are disorientated and displaced from the area, or else killed in collisions with such surfaces. Other bird species may seek to benefit from the solar installations, using the erected structures as prominent perches, sheltered roost sites or even nesting or foraging sites. Such scenarios might be associated with fouling of critical components in the solar array, bringing local bird populations into conflict with the facility operators.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 1 | 4 | 6 | 2 | 22 |
| WM | 1 | 4 | 6 | 1 | 11 |

 | **LOW (22)** | * Preconstruction Monitoring needed to determine the presence of Threatened, Rare, Endemic or Range Restricted bird species.
* Should birds collide with the solar panels, efforts should be made to restrict access by birds into the relevant, hazardous areas of the facility.
* Land management practices should not attract raptors or other species vulnerable to collision. Structures should be designed to reduce the availability of perching sites.
* Baseline monitoring could be implemented on the avifauna during the construction and operational phases of the solar plant if required, although due to the low probability of red data species occurring in the area, this would only be considered necessary should any bird mortalities occur after construction has ceased.
 | **NEGLIGIBLE (11)** |
| **6** | **LOSS OF TOPSOIL**Erosion may occur should storm water not be adequately managed.Soils may become compacted.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 2 | 2 | 18 |

 | **MODERATE (52)** | * Institute a storm water management plan including strategies such as:
1. Minimising impervious area;
2. Increasing infiltration to soil by use of recharge areas;
3. Use of natural vegetated swales instead of pipes or;
4. Installing detention or retention facilities with graduated outlet control structures.
5. Vegetation must be allowed to grow under the solar panels and anywhere where there are exposed soil surfaces;
6. Diversion berms must be implemented where necessary to divert or slow surface water run-off; and
7. Stone pitching should be used in any drainage channels in order to reduce speed of flow.
* Sensitive soils with high risk of compaction (e.g. clayey soils) must be avoided by vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
* Have a permanent erosion control plan to focus on the establishment of stable native vegetation communities.
 | **NEGLIGIBLE (18)** |
| **7** | **SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **MODERATE (52)** | * Develop and implement an alien invasive plant species eradication programme.
* Ensure that weeds and alien invasive plant species are removed and destroyed on a regular basis, preferably on a monthly basis.
 | **NEGLIGIBLE (14)** |
| **8** | **SOCIO-ECONOMIC**Temporary employment opportunities will be created during the operational phase of the project which will have a positive socio-economic impact.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 1 | 2 | 2 | 12 |
| WM | 3 | 1 | 6 | 4 | 40 |

  | **NEGLIGIBLE (12)****(POSITIVE)** | * Locally based contractors and service providers should be utilised for the project in order to encourage local economic growth.
* Where possible the contractor should involve local communities in order to provide them with training and skills development.
* Unskilled work must be sourced from the local communities as far as possible.
 | **MODERATE (40)****(POSITIVE)** |
|  | **Indirect Impacts:** |
|  | **NONE** |  |  |  |
|  | **Cumulative Impacts:** |
| **1** | **IMPACT ON AVIFAUNA**The cumulative negative impact of the development on the fauna has the potential to be moderate. However, considering the following general mitigation and management actions taken on site during construction, the impact on avifauna populations should be low. As the preferred layout design alternative will not involve any overhead power lines, the impact on avifauna will be less.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 3 | 2 | 4 | 36 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **LOW (36)** | * Where trenches pose a risk to bird safety, they should be adequately cordoned off to prevent ground-living birds falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process.
* No birds may be poached during the construction of the solar plant or power line developments. Many birds are protected by law and poaching or other interference could result in a fine or jail term.
* Do not feed any birds on site.
* The occurrence of the vulture species will be influenced by the availability of carcasses and adequate roosting and nesting sites on the property. Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the vulture species as well as other birds of prey occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from a Registered Pest Control Officer.
* Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum during the constructional and operational phases. Monitoring of specific bird species is necessary to ensure that these species would be unaffected over the longer term by the development. Information on red data species should be provided to construction workers to make them more aware of these fauna and their behaviour.
 | **NEGLIGIBLE (14)** |

**TABLE 7: IMPACTS ANTICIPATED DURING THE DECOMMISSIONING AND CLOSURE PHASE OF THE PROPOSED ACTIVITY (PREFERRED LAYOUT DESIGN ALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM**  |
|  | **Direct Impacts** |
| **1** | **SOIL, GROUND WATER AND SURFACE WATER CONTAMINATION.**Waste generated during the decommissioning phase if not properly disposed of could produce soil ground water or surface water contamination.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 6 | 4 | 52 |
| WM | 3 | 4 | 6 | 1 | 13 |

 | **MODERATE (52)** | * A sufficient number of waste bins and skips shall be provided on site in order to manage waste effectively. These bins and skips shall be placed in strategic points around the site.
* Waste separation shall be implemented according to the different types of waste generated. This will include building waste (sand, rock, concrete, building rubble, General waste and hazardous waste. etc.),
* Waste to be removed from site and disposed of at a Licenced waste disposal facility.
* Safe disposal certificates must be obtained and kept on record.
* Burning of waste is prohibited.
* No waste may be buried, nor dumped at unauthorised locations or dump sites.
* An integrated waste management approach must be implemented on site meaning that waste must be reduced, recycled and re-used as far as practically possible.
* Waste management must be monitored on a daily basis.
 | **NEGLIGIBLE (13)** |
| **2** | **LOSS OF BIODIVERSITY**Following clearance of the site, should the site not be properly rehabilitated, then weeds and alien invasive plants would propagate and spread to surrounding areas, thereby altering plant communities and taking over/ out competing indigenous species.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 5 | 65 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **HIGH (65)** | * Rehabilitation of the site must take place.
* Rehabilitation of the site must ensure that the site is returned to its original state or better.
* The site must blend in with the natural surroundings.
* Rehabilitation progress must be monitored frequently to identify any inadequacies.
* Any rehabilitation inadequacies must be corrected.
* Weeds and alien invasive plants must be controlled.
 | **NEGLIGIBLE (14)** |
| **3** | **EROSION / LOSS OF SOIL**Should following decommissioning and removal of structures from the site be completed, exposed soils surfaces will be exposed to erosive forces.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 1 | 5 | 6 | 4 | 48 |
| WM | 1 | 3 | 2 | 1 | 6 |

 | **MODERATE (48)** | * Storm water must be managed on the site during the decommissioning phase.
* Natural vegetation which is indigenous to the area must be encouraged to grow on exposed soil surfaces as soon as possible during the decommissioning phase.
 | **NEGLIGIBLE (6)** |
| **4** | **SOCIO-ECONOMIC JOB CREATION & EMPLOYMENT OPPORTUNITIES**During the decommissioning phase, labour from the local community or local contractors and re-cycling companies should be employed during the decommissioning phase.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 2 | 16 |
| WM | 3 | 3 | 6 | 5 | 60 |

 | **NEGLIGIBLE (16)****(POSITIVE)** | * Labour from the local community or local contractors and re-cycling companies should be employed during the decommissioning phase.
 | **HIGH (60)****(POSITIVE)** |
|  | **Indirect Impacts** |
|  | NONE |  |  |  |
|  | **Cumulative Impacts** |
| **1** | **LOSS OF BIODIVERSITY**Increased volumes of waste going to landfill, together with waste from other activities results in the need for more landfill space, and new areas need to be cleared of vegetation for new waste disposal landfill sites.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 6 | 4 | 56 |
| WM | 3 | 5 | 2 | 2 | 20 |

 | **MODERATE (56)** | * As much waste as possible must be recycled and re-used.
* Steel, solar panels and concrete can all be re-cycled or re-used.
 | **LOW (20)** |

