ENVIRONMENTAL IMPACT ASSESSMENT

A “significant impact” is defined as it is defined in the EIA Regulations (2014): “an impact that may have a notable effect on one or more aspects of the environment or may result non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as by its duration, magnitude, intensity or probability of occurrence”. The objective of this EIA methodology is to serve as framework for accurately evaluating impacts associated with current or proposed activities in the biophysical, social and socio-economical spheres. It aims to ensure that all legal requirements and environmental considerations are met in order to have a complete and integrated environmental framework for impact evaluations.

1. IMPACT ASSESSMENT METHODOLOGY

The process of determining impacts to be assessed is one of the most important parts of the environmental impact assessment process. It is of such high importance because the environmental impacts identified can and are often linked to the same impact stream.

In this method all impacts on the biophysical environment are assessed in terms of the overall integrity of ecosystems, habitats, populations and individuals affected. The Environmental Impact Assessment (EIA) 2014 Regulations promulgated in terms of Sections 24 (5), 24M and 44 of the National Environmental Management Act (NEMA) (Act No. 107 of 1998) [as amended] requires that all identified potential impacts associated with the proposed project be assessed in terms of their overall potential significance on the natural, social and economic environments.

The criteria identified in the EIA Regulations (2014) include the following:

- Nature of the impact;
- Extent of the impact;
- Duration of the impact;
- Probability of the impact occurring;
- Degree to which impact can be reversed;
- Degree to which impact may cause irreplaceable loss of resources;
- Degree to which the impact can be mitigated; and
- Cumulative impacts.

Greenmined Environmental has developed an impact assessment methodology (as defined below) whereby the significance of a potential impact is determined through the assessment of the relevant temporal and spatial scales determined of the extent, magnitude and duration criteria associated with a particular impact.

This method does not explicitly define each of the criteria but rather combines them and results in an indication of the overall significance.

DEFINITIONS AND CONCEPTS:

Environmental significance:

The concept of significance is at the core of impact identification, evaluation and decision-making. The concept remains largely undefined and there is no international consensus on a single definition. The following common elements are recognised from the various interpretations:

- Environmental significance is a value judgement;
- The degree of environmental significance depends on the nature of the impact;
- The importance is rated in terms of both biophysical and socio-economic values; and
- Determining significance involves the amount of change to the environment perceived to be acceptable to affected communities.

Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of acceptability) (DEAT (2002) Impact Significance, Integrated Environmental Management, Information Series 5).

The concept of risk has two dimensions, namely the consequence of an event or set of circumstances, and the likelihood of particular consequences being realised (Environment Australia (1999) Environmental Risk Management).

1.1. Nature of the impact

The nature of an impact can be defined as “a brief description of the impact being assessed, in terms of the proposed activity or project, including the socio-economic or environmental aspect affected by this impact”.

1.2. Extent of the impact

The extent of an impact can be defined as “a brief description of the spatial influence of the impact or the area that will be affected by the impact”.

Table 1: Determining the extent of an impact

EXTENT Extent or spatial influence of impact	**Footprint**	Only as far as the activity, such as footprint occurring within the total site area
	Site	Only the site and/or 500m radius from the site will be affected
	Local	Local area / district (neighbouring properties, transport routes and adjacent towns) is affected
	Region	Entire region / province is affected
	National	Country is affected

1.3. Severity of the impact

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment.

Table 2: Rating of Severity

Type of criteria	Rating				
	1	**2**	**3**	**4**	**5**
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant/ Harmful	Great/ Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance/ Easily reversible	Low cost to mitigate	Substantial cost to mitigate/ Potential to mitigate impacts/ Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate/ Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

1.4. Duration of the impact

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

Table 3: Rating of Duration

Rating		Description
1	Very Short Term	Up to three months (quarter) after construction
2	Short Term	Three months to one year after construction
3	Medium Term	One year to six years after construction
4	Long Term	Six to ten years after construction
5	Permanent	Beyond ten years after construction

1.5. Probability of the impact occurring

The probability of an impact can be defined as “the estimated chance of the impact happening”. Probability refers to how often the activity or aspect has an impact on the environment.

Table 4: Determining the probability of an impact

PROBABILITY	**1**	Almost never / almost impossible	*Impossible* to occur (0 – 20% probability of occurring)

	2	Very seldom / highly unlikely	*Unlikely* to occur (20 -40% probability of occurring)
	3	Infrequent / unlikely / seldom	*May* occur (40-60% chance of occurring)
	4	Often / regularly / likely / possible	*Likely* to occur (60-80% chance of occurring)
	5	Daily / highly likely / definitely	Will *certainly* occur (80-100% chance of occurring)

1.6. Degree to which impact can be reversed

The reversibility of an impact can be defined as "the ability of an impact to be changed from a state of affecting aspects to a state of not affecting aspects".

