



LEFATSE
Environmental Planning Services (PTY) Ltd

Environmental Impact, Risk Assessment and Management Report

Proposed sand mining and associated activities on the farm
Jammerbergsdrift 540/RE, Magisterial District Wepener, Free
State Province

November 2019

Reference: FS 30/5/1/3/3/2/1/10283 MP

Lefatse Environmental Planning Services (Pty) Ltd. (Reg no. 2016/047456/07)

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Environmental Impact, Risk Assessment and Management Report

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1. PROJECT DESCRIPTION

Lefatse Environmental Planning Services (Pty) Ltd (Lefatse EPS) was appointed to manage an application for Environmental Authorisation (EA) in terms of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) and related regulations for a mining permit in terms of Section 27 of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002).

The details of the application are as follow:

Applicant information:

Applicant: Glen Shee Zand (Pty) Ltd. (Registration no. 2019/159609/07)

Ref. No. FS 30/5/1/3/3/2/1/10283 MP

Extent: Approximately 4.99 ha

Contact details:

Mr. S.J. Meyer

P.O. Box 31318

Fichardtpark

9317

Email: asasandkonstruksie@gmail.com

Tel: 051 443 8942

Property information:

Remaining Extent of the farm Jammerbergsdrift 540 situated in the Magisterial District of Wepener, Free State Province (Figure 1: Locality map). [F04000000000054000000]

Mineral type:

Sand

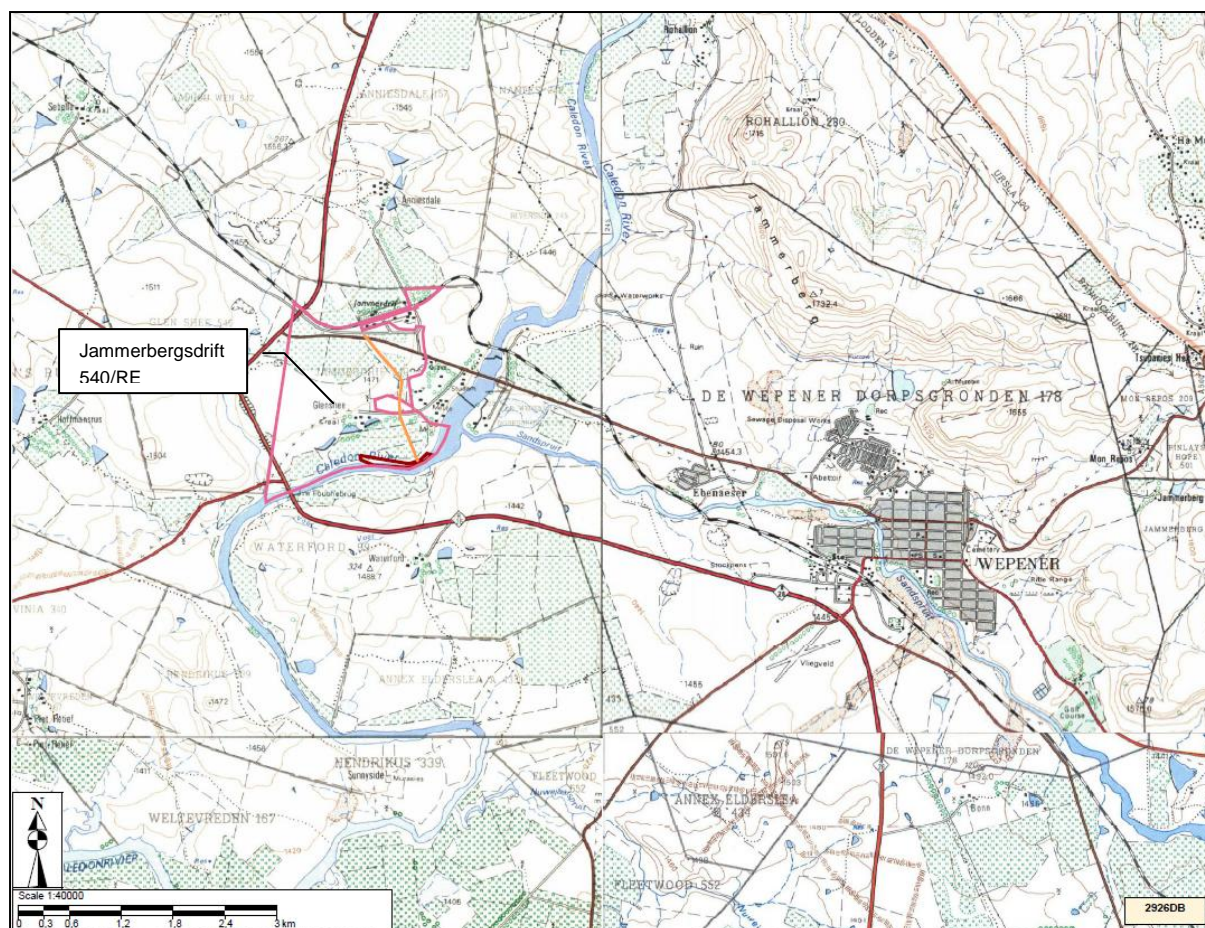


Figure 1: Locality map

Activities on site will mainly include the following:

- Site establishment, including establishment of mining equipment, e.g. floating pump and sifting equipment. No permanent infrastructure is currently planned.
- Clearance of vegetation of operational areas (including stockpile and sifting area) and access road.
- Pumping of sand from the riverbed of the Caledon River via a floating pump and excavator equipped with a pump.
- Sand will be pumped to the riverbank to a containment area formed by sand to allow the water from the slurry to drain back to the river.
- Depending on the quality of sand required, it will be sifted on site and stockpiled on product stockpiles.
- Loading and hauling of product.
- Continuous environmental management throughout all the phases of the operation.
- Rehabilitation of disturbed areas during the Decommissioning Phase giving consideration to the planned end land use at the time of Closure.

2. SCOPE

A Basic Assessment process in terms of regulations 19 and 20 of the NEMA Environmental Impact Assessment (EIA) Regulations, 2014 as amended was commenced with as part of the EA application for the following listed activities:

Activity	Activity description
Listing Notice 1, No. 21 of GNR 327	<i>Any activity including the operation of that activity which requires a mining permit in terms of Section 27 of the MPRDA, 2002 (Act 28 of 2002), including (a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or (b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in Listing Notice 2 applies.</i>
Listing Notice 1, No. 27 of GNR 327	<i>The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.</i>

The pumping activities to be undertaken within the river also require a Water Use Authorisation in terms of Section 40 of the NWA, 1998 (Act 36 of 1998) for a Section 21(c) and/or 21(i) water use. An application in this regard was submitted to DWS (Annexure 3), the outcome of which will be submitted to DMR on receipt thereof. At the time of writing of this report, the application was still in process.

The purpose of this Environmental Impact Assessment/Risk and Management report is to identify and assess the significance of the potential impacts expected to be associated with the proposed operation as well as to develop environmental management/mitigation measures to be implemented to prevent and/or limit these expected impacts.

3. DETAILS OF THE ASSESSOR

The details of the person responsible for the assessment and preparation of this report are as follow:

Environmental Assessment Practitioner:

Mrs. Hanri van Jaarsveld

Contact details:

Lefatse Environmental Planning Services (Pty) Ltd

PO Box 11945

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Tel: 079 499 7999

Qualifications of the practitioner:

B.Sc. Microbiology and Zoology

B.Sc. Honours in Zoology

Magister in Environmental Management

Summary of the practitioner's expertise:

H van Jaarsveld has been involved in environmental management since 2007. Personal experience includes amongst other: Coordination of environmental courses presented at the Centre for Environmental Management, UFS; Project management; Applications for Environmental Authorisation in terms of NEMA, 1998 (Act 107 of 1998) and related regulations, including waste licences and atmospheric emission licenses; Application of Integrated Water Use Licenses in terms of the NWA, 1998 (Act 36 of 1998); Environmental compliance auditing on especially road construction projects and mining related operations.

4. METHODOLOGY USED IN DETERMINING AND RANKING THE NATURE, SIGNIFICANCE, CONSEQUENCES, EXTENT, DURATION AND PROBABILITY OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

The criteria for determining impact significance as specified in the "DEAT (2002) Impact Significance, Integrated Environmental Management, Information Series 5, Department of Environmental Affairs and Tourism (DEAT)" was adopted to determine and rank the potential impacts that may be associated with the proposed operation.

The criteria is based on the a) Extent or spatial scale of the impact; b) Intensity or nature of the impact; c) Expected duration of the impact; d) Mitigatory potential of impacts; e) Acceptability of impacts; f) The probability of the impacts occurring; g) The status of the impact, i.e. positive, negative or neutral; and h) Identify the specific legal and permit requirements relevant to the project. All of these are used to give a significance rating for each identified impact (Table 7). The locality of the study area and distance of the proposed project site from potential affected landowners were also considered during the rating of the significance.

The rating for the extent of an impact is related to the area that is likely to be affected by the impact, e.g. limited to the site or local area (Table 1).