**ALTERNATIVE S2 (Layout design Alternative)**

**TABLE 8: IMPACTS ANTICIPATED DURING THE PLANNING AND DESIGN PHASE OF THE PROPOSED ACTIVITY (LAYOUT DESIGN ALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM** |
|  | **Direct Impacts:** |
|  | No direct impacts are anticipated. |  |  |  |
|  | **Indirect Impacts:** |
|  | No indirect impacts are anticipated. |  |  |  |
|  | **Cumulative Impacts:** |
| **1** | **WATER RESOURCE DEPLETION:**Water is used to grow trees from which paper is used, therefore wasting paper results in an increase in water consumption.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 4 | 32 |
| WM | 3 | 3 | 2 | 2 | 16 |

 | **LOW (32)** | * Plans and drawings must rather be communicated electronically prior to finalisation of the design plans/ drawings in order to ensure all details are correct prior to printing, this will ensure that no re-prints are required and will save paper.
* Any waste paper should be recycled.
 | **NEGLIGBLE (16)** |
| **2** | **LOSS OF HABITAT/ BIODIVERSITY**Materials used in the planning and design phase, especially paper used for the printing of drawings and design plans might be used wastefully, resulting in an increased volume of waste going to landfill, thereby increasing the area of land needed for landfill space.Natural resources used for the development could result in loss of habitats (e.g. mining for minerals).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 2 | 4 | 40 |
| WM | 3 | 5 | 2 | 2 | 20 |

 | **MODERATE (40)** | * Plans and drawings must rather be communicated electronically prior to finalisation of the design plans/ drawings in order to ensure all details are correct prior to printing, this will ensure that no re-prints are required and will save paper.
* All waste paper should be recycled.
* Identify environmentally friendly technologies, processes and materials in the design of the development.
 | **LOW (20)** |
| **3** | **GLOBAL WARMING**Means of travel for meetings results in carbon emissions, thus contributing towards global warming.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 4 | 36 |
| WM | 3 | 4 | 2 | 2 | 18 |

 | **LOW (36)** | * Travel for meetings should be limited as far as possible. Communication via telephone and email should be encouraged over physical meetings.
 | **NEGLIGIBLE (18)** |
| **4** | **JOB CREATION (POSITIVE IMPACT)**The development has the potential to provide new job opportunities and this opportunity should be maximised as far as possible.

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|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 2 | 16 |
| WM | 3 | 3 | 6 | 4 | 48 |

 | **NEGLIGIBLE (16)****(POSITIVE)** | * Identify and employ local contractors, suppliers and services as far as reasonably possible.
* Ensure that employees are recruited from the local communities as far as possible.
 | **MODERATE (48)****(POSITIVE)** |

**TABLE 9: IMPACTS ANTICIPATED DURING THE CONSTRUCTION PHASE OF THE PROPOSED ACTIVITY (LAYOUT DESIGN ALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM** |
|  | **Direct Impacts:** |
| **1** | **LOSS OF FLORA BIODIVERSITY & HABITAT DESTRUCTION OR MODIFICATION**This impact is rated as low to negligible due to degraded/ modified state of the natural environment. Three vegetation units were identified on the site by the specialist:1. Cultivated land with zero sensitivity and only a few pioneer grasses and exotic weeds;
2. Degraded grassland with a low sensitivity;
3. The artificial stormwater canals representing degraded areas with a medium to low sensitivity with limited ecosystem and hydrological functionalities.

This impact assesses the impact on flora species on site as a result of a loss of biodiversity and habitat through clearing of natural vegetation for the site and servitudes.This impact will be higher for the alternative as this layout design does not include a buffer area between the site footprint and the drainage line (artificial temporary wetland). The rating would also be higher due to the pylons for the overhead power line, one of which will be located in the wetland zone and also due to the road which would’ve been constructed over the artificial wetland.

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|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 6 | 2 | 26 |

 | **MODERATE (52)** | * An important aspect relating to the proposed development should be to protect and manage the biodiversity (structure and species composition) of the Central Sandy Bushveld vegetation type which are represented in the project area. The following general management measures and guidelines should be implemented:
* All development activities should be restricted to specific recommended areas and should be approved by the ECO.
* Vegetation removal should be kept to a minimum; the construction footprint and laydown areas must be clearly demarcated prior to the commencement of de-bushing in order to avoid unnecessary damage to vegetation.
* The few taller than 3m indigenous trees along the proposed powerline servitude provide resting/perching sites for larger birds like vultures, birds of prey, arboreal reptiles and mammals that might occur/pass through the area and should preferably be preserved. These larger trees should be protected as far as possible and be incorporated as part of the landscaping of future development in the area.
* Construction vehicles and plant must not be allowed to operate outside of the site boundary and designated access routes.
* Construction vehicles must be restricted to using existing roads and access routes as far as practically possible in order to reduce the impact on natural vegetation.
* The collection of firewood or plants for medicinal purposes is prohibited, unless they have specifically been earmarked for removal for construction purposes.
* Training must be given to all employees of contractors, sub-contractors and service providers who will be operating on site in order to ensure that all employees know their roles and responsibilities in managing the environmental impact.
* A rehabilitation plan should be developed and implemented as part of the solar plant and power line developments.
 | **LOW (26)** |
| **2** | **LOSS OF FAUNA BIODIVERSITY & HABITAT** Negative impact on fauna species on site as a result of a loss of habitat through clearing of natural vegetation for the development and through irresponsible behaviour of individuals.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 2 | 4 | 36 |

 | **MODERATE (52)** | * The construction footprint and laydown areas must be clearly demarcated prior to the commencement of de-bushing in order to avoid unnecessary damage to vegetation.
* The few taller than 3m indigenous trees along the proposed powerline servitude provide resting/perching sites for larger birds like vultures, birds of prey, arboreal reptiles and mammals that might occur/pass through the area and should preferably be preserved. These larger trees should be protected as far as possible and be incorporated as part of the landscaping of future development in the area.
* Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
* Construction vehicles and plant must not be allowed to operate outside of the site boundary and designated access routes.
* Construction vehicles must be restricted to using existing roads and access routes as far as practically possible in order to reduce the impact on natural vegetation and possible disturbances to fauna.
* Any animal species found on the site must be relocated to an area of safety and released into natural habitat.
* No animals may be injured or killed purposefully or through negligence.
* No animals may be trapped or kept as pets.
* Hunting of animals is prohibited.
* Should any sensitive faunal species be observed which might be impacted on, the ECO must be informed immediately in order to deal with it timeously.
* Training must be given to all employees of contractors, sub-contractors and service providers who will be operating on site in order to ensure that all employees know their roles and responsibilities in managing the environmental impact.
 | **LOW (36)** |
| **3** | **LOSS OF AVIFAUNAL BIODIVERSITY**Overhead power lines and associated infrastructure such as substations are known to impact significantly on various bird species, both directly through causing mortality of birds, and indirectly through disturbance of birds and destruction of habitats.This impact is rated higher than the preferred alternative due to the overhead power line associated with the alternative layout design plan.