Table 5: Determining the reversibility of an impact

REVERSIBILITY	**Reversible**	Impacts can be reversed through the implementation of mitigation measures
	Irreversible	Impacts are permanent and can't be reversed by the implementation of mitigation measures

1.7. Determination of Likelihood:

The irreplaceability (likelihood) of an impact can be defined as "the amount of resources that can/can't be replaced". The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described below and in tables 6 and 7.

1.8. Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2.

Example of calculating Overall Likelihood

Consequence	**Rating**
Duration	Example 4
Probability	Example 2
SUBTOTAL	**6**
TOTAL LIKELIHOOD **(**Subtotal divided by 2)	**3**

1.9. Determination of Overall Environmental Significance:

The environmental significance assessment methodology is based on the following determination:

Environmental Significance = Overall Consequence X Overall Likelihood

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of **LOW**, **LOW-MEDIUM**, **MEDIUM**, **MEDIUM-HIGH** or **HIGH**, as shown in the table below.

Significance or Risk	Low	Low-Medium	Medium	Medium-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

Based on the above, the significance rating scale has been determined as follows:

High	Of the highest order possible within the bounds of impacts which could occur. In the case of negative impacts, there would be no possible mitigation and / or remedial activity to offset the impact at the spatial or time scale for which it was predicted. In the case of positive impacts, there is no real alternative to achieving the benefit.
Medium-High	Impacts of a substantial order. In the case of negative impacts, mitigation and / or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these. In the case of positive impacts, other means of achieving this benefit would be feasible, but these would be more difficult, expensive, time-consuming or some combination of these.
Medium	Impact would be real but not substantial within the bounds of those, which could occur. In the case of negative impacts, mitigation and / or remedial activity would be both feasible and fairly easily possible, in case of positive impacts; other means of achieving these benefits would be about equal in time, cost and effort.
Low-Medium	Impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and / or remedial activity would be either easily achieved of little would be required, or both. In case of positive impacts alternative means for achieving this benefit would likely be easier, cheaper, more effective, less time-consuming, or some combination of these.
Low	Impact would be negligible. In the case of negative impacts, almost no mitigation and or remedial activity would be needed, and any minor steps, which might be needed, would be easy, cheap and simple. In the case of positive impacts, alternative means would almost all likely be better, in one or a number of ways, than this means of achieving the benefit
Insignificant	There would be a no impact at all – not even a very low impact on the system or any of its parts.

1.10. Determination of Overall Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: ***Severity/Intensity, Duration and Extent/Spatial Scale***. Each factor is assigned a rating of 1 to 5, as described in the tables above.

1.11. Degree to which the impact can be mitigated

The degree to which an impact can be mitigated can be defined as “the effect of mitigation measures on the impact and its degree of effectiveness”.

Table 6: Determining the mitigation rating of an impact

MITIGATION RATING	**MITIGATED Degree impact can be mitigated**	High	*Impact 100% mitigated*
		Medium	*Impact >50% mitigated*
		Low	*Impact <50% mitigated*

1.12. Cumulative Impacts

The effect of cumulative impacts can be described as "the effect the combination of past, present and "reasonably foreseeable" future actions have on aspects".

Table 7: Determining the confidence rating of an impact

CUMULATIVE RATING	**CUMULATIVE EFFECTS**	Low	*Minor* cumulative effects
		Medium	*Moderate* cumulative effects
		High	*Significant* cumulative effects

2. The positive and negative impacts that the proposed activity will have on the environment and the community that may be affected.

No other alternative sites needed to be investigated as this is an amendment of the current EMPR.

The site was identified during the assessment phase of the environmental impact assessment (2014 assessment), by the applicant and project team, and was therefore selected as the **preferred alternative** due to the following:

Positive Impacts:

- The mining site offers the mineral sought after;
- The proposed footprint area was previously used for mining therefore very little indigenous vegetation needs to be disturbed in order to establish the mining area;
- The site is located within neighbouring sand mines, and will minimally affect the community with regards to dust and noise;
- The mineral to be mined is already in sand form and will not need to be blasted in order to loosen the material;
- The mining area can be reached by an existing farm access road that connects to Vaal Eden-Barrage road. No new road infrastructure need to be constructed;
- Due to the small size of the activity and the remote location of the mining area the potential impacts on the surrounding environment, associated with mining is deemed to be of low significance; and
- No residual waste as a result of the mining activity will be produced that needs to be treated on site. Any general waste that may be produced on-site will be contained in sealed refuse bins to be

transported to the local municipal landfill site (Parys). The amount of hazardous waste to be produced at the site will be minimal and will mainly be as a result of accidental leakage. Contaminated soil will be removed to the depth of the spillage and contained in sealed bins until removed from site by a hazardous waste handling contractor to be disposed of at a registered hazardous waste handling site.