Table 1: Extent or spatial scale of impacts

Rating	Description
High	Regional / National / International scale
Medium	Beyond site boundary
Low	Within site boundary (i.e. mining permit area)

The intensity of an impact is rated to be high, medium or low and is based on legal standards and information from specialist studies as far as possible (Table 2). Where no legal standard is available, best practice is considered.

Table 2: The intensity or nature of impacts

Rating	Description
High	Disturbance of pristine areas that have important conservation value. / Destruction of rare or endangered species.
Medium	Disturbance of areas that have potential conservation value or are of use as resources. / Complete change in species occurrence or variety.
Low	Disturbance of degraded areas, which have little conservation value. / Minor change in species occurrence or variety.

It is determined what the expected duration of the impact occurring would be, i.e. short term, medium term, long term or considered to be permanent (Table 3).

Table 3: The expected duration of impacts

Rating	Description
High	Permanent / Long term (More than 15 years)
Medium	Medium term (5 – 15 years)

Rating	Description
Low	Short term (0 – 5 years)

Based on experience and known results from environmental management and/or mitigation measures on similar projects, the mitigatory potential of an impact is estimated to be low, medium or high (Table 4). Also refer to Table 9 in this report for the expected significance rating of each impact after management measures have been implemented to limit and/or prevent the expected impact or the extent thereof.

Table 4: The mitigatory potential of impacts

Rating	Description
High	High potential to mitigate negative impacts to the level of insignificant effects.
Medium	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects.
Low	Little or no mechanism to mitigate negative impacts.

Although there are criteria and standards in terms of the acceptability level of impacts that are emissions-based or that relate to the receiving environment, e.g. air quality, water quality or noise, it often depends on the stakeholders and I&APs directly affected by the proposed project (DEAT, 2002). The ratings proposed for this impact assessment criteria are indicated in Table 5.

Table 5: The acceptability of impacts

Rating	Description
High (unacceptable)	Redesign project to remove or avoid impact.
Medium (Manageable)	With regulatory controls. / With project proponent's commitments.
Low (Acceptable)	No risk

The degree of certainty of the impact actually occurring is described to be unlikely, likely, highly likely or definite (i.e. impact will occur regardless of prevention measures) (Table 6).

Table 6: The probability of the impact occurring

Rating	Description
Definite	More than 90% sure of a particular fact. Substantial supportive data exist to verify the assessment.
Highly likely	Over 70% sure of a particular fact or of the likelihood of that impact occurring.
Likely	Possible: Only over 40% sure of a particular fact or of the likelihood of an impact occurring.

Rating	Description
Unlikely	Less than 40% sure of a particular fact or the likelihood of an impact occurring.

All the criteria described, the environmental features as a whole together with the expected impact on the local community are considered in rating the significance of an impact (Table 7).

Table 7: The rating of impact magnitude and significance

Magnitude / Significance rating	Description
High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. In the case of beneficial impacts, the impact is of a substantial order within the bounds of impacts that could occur.
Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost and effort.
Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural and economic activities of communities can continue unchanged. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.
No impact	Zero impact

5. IDENTIFIED ENVIRONMENTAL IMPACTS AND RISKS ASSOCIATED WITH THE PROPOSED PROJECT

The potential impacts were identified through a desktop study of the study area and a site assessment by the EAP, Ecological and Wetland Assessment, Phase 1 Heritage Impact Assessment and involvement from Interested and/or Affected Parties (I&APs) and stakeholders. This assessment is also based on the following assumptions, uncertainties and knowledge gaps/limitations:

- During the assessment and development of the management measures, it was assumed that the information provided by the applicant, input from I&APs and

stakeholders and input from the specialists were true, correct to the best of their knowledge and unbiased.

- The annual volume of sand that will be recovered during the proposed operation was calculated based on projected sales and estimated available resource. An estimate was calculated within the Financial and Technical Capability report.

- i) The potential impacts/risks expected to be associated with the proposed operation include the following:
 - Clearance of vegetation and impact on the riparian area;
 - Habitat loss and effect on the general biodiversity;
 - Temporary impact on the ecosystem function;
 - Destabilisation of the riverbank;
 - Establishment and spread of alien vegetation;
 - Erosion and loss of topsoil;
 - Loss of agriculture potential due to a temporary change in land use;
 - Change in storm water flow;
 - Impact on surface water and groundwater quality (e.g. spillage, increase in suspended solids);
 - Pollution to the surrounding environment due to waste and spills;
 - Dust generation;
 - Elevated noise levels;
 - Damage or destruction of archaeological remains;
 - Health and safety risk to employees on site and people entering the mining area;
 - Impact on the general aesthetics of the area and immediate visual impact;
 - Risk of veld fires;
 - Indirect loss of sales of existing sand recovery operations within a radius of 1 km;
 - Positive impact on employment opportunities and skills development; and
 - Positive impact of economic development.