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| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 6 | 2 | 26 |

 | **MODERATE (52)** | * The taller (>3m) indigenous trees within this area also provide resting/perching sites for larger birds like vultures and birds of prey might occur/pass through the area and, other than the proposed footprint area for the development, should preferably be preserved. These larger trees should be protected as far as possible and be incorporated into the proposed energy development. A monitoring programme needs to be implemented by a specialist if any rare species are confirmed on the property.
* The removal of vegetation should only occur on the footprint area of the development. The clearing and damage of plant growth in these areas should be restricted to the footprint way leave area.
* Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area.
* Monitoring should be implemented during the construction phase of the PV Power Plant to ensure that minimal impact is caused to the fauna of the area. The impact of power line and specific placement of the poles should be restricted to the proposed line.
* Construction of the power line close to existing power lines should to a certain extent eliminate the need for new access roads and gates etc. This would reduce the level of disturbance and habitat destruction. In addition, birds in the immediate vicinity of the existing power line would already be relatively tolerant of disturbance as a result of maintenance activities on the already established lines.
* Landscape management at the site needs to consider different objectives, including
* Maintaining pre-existing land uses;
* Conserving and restoring natural habitats;
* Managing land for priority species; and
* Hunting of birdlife should be prohibited on site.
* Facilitating post-construction monitoring. For best results, vegetation management should be carefully planned in advance and recorded within the project’s Environmental Management
 | **LOW (26)** |
| **4** | **IMPACT ON AVIFAUNA MOVEMENTS** **Disturbance through human activities, noise and fires:**Construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. An increase in human activity on the site and surrounding areas is anticipated, especially during the construction phase of the power line. Birds will move out of the area during construction activities as a result of noise disturbance. The presence of a large number of construction workers or regular workers during the construction phase on site over a protracted period will result in a greatly increased risk of uncontrolled fires which might cause loss of bird diversity when ground-living birds are killed in the fires or their nests destroyed.

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| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 3 | 6 | 5 | 55 |
| WM | 2 | 3 | 2 | 5 | 35 |

 | **MODERATE (55)** | * Care should always be taken to disturb the receiving environment as little as possible. Careful control of construction workers movements must be maintained at all times.
* Staff that will stay on site should be accommodated in one location of the site to ensure that the impact will be minimal on the larger area.
* Construction activities must remain within defined construction areas as per the layout plan. No construction / disturbance will occur outside these areas.
* Construction activities must be restricted to working hours Monday to Saturday, unless otherwise approved by the appropriate competent person in consultation with the affected residents.
* Educate workers regarding the occurrence of important resources in the area and the importance of protection.
* Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g. courtship, nesting) seasons. In addition, control pets to avoid harassment and disturbance of wildlife.
* Camp fires at construction sites must be strictly controlled to ensure that no veld fires are caused.
* Noise levels will be kept within acceptable limits by limiting the speed of vehicles.
* Compliance with appropriate noise legislation must take place.
 | **LOW (35)** |
| **5** | **LOSS OF BIODIVERSITY AND NATURAL HABITAT**Potential negative impact on fauna and flora species as a result of poor waste management.

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| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 1 | 6 | 4 | 40 |
| WM | 3 | 1 | 6 | 1 | 10 |

 | **MODERAATE (40)** | * Waste must be placed in waste bins as soon as waste is generated on the site.
* No littering or uncontained waste will be allowed on site.
* Hazardous waste such as waste contaminated with hazardous chemical substances must be placed in bins specifically provided for hazardous waste only.
* Toilets must be provided on site at a ratio of no less than 1 per 15 persons.
* General waste must be disposed of at a licensed waste landfill facility.
* Hazardous waste must be disposed of at a licensed hazardous waste treatment facility.
* Sewage must be disposed of at a licensed waste water treatment facility, and a letter stating that sewage from the site or sewage collected by the toilet servicing company may be and is being disposed of at the facility.
* Should chemical toilets be used on site they must be emptied regularly to ensure that toilets do not overflow.
* Safe disposal certificates must be obtained for all waste streams and must be kept on file on site as proof of proper disposal (in accordance with the National Environmental Management Waste Act (Act 36 of 1998).
 | **NEGLIGIBLE (10)** |
| **6** | **HABITAT FRAGMENTATION**The development will have a relatively small impact on the natural movement patterns and fragmentation of avifauna habitats. Such impacts would however be temporary in the solar plant site.

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|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 5 | 2 | 2 | 18 |

 | **LOW (26)** | * Use existing facilities (e.g., access roads) to the extent possible to minimize the amount of new disturbance.
* Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. All possible efforts must be made to ensure as little disturbance as possible to sensitive bird habitats during construction.
* During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
* Construction activities must remain within defined construction areas and the road servitudes. No construction / disturbance will occur outside these areas.
 | **NEGLIGIBLE (18)** |
| **7** | **SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES**Potential negative impact on fauna and flora species as a result of lack of control of weeds and alien invasive vegetation.

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|  | S | D | M | P | S |
| WOM | 3 | 5 | 6 | 5 | 70 |
| WM | 3 | 5 | 6 | 2 | 28 |

 | **HIGH (70)** | * Weeds and alien vegetation must not be allowed to propagate on the site.
* Weeds and alien invasive vegetation must be eradicated prior to the plants coming into flower, in order to prevent them from spreading over the site and invading/ taking over the surrounding natural vegetation in the area.
* All Category 1 declared weeds, as well as other species which can invade natural vegetation, must be removed on an on-going basis. The contractor must liaise with the ECO for further guidance in this regard.
* Institute a monitoring and eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.
* Rehabilitate and re-vegetate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish
 | **LOW (28)** |
| **8** | **LOSS OF AND DAMAGE TO TOPSOIL*** Potential impact on soil as a result of vegetation clearance and poor waste management.
* Potential impact on topsoil as a result of poor stockpiling and management.
* Loss of topsoil as a result of erosion.
* Disturbance of soils (Soil compaction, erosion and crusting).
* Sterilisation of soil (soil stripping).
* Soil contamination due to fuel or oil spillages from vehicles during the construction phase of the solar plant.
* Loss of current and potential agricultural land.