Negative Impacts:

- Due to the remote location of the mining area very little negative impacts on the community could be identified that were deemed to be of significant importance. The dust and noise impacts that may emanate from the mining area during the operational phase could have a negative impact on the surrounding community if the mitigation measures proposed in this document is not implemented and managed on-site; and
- Negative impacts with regard to the environment include potential contamination of the area due to spillage of hydrocarbon products.

The land is currently under cultivated grazing and mixed farming. Two farm houses, a barn and outbuildings are currently present on site. These buildings will not be impacted by mining and are situated in the exclusion zones on the mining plan.

Table 8: Impact Assessment of Tja Naledi-Barrage Bulk Sand Mine

Nature of Impact	Impact	Positive/Negative / Neutral Impact	Reversibility	Extent	Severity	Duration	Consequence	Probability	Likelihood	Significance	Mitigation Rating	Mitigation	EMP Section
CONSTRUCTION AND OPERATIONAL PHASES													
ACTIVITY: Utilization of haul and access roads within the mining right area													
ACTIVITY: Creation of opencast pits													
SUB ACTIVITY: Truck and heavy machinery operations													
SUB-ACTIVITY: Soil stockpiling &/ or berm construction													
SUB ACTIVITY: Compaction and grading of roads													
SUB ACTIVITY: Removal of sand, aggregate and alluvial diamonds													
SUB ACTIVITY: Removal of grassland and vegetation for site preparation													
Geology	Disturbance of geological strata	Neg	Irreversible	1	3	5	3	5	5	15	Low	None.	Part B 1) d) (2) (a)
Soils	Potential for loss of soil & damage to soil characteristics	Neg	Reversible	1	3	4	3	2	3	9	High	• Ensure activities occur only within the designated areas and stockpile and revegetated soil as soon as possible. • Topsoil will be removed before mining activities commence and stored outside of the active mining cell.	Part B 1) d) (2) (a)
Soils	Potential for erosion, loss of soil characteristics, compaction of soil & soil degradation through stockpiling	Neg	Reversible	1	3	2	3	2	2	6	High	• The necessary measures will be put in place to limit erosion form the stockpiles and to divert storm water away from the stockpiles. • Re-vegetate any bare soil immediately. • Herbaceous plant mater should be stockpiled to retain organic content of soil. • Stockpiles should be to the specifications of the pedological study.	Part B 1) d) (2) (a)

Nature of Impact	Impact	Positive/Negative / Neutral Impact	Reversibility	Extent	Severity	Duration	Consequence	Probability	Likelihood	Significance	Mitigation Rating	Mitigation	EMP Section
Flora	Loss of biodiversity	Neg	Reversible	1	4	2	4	2	2	8	High	• topsoil will be removed before mining operations commence. • restoring of topsoil during rehabilitation would encourage natural re-vegetation of the area. • re-vegetation with indigenous seeds would be done if it is necessary. • Ensure permits are obtained to remove protected species. • Relocate all protected species with aid of specialists. • Only remove species in areas designated for activity and do not disturb surrounding areas.	Part B 1) d) (2) (b)
Flora	Alien invasive encroachment	Neg	Reversible	1	2	2	2	2	2	4	High	• Eradicate and control all alien invasive species on site. • Rehabilitate and revegetated all areas where alien invasive species were removed. • A weed control plan that would consist of removing the weeds by hand on a monthly basis as well as chemical control, where herbicides would be used to combat weeds.	Part B 1) d) (2) (b)
Topography	Alteration of topography	Neg	Irreversible	1	2	5	2	2	3.5	7	Low	• Excavation areas will be sloped during rehabilitation to even out depressions.	Part B 1) d) (2) (c)
Land Use	Degrading of grazing potential for livestock farming	Neg	Reversible	1	2	2	2	3	2.5	5	High	• Should it be found that after mining operation have ceased, that the natural vegetation of the area is unacceptable, the area would be re-vegetated with an indigenous s grass seed mix.	Part B 1) d) (2) (d)