Refer to Tables 8 - 10 of this document for an assessment of each of the above listed impacts in respect of the preferred locality and alternative site layout, both without mitigation and with mitigation. The results from the specialist assessments were also used to complete the assessment.

Table 8: Assessment of the potential impacts expected in respect of the preferred locality and site layout (without mitigation)

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Development Phase									
Site establishment (Clearance of vegetation; establishment of equipment; establish access points; access road; etc.)	Clearance of riparian vegetation	Negative	Low	Low	Low	Definite	Manageable	Low	High
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Medium	Medium
	Establishment of alien vegetation	Negative	Low	Low	Medium	Highly likely	Unacceptable	Medium	Medium
	Habitat destruction	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Impact on terrestrial fauna	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Erosion	Negative	Medium	Low	Medium	Highly likely	Manageable	Medium	Medium
	Loss of topsoil	Negative	Medium	Low	Low	Likely	Manageable	Low	Medium
	Visual scarring	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Elevated noise levels	Negative	Medium	Low	Low	Unlikely	Acceptable	Low	Medium
	Change in land use (Loss of agriculture potential)	Negative	Low	Low	Low	Highly likely	Manageable	Low	High
	Damage or destruction of objects/artefacts of heritage importance	Negative	Low	Medium	Low	Likely	Unacceptable	Medium	Medium
Operational Phase									
Recovery of sand: Pumping from riverbed via floating pump	Water quality: Increase in suspended solids	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Negative	Medium	Medium	Low	Likely	Unacceptable	Medium	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Unlikely	Manageable	Low	High
	Disturbance to aquatic habitat (or biotypes)	Negative	Low	Low	Low	Likely	Manageable	Low	Medium

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
	Change in surface water drainage: Instream	Negative	Low	Medium	Low	Unlikely	Acceptable	Low	High
Recovery of sand: Pumping from riverbed via excavator fitted with a pump	Water quality: Increase in suspended solids	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Negative	Medium	Medium	Low	Likely	Unacceptable	Medium	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Disturbance to aquatic habitat (or biotypes)	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
	Change in surface water drainage: Instream	Negative	Low	Medium	Low	Likely	Manageable	Low	High
Recovery of sand: Excavating sand from the riverbed via excavator (only during dry periods)	Water quality: Increase in suspended solids	Negative	Low	Medium	Low	Unlikely	Acceptable	Low	High
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Negative	Low	Medium	Low	Likely	Unacceptable	Medium	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Medium	Medium
	Disturbance to aquatic habitat (or biotypes)	Negative	Low	Low	Low	Unlikely	Manageable	Low	High
	Change in surface water drainage: Instream	Negative	Low	Medium	Low	Likely	Manageable	Low	High
Settling pond on the riverbank	Change in surface water drainage	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Surface water quality: Increase in suspended solids	Negative	Medium	Medium	Low	Unlikely	Manageable	Medium	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
Sifting	Dust generation	Negative	Low	Low	Low	Likely	Manageable	Low	High

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Stockpiling	Dust generation	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Change in surface water drainage	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Erosion & loss of topsoil	Negative	Low	Low	Low	Likely	Manageable	Medium	High
	Establishment of alien vegetation	Negative	Low	Low	Low	Likely	Unacceptable	Medium	High
Loading & hauling	Dust generation	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Deterioration of the gravel access road	Negative	Medium	Low	Low	Likely	Manageable	Medium	High
	Change in surface water drainage	Negative	Low	Low	Medium	Likely	Manageable	Medium	High
	Erosion	Negative	Medium	Low	Medium	Likely	Manageable	Medium	Medium
	Loss of topsoil	Negative	Medium	Low	Medium	Likely	Manageable	Medium	Medium
Storage of material and substances with the potential to pollute (e.g. fuel, oil, gas)	Soil contamination from spillages	Negative	Low	Low	Low	Likely	Manageable	Medium	Medium
	Water quality: Spillage of hydrocarbons, e.g. diesel	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Fire risk	Negative	Medium	Low	Low	Unlikely	Manageable	Low	Medium
Waste generation: General and domestic solid waste	Littering	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Fire risk	Negative	Medium	Low	Low	Unlikely	Manageable	Low	Medium
Waste generation: Sewage	Water quality: Spillage of sewage	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Soil contamination from spillages	Negative	Low	Low	Low	Likely	Manageable	Low	Medium