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|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 6 | 2 | 26 |

 | **MODERATE (52)** | * Vegetation clearance must be kept to a minimum in order to minimise erosion during rainy periods.
* Soil should be handled when dry during removal and placement to reduce the risk of compaction.
* Maintain topsoil stockpiles in a weed free condition.
* Topsoil should not be compacted in any way, nor should any object be placed or stockpiled upon it.
* Stockpile topsoil for the minimum time period possible i.e. strip just before the relevant activity commences and replace as soon as it is completed.
* The project should be divided into as many phases as possible, to ensure that the exposed areas prone to erosion are minimal at any specific time.
* Topsoil shall be stockpiled outside of drainage lines or storm water trenches and stockpiles shall not exceed 2.0 meters in height.
* Topsoil and subsoil must be stockpiled separately.
* Topsoil stockpiles must be protected from water and wind erosion through adequate mitigation measures such as vegetation cover, berms or silt traps to trap sediment run-off, and watering during periods of high winds, etc.
* Avoid stripping of topsoil and subsoil during periods of high wind.
* Rehabilitate plant cover as a continual process, to maximize viability of the natural seedbank and reduce loss of topsoil during storage so as to prevent dust and loss of topsoil.
* Monitor rehabilitation success by comparing data from the servitude with that of surrounding habitats.
* No waste shall be permanently stored or buried on site.
* Storm water must be managed in order to prevent erosion.
 | **LOW (26)** |
|  |  |  | * The main objective of the development in terms of the hydrological regime of stormwater should be to control stormwater on site. An engineer should address this in a detailed stormwater management plan. A small buffer of 5 meters should be implemented to ensure the integrity of the stormwater canal is kept intact, refer to the sensitivity map and the layout plan.
* Oil and fuel spillages must be cleaned up immediately along with the necessary remediation actions.
* A storm water management plan should be developed and implemented in order to ensure effective storm water management and erosion control.
* Earthen berms or sand bags, should be used to create a barrier at the upslope side of the site or any exposed embankments or slopes to prevent storm water from flowing down the slopes and thereby preventing erosion.
* Earthen berms or sand bags or silt fences can also be put in place at the down-slope side of exposed slopes or embankments to trap sediment run-off.
* Exposed soil surfaces should be protected, especially on sloped gradients.
* G5 Material can be spread over the ground, especially in the site camp.
* No storm water shall flow through waste storage areas.
* Diversion berms should be constructed in order to divert any storm water away from batching areas, waste storage areas and workshops where applicable.
* Disturbed areas must be rehabilitated as soon as possible in order to prevent erosion and loss of topsoil.
* In the event of erosion occurring, the contractor must commence with remedial action as soon as possible.
* During construction, sensitive soils with high risk of compaction (e.g. clayey soils) must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place
* Have both temporary (during construction) and permanent erosion control plans.
* Temporary control plans should include: 1. Short term seeding or mulching of exposed soil areas (particularly on slopes); 2. Limitations on access for heavy machinery and the storage of materials to avoid soil compaction.
* Permanent erosion control plans should focus on the establishment of stable native vegetation communities.
 |  |
| **9** | **SOIL POLLUTION**Possible contamination of soil during the construction phase, due to inadequate storage and handling of hazardous substances.

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|  | S | D | M | P | S |
| WOM | 1 | 4 | 6 | 4 | 44 |
| WM | 1 | 1 | 6 | 1 | 8 |

 | **MODERATE (44)** | * Hazardous chemical substances must be kept either in a bunded area or in drip trays during both storage and when being used on site so as to prevent soil contamination should the container be knocked over or be leaking.
* Drip trays or bunded areas must be designed to contain 110% of the total volume of chemicals to be stored in the bunded area/ drip tray.
* Chemical storage areas must have a roof constructed over it, wherever possible, in order to prevent rain water ingress which would result in unnecessary contaminated waste water requiring disposal.
* Smaller spillages within the drip tray must be cleaned up immediately that they occur, utilising the emergency spill kit.
* Drip trays must be used when taking chemical containers out of the storage area to be used on site.
* Drip trays must be used when re-fuelling and under plant and machinery that are known to be leaking oil.
* Drip trays are to be used when doing any maintenance work on vehicles or plant and equipment.
* Drip trays should be emptied into a holding tank and returned to the supplier or dispos of as hazardous waste.
* Servicing of plant should take place off site at a proper workshop with an impermeable concrete floor.
* Spill kits should be on-hand to deal with spills immediately.
* An emergency response plan to address spillages should be developed, implemented and communicated to all staff
* All construction vehicles should be inspected for oil and fuel leaks regularly and frequently.
* Should maintenance or emergency repairs of plant and vehicles need to be done on site then drip trays must be used to trap and contain any hydrocarbon spillages.
* Contaminated materials and waste must be disposed of at a licensed hazardous waste treatment facility and records of waste safe disposal certificates must be kept.
* Regular site inspections to be conducted in order to identify areas of concern with regards to surface and ground water related impacts. Such incidents must be reported to the ECO and attended to as soon as possible.
 | **NEGLIGIBLE (8)** |
|  |  |  | * Hazardous substances such as paint, cement, fuels or detergents shall be stored in sealed, lockable containers when not in use.
* Construction workers responsible for refuelling must be trained on the handling of spill kits.
* Any spillages occurring must be cleaned up as soon as possible with the use of spill kits and disposed of at a registered waste disposal facility, along with implementation of the necessary remedial actions. Spill remains must be disposed of at a registered hazardous waste disposal site as soon as possible.
* Refuelling of plant and machinery must take place with the use of a drip tray, in order to avoid any spillages during refuelling.
* Any significant spills or pollution of ground and surface water resources should be reported to the Department of Water Affairs as soon as possible.
 |  |
| **10** | **IMPACT ON SURFACE WATER QUALITY** Improper waste disposal and lack of waste management controls may result in surface water pollution.The risk for the alternative will be higher than that of the preferred alternative as the alternative layout design has no buffer zone from the artificial wetland.

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|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 4 | 36 |
| WM | 3 | 4 | 2 | 2 | 18 |

 | **LOW (36)** | * Ablution facilities may not be situated closer than 100m from water sources.
* All chemicals and hazardous substances must be stored in bunded areas or drip trays outside of 100 meters of any water course or drainage lines.
* Waste must be placed in waste receptacles immediately upon being generated, and all waste must be disposed of at a licensed waste treatment facility according to the waste types.
* Safe disposal certificates must be obtained from the relevant services providers for all waste removed on site, including but not limited to sewerage, general and hazardous waste.
 | **NEGLIGIBLE (18)** |
| **11** | **IMPACT ON GROUND WATER QUALITY** Improper waste disposal and lack of waste management controls may result in ground water pollution.

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|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 2 | 18 |
| WM | 3 | 4 | 2 | 1 | 9 |

 | **NEGLIGIBLE (18)** | * Sufficient ablution facilities shall be provided. 1 portable toilet for every 15 employees will be available on site.
* A contractor shall be appointed to empty temporary ablution facilities on a regular basis in order to avoid spillages.
* Should portable toilets be used on site the sewage must be disposed of at a licensed waste water treatment facility (sewage works), and a letter stating that sewage from the site may be and is being disposed of at the facility must be obtained and kept on site.
* Safe disposal certificates must be obtained and kept on file on site as proof of proper disposal.
 | **NEGLIGIBLE (9)** |
| **12** | **IMPACT ON SURFACE WATER QUANTITY**Depleting water reserves and reducing the quantity of water available for downstream users.

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|  | S | D | M | P | S |
| WOM | 3 | 3 | 6 | 4 | 48 |
| WM | 3 | 3 | 2 | 2 | 16 |

 | **MODERATE (48)** | * Water may only be extracted from approved sources.
* All water uses on site must comply with the provisions of the National Water Act (Act 36 of 1998).
 | **NEGLIGIBLE (16)** |
| **13** | **POLLUTION DUE TO WASTE**Poor waste management might have a negative impact on surrounding water resources, ecological resources and soil.