Nature of Impact	Impact	Positive/Negative / Neutral Impact	Reversibility	Extent	Severity	Duration	Consequence	Probability	Likelihood	Significance	Mitigation Rating	Mitigation	EMP Section
Land Use	Veldt fire might seriously impact on surrounding land-use (livestock/irrigation of neighboring farmers)	Neg	Reversible	1	2	2	2	2	2	4	High	• Precautionary measures such as fire breaks would be taken into account and the company will join the local FPA.	Part B 1) d) (2) (d)
Visual aspect	Deterioration in visual aesthetics of the area	Neg	Reversible	2	1	3	2	2	2.5	5	High	• Area would be properly rehabilitated as mining activities progress in order to reduce the visual aspect as much as possible. • Screens will be considered if I&AP complaints are received.	
Archaeological & cultural sites	Loss of and disturbance to surface archaeological sites	Neg	Irreversible	1	5	5	5	1	3	15	Low	• Should artefacts or archaeological items be observed, then all activity should cease immediately, the area marked off and a specialists consulted prior to any further activity.	Part B 1) d) (2) (e)
Social	Financial gain on different levels	Pos	Reversible	1	2	3	2	4	3.5	7	High	• The comprehensive SLP that was submitted as part of the application manages this aspect of the project.	
Noise	Increased noise levels	Neg	Reversible	1	1	3	1	2	2.5	2.5	High	• Use of earthmoving equipment will be limited to office hours. • Trucks, machinery and equipment will be regularly serviced to ensure acceptable noise levels are not exceeded. • Silencers will be utilized where possible.	Part B 1) d) (2) (f)
Air quality	Dust generation	Neg	Reversible	2	2	1	4	2	1.5	6	Med	• Sandy nature of the soil will result in dust. • Working times will be strictly controlled. • A water cart will be used to spray relevant areas when dust levels are high.	Part B 1) d) (2) (f)

Nature of Impact	Impact	Positive/Negative / Neutral Impact	Reversibility	Extent	Severity	Duration	Consequence	Probability	Likelihood	Significance	Mitigation Rating	Mitigation	EMP Section
Fauna	Loss of food, nest sites and refugee	Neg	Reversible	2	1	3	2	1	2	4	High	• Relocate larger animals with the aid of specialists. • Ensure relevant permits are in place.	Part B 1) d) (2) (g)
Fauna	Alienation of animals from the area	Neg	Reversible	2	1	3	2	1	2	4	High	• Mining will only take place on designated areas, and will be restricted to office ours. • No traps or hunting of any animals will be allowed. • Mining will be done with the least possible habitat destruction. mining activities are only temporary. • Inform staff, contractors and visitors to not harm fauna in the area.	Part B 1) d) (2) (g)
Surface water	Potential hydrocarbon contamination which may reach downstream surface water bodies	Neg	Reversible	1	1	3	1	2	2.5	2.5	High	• Truck, machinery and equipment will be regularly serviced to reduce risk of leaks. • Any leakages should be reported and treated immediately in a reputable manner. • For large spills Hazmat will called in.	Part B 1) d) (2) (h)
Surface water	Increased risk of siltation of surface water bodies	Neg	Reversible	2	1	2	2	2	2	4	High	• Ensure clean and dirty water separation and storm water management systems are established on site prior to construction taking place.	Part B 1) d) (2) (h)
Surface water	Downstream water quantity of catchment reduced	Neg	Reversible	2	1	2	2	2	2	4	High		Part B 1) d) (2) (h)
Sensitive Landscapes	Potential damage to or destruction of sensitive faunal habitats: Pans & watering points	Neg	Reversible	2	1	2	2	2	2	4	High	• Pans and artificial watering points must be cordoned off with at least 100m horizontal distance buffer zones and no activity is too take place within these areas.	Part B 1) d) (2) (h)

Nature of Impact	Impact	Positive/Negative / Neutral Impact	Reversibility	Extent	Severity	Duration	Consequence	Probability	Likelihood	Significance	Mitigation Rating	Mitigation	EMP Section
												• Consideration should be given to create alternative watering point if existing artificial water point will be disturbed.	
Groundwater	Quality and Quantity of groundwater could be adversely affected by mining activities	Neg	Reversible	2	1	2	2	2	2	4	High	• Groundwater will only be used for domestic purposed and will not be directly affected by mining activities.	Part B 1) d) (2) (i)

Cumulative Impacts

Table 9: Cumulative Impact Assessment of Tja Naledi-Barrage Bulk Sand Mine

Nature of Impact	Impact	Positive/Negative / Neutral Impact	Reversibility	Extent	Severity	Duration	Consequence	Probability	Likelihood	Significance	Mitigation Rating	Mitigation	EMP Section
CONSTRUCTION AND OPERATIONAL PHASES													
ACTIVITY: Utilization of haul and access roads within the mining right area													
SUB ACTIVITY: Truck and heavy machinery operations													
Traffic & Safety	Increased potential for road incidences	Neg	Reversible	2	3	1	6	3	2	12	Med	All intersections with main tarred roads will be clearly signposted. Drivers will be enforced to keep to set speed limits. Trucks will be in road-worthy condition with reflective strips.	Part B 1) d) (2) (j)
Traffic & Safety	Road degradation	Neg	Reversible	1	3	1	3	2	1.5	4.5	Med	A fund will be set aside (with the two similar mines in close vicinity f the Tja Naledi) to maintain the serviceability of the road verge where the trucks approach or depart from the main road.	Part B 1) d) (2) (j)