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|  | S | D | M | P | S |
| WOM | 3 | 4 | 6 | 4 | 52 |
| WM | 3 | 4 | 6 | 1 | 13 |

 | **MODERATE (52)** | * A sufficient number of waste bins and skips shall be provided on site in order to manage waste effectively. These bins and skips shall be placed in strategic points around the site.
* Waste separation shall be implemented according to the different types of waste generated. This will include building waste (sand, rock, concrete, building rubble etc.), General waste and hazardous waste.
* Waste to be removed from site regularly and disposed of at a Licenced waste disposal facility. Safe waste disposal certificates must be obtained and kept on record.
* Burning of waste on site is prohibited.
* Littering is prohibited.
* An integrated waste management approach must be implemented on site meaning that waste must be reduced, recycled and re-used as far as practically possible.
* Waste management must be monitored on a daily basis.
 | **NEGLIGIBLE (13)** |
| **14** | **VISUAL IMPACT** Visual Impact to surrounding areas as a result of construction.

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|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 2 | 18 |
| WM | 3 | 4 | 2 | 1 | 9 |

 | **NEGLIGIBILE (18)** | * Keep disturbed areas to a minimum.
* No clearing of land to take place outside the demarcated footprint.
* Only indigenous plant species to be introduced and planted in an organic manner and location which would not cast shadows on the PV panels.
* Utilise existing roads and tracks to the extent possible.
 | **NEGLIGIBILE (9)** |
| **15** | **IMPACT ON SENSE OF PLACE**The alterative layout would have a greater impact on the sense of place due to the overhead power line.

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|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 6 | 2 | 26 |

 | **MODERATE (52)** | * Keep disturbed areas to a minimum.
* No clearing of land to take place outside the demarcated footprint.
* Only indigenous plant species to be introduced and planted in an organic manner and location which would not cast shadows on the PV ‘strings’.
* Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits.
* Utilise existing roads and tracks as far as possible.
 | **LOW (26)** |
| **16** | **VISUAL IMPACT OF LIGHTING**Lighting installed for security or night operations may impact on the surrounding areas.

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|  | S | D | M | P | S |
| WOM | 2 | 4 | 6 | 2 | 24 |
| WM | 1 | 4 | 2 | 2 | 14 |

 | **LOW (24)** | * Outdoor lighting must be strictly controlled so as to prevent light pollution.
* All lighting must be installed at downward angles.
* Sources of light must as far as possible be shielded by physical barriers.
* Consider the application of motion detectors to allow the application of lighting only where and when it is required.
* Only minimum wattage light fixtures must be used.
 | **NEGLIBIBLE(14)** |
| **17** | **VISUAL IMPACT OF THE POWER LINE**The power line would alter the sense of place.

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|  | S | D | M | P | S |
| WOM | 2 | 4 | 2 | 4 | 32 |
| WM | 2 | 4 | 2 | 4 | 32 |

 | **LOW (32)** | * No mitigation measures possible
 | **LOW (32)** |
| **18** | **VISUAL IMPACT OF REFLECTION AND GLARE**The Solar panels may create a reflection or a glare.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 4 | 6 | 2 | 24 |
| WM | 2 | 4 | 2 | 1 | 8 |

 | **LOW (24)** | * Install all steel structures and columns at right angles to the sun.
* Prevent the use of reflective steel columns and structures in the designs.
* The steel components within the substation should not be painted but be galvanised and allowed to oxidise naturally over time. The grey colour produced in this process will help to reduce the visual impact.
 | **NEGLIBIBLE (8)** |
| **19** | **NOISE**Potential noise impact associated with the noise generated during the construction phase.

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|  | S | D | M | P | S |
| WOM | 2 | 3 | 6 | 4 | 44 |
| WM | 2 | 3 | 2 | 4 | 28 |

 | **MODERATE (44)** | * Construction activities must be restricted to between 7h00 and 17h00.
* All activities on site, as well as construction vehicles and machinery must comply with National Noise Legislation, Provincial Noise Regulations and Local Noise By-laws.
* Appropriate silencing measures must be taken should noise levels exceed 85 decibels at the perimeter of the construction area.
* Playing of loud music on site will not be permitted.
 | **LOW (28)** |
| **20** | **ARCHAEOLOGICAL LOSS / LOSS OF HERITAGE RESOURCES**Possible loss of heritage sites or artefacts of archaeological importance. An Archaeological impact assessment was done, and it was found that no heritage resources occur on the site, and the desktop study also found that heritage or paleontological resources were very unlikely to occur in the region. However, heritage resources such as graves may still be found once excavations of earthworks commence and mitigation measures must therefore be implemented should there be any findings.

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|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 5 | 6 | 1 | 13 |

 | **LOW (26)** | * Should any archaeological artefacts or remains be exposed during excavation, work shall cease immediately and the Environmental Control Officer shall be notified and this must also be reported to the Provincial Heritage Authority and specialist.
* A qualified archaeologist must verify the importance of the remains before construction activities continues and decide on the way forward.
* No archaeological artefacts shall be disturbed or removed from site prior to the necessary consultation with the regulatory authorities and permits required.
* Contractors should be briefed on the nature of possible heritage remains in the area prior to the commencement of construction activities.
* Construction activities should be in line with the provisions of the National Heritage Resources Act (Act 25 of 1999).
 | **NEGLIGIBLE (13)** |
| **21** | **TRAFFIC**Traffic impact will be negligible as construction plant will not be travelling on public roads, apart from delivery and return of the construction vehicles before and after construction is completed.

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|  | S | D | M | P | S |
| WOM | 3 | 4 | 2 | 4 | 36 |
| WM | 3 | 1 | 2 | 2 | 12 |

 | **LOW (36)** | * Construction and delivery vehicles must avoid moving around during periods of peak traffic as far as possible.
* Contractors and construction personnel must adhere to traffic rules at all times, including prescribed speeding limits.
* Access and entry points must be situated strategically in order to have a minimal impact on existing traffic volumes.
* Construction vehicles must make use of existing access roads as far as possible.
* All vehicles shall be roadworthy.
* Repair damage to construction access roads within 24 hours of its identification; and
* Access and haul roads shall be clearly demarcated and vehicle movement confined to the demarcated areas only.
 | **NEGLIGIBLE (12)** |
| **22** | **AIR QUALITY**Construction activities might increase the levels of ambient dust to the surrounding areas during the construction phase. However it is anticipated that this will only be temporary.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 3 | 6 | 4 | 44 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **MODERATE (44)** | * Implement standard dust control measures, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
* No water may be sourced from a watercourse for dust suppression or any other construction activities without the required approval.
* A speed limit (preferably 40 km/hour) should be enforced on dirt road.
* Activities on site must be in line with the provisions of the National Environmental Management Air Quality Act (Act No. 39 of 2004).
* No open fires will be allowed on site and burning of waste is prohibited.
* Disturbed areas must be rehabilitated as fast as possible in order to reduce dust from exposed soil surfaces.
* Complaints received from interested and affected parties must be logged in the I&AP register and attended to appropriately and as soon as possible.
* Control of waste to minimize odour’s and gasses.
* Control of hazardous substances to minimize gasses and odours.
 | **NEGLIGIBLE (14)** |
| **23** | **SAFETY, SECURITY AND FIRE HAZARDS*** Construction personnel on site may contribute to an increase in the risk for fires and crime in the area.
* The influx of construction personnel during the construction period might have an impact on the general safety in the areas, however due to the extent of the planned project it is not anticipated that there will be a significant impact, as the amount of construction personnel will be minimal.
* Open trenches or excavations might have an impact on safety during the construction phase.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 6 | 4 | 48 |
| WM | 3 | 3 | 6 | 1 | 12 |

 | **MODERATE (48)** | * Construction personnel will not be allowed to sleep over on the site, unless it is agreed upon and communicated to the surrounding land owners.
* No open fires will be allowed on site.
* Activities on site shall be according to the provisions of the Occupational Health and Safety Act, 1993 (Act No.85 of 1993) and the National Building Regulations.
* Warning and demarcation signs must be used in order to prevent pedestrians from entering the construction site, open trenches, laydown areas etc. Access control should be enforced should it be deemed necessary.
* Construction vehicles should be under the control of competent, trained and experienced personnel.
* The relevant emergency and contact numbers to be visible on site in case of an emergency situation.
* Regular site inspections to be conducted in order to identify areas of concern with regards to safety and fire hazards.
* Open man holes, open excavations and trenches shall either be closed or demarcated with the necessary warning signs.
 | **NEGLIGIBLE (12)** |
| **24** | **LOSS OF AGRICULTURAL LAND**The proposed site is located on land used, until recently, for agricultural activities and there will be a loss of agricultural land, the impact can therefore not be prevented, only reduced.The preferred alternative will use less agricultural land than the alternative layout design and therefore the impact will be less.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 1 | 4 | 2 | 5 | 35 |
| WM | 1 | 4 | 2 | 5 | 35 |

 | **LOW (35)** | * The solar farm will be an offset to improve the power generation capacity of the farm which will be used to increase economically viable crop production.
* Corridors should be secured around the solar development footprint areas to ensure the current land use (crop production) can continue in a functional way.
* All development activities should be restricted to specific recommended areas and strict buffer zones should be applied around the sensitive areas such as water courses and drainage lines. The Environmental Control Officer (ECO) should demarcate and control these areas. Unnecessary bulldozing through the crop fields should be avoided. Storage of road-building equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries.
* The site must be clearly demarcated prior to the commencement of construction so as to ensure that no unnecessary disturbances occur to areas outside of the predetermined site footprint.
* Existing access routes must be utilised as far as possible and any vehicles or plant may only utilise predetermined and approved haul routes
 | **LOW (35)** |
| **25** | **SOCIO-ECONOMIC**Temporary employment opportunities will be created during the construction phase of the project which will have a positive socio-economic impact.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 2 | 16 |
| WM | 3 | 3 | 6 | 4 | 48 |

 | **NEGLIGIBLE (16)****(POSITIVE)** | * Locally based contractors and service providers should be utilised for the project in order to encourage local economic growth.
* Where possible the contractor should involve local communities in order to provide them with training and skills development.
* Unskilled work must be sourced from the local communities as far as possible.
 | **MODERATE (48)****(POSITIVE)** |
|  | **Indirect Impacts:** |
|  | **NONE** |  |  |  |
|  | **Cumulative Impacts:** |
| **1** | **SURFACE AND GROUND WATER POLLUTION**Surface water and ground water may become contaminated as a result of sediment laden storm water entering into water resources, or as a result of any chemicals, especially oils entering into these water systems as a result of negligence and lack of planning. This can compound the problem of water pollution in the region.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 6 | 4 | 52 |
| WM | 3 | 4 | 6 | 1 | 13 |

 | **MODERATE (52)** | * A storm water management plan must be developed and implemented and should include erosion control measures.
* Hazardous chemical substances must be provided with and stored and used with secondary containments such as bunded areas or drip trays at all times so as to contain any leakages or accidental spillages of the HCS and thereby reducing the risk of soil and water pollution.
* HCS’s and ablution facilities may not be stored near any drainage line or close to any body of water.
* A spill kit must be available on site.
* An emergency spill response plan should be developed and communicated to the staff on site.
 | **NEGLIGIBLE (13)** |

**TABLE 10: IMPACTS ANTICIPATED DURING THE OPERATIONAL PHASE OF THE PROPOSED ACTIVITY (LAYOUT DESIGN ALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM**  |
|  | **Direct Impacts:** |
| **1** | **WATER RESOURCE DEPLETION**Impact on the quantity of natural water resources as a result of water abstraction.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 4 | 32 |
| WM | 3 | 3 | 2 | 2 | 16 |

 | **LOW (32)** | * Water may only be sourced from permitted sources.
 | **NEGLIGIBLE (16)** |
| **2** | **ENVIRONMENTAL DEGRADATION**Waste which may be generated from the operational phase would mainly consist of broken solar panels.Contamination of soil as a result of poor waste management**.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 6 | 2 | 28 |
| WM | 3 | 5 | 6 | 1 | 14 |

 | **LOW (28)** | * Waste generated during the operational phase of the activity shall be disposed of as soon as possible at a licensed waste disposal site.
 | **NEGLIGIBLE (14)** |
| **3** | **LOSS OF BIODIVERSITY**Fauna on the site might be killed or trapped by individuals for various reasons (fear, pets, negligence etc.)Weeds, alien vegetation and pioneer plant species may propagate in disturbed areas and spread to the surrounding habitat, thereby taking over natural vegetation and altering the habitat.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **LOW (26)** | * No animals may be trapped or killed.
* Should an animal pose a nuisance the local authorities should be contacted to remove the animal from the site.
* Weeds and alien vegetation must be controlled, eradication of these species must be undertaken on an on-going basis.
 | **NEGLIGIBLE (14)** |
| **4** | **LOSS OF HABITAT**The lower vegetation layer underneath the solar panels and the servitudes will have to be cleared (slashed) of excess vegetation at regular intervals in order to allow access to the area for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the solar panels and power line conductors and to minimize the risk of fire which can result in electrical flashovers. These activities have an impact on birds and other small animals breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 2 | 26 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **LOW (26)** | * Landscape management at the site needs to consider different objectives, including:
* Maintaining pre-existing land uses;
* Conserving and restoring natural habitats; and
* Managing land for priority species.
* Hunting of birdlife should be prohibited on site.
* Facilitating post-construction monitoring. For best results, vegetation management should be carefully planned in advance and recorded within the project’s Environmental Management Plan.
 | **NEGLIGIBLE (14)** |
| **5** | **ELECTROCUTIONS**According to the Avifauna Specialist Report, electrocution on the proposed power line is improbable given the adequate clearances and will only apply during the operational phase of the proposed development.The risk rating will be higher for the alternative layout design due to the overhead power line which will be installed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 6 | 2 | 26 |

 | **MODERATE (52)** | * Power line structures can present electrocution hazards to birds when less than adequate separation exist between energized conductors or between energized conductors and grounded conductors. Avian-safe facilities can be provided by one or more of the following mitigation measures as stipulated by Prinsen et al. (2011):
* Increasing separation between abovementioned conductors to achieve adequate separation for the species involved (larger birds, raptors). To mitigate for bird electrocution, distances between electric conductors (or phases) and distances between conductors and grounded hardware should be separated over a larger distance than the wrist-to-wrist or head-to-foot distance of a bird. When the power line is located within the distribution area of large raptors or species such as cranes in the study area, this distance should be increased to 1.4 m (or even 1.8 m in the case of vultures). Because dry feathers provide insulation, the distance between fleshy parts, such as skin, feet or bill, is generally the critical factor to determine if a power line construction is safe for perching birds. Note, however, that wet bird feathers provide less insulation, therefore, in wet climates safe distances between energised parts should be based on wingspan and toe-to-wing tip distances of the largest perching protected species in the area.
* Applying perch managing techniques such as conspicuous objects and support roosting sites along the power line that would allow large raptors and bustards to safely roost. An “avian-safe” power pole is a configuration designed to minimise bird electrocution risk by providing sufficient separation between energised phase conductors (also-called ‘phases’) and between phases and grounded hardware to accommodate at least the wrist-to-wrist or head-to-foot distance of a bird. Cross-arms, insulators and other parts of the power lines can be constructed so that there is no space for birds to perch where they can be proximate to energised wires. This happens often by exclusion devices, or perch discouragers, but often these cause even more problems than benefits. Because the birds still try to perch on the constructions and the space is even more limited, birds have a higher chance to contact the energised wires. There has been considerable success achieved by providing artificial bird safe perches and nesting platforms which are placed at a safe distance from the energised parts (Bayle, 1999; Goudie, 2006).
 | **LOW (26)** |
| **6** | **COLLISIONS WITH POWER LINES OR SOLAR PANELS**Solar installations often feature large areas of reflective panelling. Any vertical, reflective surfaces may confuse approaching birds with the result that numbers are disorientated and displaced from the area, or else killed in collisions with such surfaces. Other bird species may seek to benefit from the solar installations, using the erected structures as prominent perches, sheltered roost sites or even nesting or foraging sites. Such scenarios might be associated with fouling of critical components in the solar array, bringing local bird populations into conflict with the facility operators.The risk rating will be higher for the alternative layout design due to the overhead power line which will be installed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 1 | 4 | 6 | 4 | 44 |
| WM | 1 | 4 | 6 | 2 | 22 |

 | **MODERATE (44)** | * Preconstruction Monitoring needed to determine the presence of Threatened, Rare, Endemic or Range Restricted bird species.
* Should birds collide with the solar panels, efforts should be made to restrict access by birds into the relevant, hazardous areas of the facility.
* Land management practices should not attract raptors or other species vulnerable to collision. Structures should be designed to reduce the availability of perching sites.
* Ensure that sites are close to existing power lines, so that few new lines are required.
* The impact of collision of birds is partially mitigated for by placing new infrastructure close to existing lines for the following reasons:
1. The more overhead power lines and other associated infrastructure there are together, the more visible they would be to the birds in the area (Avian Power Line Interaction Committee - 1994).
2. Resident birds in an area become accustomed to a power line that crosses their flight paths, and learn to avoid it during their everyday activities. Hence adding a new connection line adjacent to existing lines would probably have less impact than putting it in a totally new area, where the resident birds are not yet accustomed to overhead power lines.
* Specialist advice should be sought in devising effective avian deterrents to minimize associated damage.
* The high risk sections of line should be marked with suitable anti-collision marking devices on the earth wire as per the Eskom guidelines. Since the assumption is that birds collide with overhead cables because they cannot see them, fitting the cables with devices in order to make them more visible to birds in flight has become the preferred mitigation option worldwide. Besides thickening, coating or colouring the often least visible thin ground wires, a wide range of potential ‘line marking’ devices has evolved over the years, including: spheres, swinging plates, spiral vibration dampers, strips, swan flight diverters, Firefly Bird Flight Diverters, bird flappers, aerial marker spheres, ribbons, tapes, flags, fishing floats, aviation balls and crossed bands. The design and technical aspects of using devices on the power line should consider the following:
 | **LOW (22)** |
|  |  |  | 1. Line markers should be as large as possible, and increase the visible thickness of the line by at least 20 cm, for a length of at least 10-20cm;
2. Spacing of devices should be not more than 5-10 m apart;
3. Line markers should incorporate as much contrast with relevant backgrounds as possible;
4. Colour is probably less important than contrast;
5. Movement of the device is likely to be important;
6. Markers that protrude vertically both above and below the cable are likely important;
7. Since we suspect that many collisions may occur at night, devices that are nocturnally visible (through illumination, ultraviolet radiation and other means) would be advantageous. Although bearing in mind what is known about birds being attracted to illuminated objects; and
8. Line design: Although different bird species fly at different heights above the ground, there is general consensus that the lower power line cables are to the ground, the better for preventing bird collision. There is also consensus that less vertical separation of cables is preferred as it poses less of an ‘obstacle’ for birds to collide with. Horizontal separation of conductors is therefore preferred.
 |  |
| **7** | **LOSS OF TOPSOIL**Erosion may occur should storm water not be adequately managed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 5 | 2 | 2 | 18 |

 | **MODERATE (52)** | * Institute a storm water management plan including strategies such as:
1. Minimising impervious area;
2. Increasing infiltration to soil by use of recharge areas;
3. Use of natural vegetated swales instead of pipes or;
4. Installing detention or retention facilities with graduated outlet control structures.
5. Vegetation must be allowed to grow under the solar panels and anywhere where there are exposed soil surfaces;
6. Diversion berms must be implemented where necessary to divert or slow surface water run-off; and
7. Stone pitching should be used in any drainage channels in order to reduce speed of flow.
* Sensitive soils with high risk of compaction (e.g. clayey soils) must be avoided by vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.
* Have a permanent erosion control plan to focus on the establishment of stable native vegetation communities.
 | **NEGLIGIBLE (18)** |
| **8** | **SPREAD AND ESTABLISHMENT OF ALIEN INVASIVE SPECIES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 4 | 52 |
| WM | 2 | 3 | 2 | 2 | 14 |

 | **MODERATE (52)** | * Develop and implement an alien invasive plant species eradication programme.
* Ensure that weeds and alien invasive plant species are removed and destroyed on a regular basis, preferably on a monthly basis.
 | **NEGLIGIBLE (14)** |
| **9** | **SOCIO-ECONOMIC**Temporary employment opportunities will be created during the operational phase of the project which will have a positive socio-economic impact.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 1 | 2 | 2 | 12 |
| WM | 3 | 1 | 6 | 4 | 40 |

 | **NEGLIGIBLE (12)****(POSITIVE)** | * Locally based contractors and service providers should be utilised for the project in order to encourage local economic growth.
* Where possible the contractor should involve local communities in order to provide them with training and skills development.
* Unskilled work must be sourced from the local communities as far as possible.
 | **MODERATE (40)****(POSITIVE)** |
|  | **Indirect Impacts:** |
|  | NONE |  |  |  |
|  |  |  |  |  |
|  | **Cumulative Impacts:** |
| **1** | **IMPACT ON AVIFAUNA**The cumulative negative impact of the development on the fauna has the potential to be moderate. However, considering the following general mitigation and management actions taken on site during construction, the impact on avifauna populations should be low.The risk rating will be higher for the alternative layout design due to the overhead power line which will be installed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 6 | 4 | 48 |
| WM | 3 | 3 | 6 | 2 | 24 |

 | **MODERATE (48)** | * Where trenches pose a risk to bird safety, they should be adequately cordoned off to prevent ground-living birds falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction process.
* No birds may be poached during the construction of the solar plant or power line developments. Many birds are protected by law and poaching or other interference could result in a fine or jail term.
* Do not feed any birds on site.
* The occurrence of the vulture species will be influenced by the availability of carcasses and adequate roosting and nesting sites on the property. Poisons for the control of problem animals should rather be avoided since the wrong use thereof can have disastrous consequences for the vulture species as well as other birds of prey occurring in the area. The use of poisons for the control of rats, mice or other vermin should only be used after approval from a Registered Pest Control Officer.
* The habitat and feeding grounds of the water birds would be on the peripheral areas of the wetlands and dams in the area which will be unaffected.
* Monitoring of the environmental aspects should be done over the longer term to ensure that impacts are limited to a minimum during the constructional and operational phases. Monitoring of specific bird species is necessary to ensure that these species would be unaffected over the longer term by the development. Information on red data species should be provided to construction workers to make them more aware of these fauna and their behaviour.
 | **LOW (24)** |

**TABLE 11: IMPACTS ANTICIPATED DURING THE DECOMMISSIONING AND CLOSURE PHASE OF THE PROPOSED ACTIVITY (LAYOUT DESIGNALTERNATIVE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM**  |
|  | **Direct Impacts** |
| **1** | **SOIL, GROUND WATER AND SURFACE WATER CONTAMINATION.**Waste generated during the decommissioning phase if not properly disposed of could produce soil ground water or surface water contamination.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 4 | 6 | 4 | 52 |
| WM | 3 | 4 | 6 | 1 | 13 |

 | **MODERATE (52)** | * A sufficient number of waste bins and skips shall be provided on site in order to manage waste effectively. These bins and skips shall be placed in strategic points around the site.
* Waste separation shall be implemented according to the different types of waste generated. This will include building waste (sand, rock, concrete, building rubble etc.), General waste and hazardous waste.
* Waste to be removed from site and disposed of at a Licenced waste disposal facility. Safe waste disposal certificates must be obtained and kept on record.
* Burning of waste is prohibited.
* No waste may be buried, nor dumped at unauthorised locations or dump sites.
* An integrated waste management approach must be implemented on site meaning that waste must be reduced, recycled and re-used as far as practically possible.
* Waste management must be monitored on a daily basis.
 | **NEGLIGIBLE (13)** |
| **2** | **LOSS OF BIODIVERSITY**Following clearance of the site, should the site not be properly rehabilitated, then weeds and alien invasive plants would propagate and spread to surrounding areas, thereby altering plant communities and taking over/ out competing indigenous species.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 5 | 6 | 5 | 65 |
| WM | 2 | 3 | 6 | 2 | 22 |

 | **HIGH (65)** | * Rehabilitation of the site must take place.
* Rehabilitation of the site must ensure that the site is returned to its original state or better.
* The site must blend in with the natural surroundings.
* Rehabilitation progress must be monitored frequently to identify any inadequacies.
* Any rehabilitation inadequacies must be corrected.
 | **LOW (22)** |
| **3** | **EROSION / LOSS OF SOIL**Should following decommissioning and removal of structures from the site be completed, exposed soils surfaces will be exposed to erosive forces. This rating will be slightly higher for the alternative due to the associated pylons for the alternative’s overhead power line.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 1 | 5 | 6 | 4 | 48 |
| WM | 1 | 5 | 6 | 2 | 24 |

 | **MODERATE (48)** | * Storm water must be managed on the site during the decommissioning phase.
* Natural vegetation which is indigenous to the area must be encouraged to grow on exposed soil surfaces as soon as possible during the decommissioning phase.
 | **LOW (24)** |
| **4** | **SOCIO-ECONOMIC JOB CREATION & EMPLOYMENT OPPORTUNITIES**During the decommissioning phase, labour from the local community or local contractors and re-cycling companies can be employed during the decommissioning phase.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 3 | 2 | 2 | 16 |
| WM | 3 | 3 | 6 | 5 | 60 |

 | **NEGLIGIBLE (16)****(POSITIVE)** | * Labour from the local community or local contractors and re-cycling companies can be employed during the decommissioning phase.
 | **HIGH (60)****(POSITIVE)** |
|  | **Indirect Impacts** |
|  | NONE |  |  |  |
|  | **Cumulative Impacts** |
| **1** | **LOSS OF BIODIVERSITY**Increased volumes of waste going to landfill, together with waste from other activities results in the need for more landfill space, and new areas need to be cleared of vegetation for new waste disposal landfill sites.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 6 | 4 | 56 |
| WM | 3 | 5 | 2 | 2 | 20 |

 | **MODERATE (56)** | * As much waste as possible must be recycled and re-used.
* Steel, solar panels and concrete can all be re-cycled or re-used.
 | **LOW (20)** |

**ALTERNATIVE S3 NO-GO ALTERNATIVE**

**TABLE 12: IMPACTS ANTICIPATED DURING FOR THE NO-GO ALTERNATIVE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Potential impacts** | **Impact Significance WOM** | **Mitigation measures** | **Impact Significance WM** |
|  | **Direct Impacts:** |
| 1 | **PROTECTION OF AGRICULTURAL LAND (POSITIVE IMPACT)**Should the development not go ahead, the land will continue to be used for agricultural purposes.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 2 | 4 | 2 | 2 | 16 |
| WM | 2 | 4 | 2 | 4 | 32 |

 | **NEGLIGIBLE (16) (POSITIVE)** | * Should the proposed activity not go ahead, then the site should continue to be used for agricultural activities.
 | **LOW (32)** |
|  | **Indirect Impacts:** |
| **1** | **LOSS OF JOBS/ INCREASED LEVEL OF UNEMPLOYMENT**Due to the energy crisis and load shedding in South Africa the farm may become un-economically viable and a reduction in production may result in the farm closing and therefore farm workers would be retrenched and the farm management would also be unemployed.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 8 | 4 | 64 |
| WM | 3 | 5 | 8 | 2 | 32 |

 | **HIGH (64)** | * Construct a solar power station to enable the farm to be self-sufficient.
* Negotiations would need to be made with the electricity supplier in an attempt to reach an agreement to ensure that the farm is not vulnerable to load shedding.
 | **LOW (32)** |
|  | **Cumulative Impacts:** |
| **1** | **REDUCTION IN FOOD SECURITY**Power outages result in lower levels of production, less output from the farm would mean less produce making its way to the market.Should the farm close do to power outages this will negatively affect food supply.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | D | M | P | S |
| WOM | 3 | 5 | 6 | 4 | 56 |
| WM | 3 | 5 | 6 | 2 | 28 |

 | **MODERATE (56)** | * Construct a solar power station to enable the farm to be self-sufficient.
* Negotiations would need to be made with the electricity supplier in an attempt to reach an agreement to ensure that the farm is not vulnerable to load shedding.
 | **LOW (28)** |