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
General operational activities (Especially in respect of I&APs and employees)	Visual scarring & impact on the general aesthetics of the area	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Elevated noise levels	Negative	Medium	Low	Low	Likely	Acceptable	Low	Medium
	Risk of injury to people entering the operational area	Negative	Low	Medium	Low	Likely	Unacceptable	Medium	Medium
	Risk of injury to employees working with machinery/equipment on site	Negative	Low	Medium	Low	Likely	Unacceptable	Medium	Medium
	Change in land use (Loss of agriculture potential)	Negative	Low	Low	Low	Highly likely	Manageable	Low	High
	Impact on terrestrial fauna	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Establishment of alien vegetation	Negative	Medium	Low	Medium	Highly likely	Unacceptable	Medium	Medium
	Damage or destruction of objects/artefacts of heritage importance	Negative	Low	Medium	Low	Likely	Manageable	Medium	Medium
	Indirect loss of sales of existing sand recovery operations	Negative	Medium	Low	Low	Likely	Manageable	Low	Medium
	Job creation & skills upliftment	Positive	Low	Low	Low	Definite	Acceptable	Medium	-
	Economic development in the region	Positive	Low	Low	Low	Likely	Acceptable	Low	-
Cumulative impacts considering other activities within 1km (including sand mining & farming)	Dust generation	Negative	Medium	Low	Low	Likely	Manageable	Low	High

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Cumulative impacts considering other activities within 1km (including sand mining & farming)	Visual scarring & impact on the general aesthetics of the area	Negative	Medium	Low	Low	Highly likely	Manageable	Medium	High
	Elevated noise levels	Negative	Medium	Low	Low	Likely	Acceptable	Low	Medium
	Clearance of riparian vegetation	Negative	Medium	Low	Low	Highly likely	Manageable	Medium	Medium
	Erosion	Negative	Medium	Low	Low	Likely	Manageable	Medium	High
	Change in land use (Loss of agriculture potential)	Negative	Medium	Low	Low	Highly likely	Manageable	Medium	High
	Change in surface water drainage	Negative	Medium	Medium	Low	Likely	Manageable	Medium	High
	Habitat loss and effect on the general biodiversity	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Destabilisation of the riverbank	Negative	Medium	Low	Low	Likely	Manageable	Medium	Medium
Decommissioning Phase									
Rehabilitation (e.g. removal of equipment, reshaping disturbed areas, etc.)	Soil contamination from spillages and waste disposal	Negative	Low	Low	Low	Likely	Manageable	Medium	Medium
	Water pollution due to spillages and waste disposal	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Elevated noise levels	Negative	Medium	Low	Low	Likely	Acceptable	Low	Medium
	Change in surface water drainage	Positive	Low	Low	Low	Likely	Acceptable	Medium	-
	Destabilisation of the riverbank	Negative	Low	Low	Low	Unlikely	Manageable	Low	Medium
	Erosion	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Loss of topsoil	Negative	Low	Low	Low	Unlikely	Manageable	Low	Medium
	Establishment of alien vegetation	Negative	Medium	Low	Medium	Highly likely	Manageable	Medium	Medium

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Post Monitoring Phase									
Closure	Stabilisation of the riverbank	Positive	Low	Low	Low	Likely	Acceptable	Low	-
	Establishment of a self-sustaining ecosystem	Positive	Low	Medium	Medium - high	Likely	Acceptable	Low	-
	Job creation & skills upliftment: Retrenchment	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
	Economic development in the region	Negative	Medium	Low	Low	Unlikely	Manageable	Low	Medium

Table 9: Assessment of the potential impacts expected in respect of the preferred locality and final site layout (with mitigation)

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Development Phase									
Site establishment (Clearance of vegetation; establishment of equipment; establish access points; access road; etc.)	Clearance of riparian vegetation	Negative	Low	Low	Low	Definite	Manageable	Low	High
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
	Establishment of alien vegetation	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Habitat destruction	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Impact on terrestrial fauna	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Erosion	Negative	Low	Low	Low	Highly likely	Manageable	Low	High
	Loss of topsoil	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
	Visual scarring	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Elevated noise levels	Negative	Medium	Low	Low	Unlikely	Acceptable	Low	Medium
	Change in land use (Loss of agriculture potential)	Negative	Low	Low	Low	Highly likely	Manageable	Low	High
	Damage or destruction of objects/artefacts of heritage importance	Negative	Low	Medium	Low	Unlikely	Manageable	Low	Medium
Operational Phase									
Recovery of sand: Pumping from riverbed via floating pump	Water quality: Increase in suspended solids	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Unlikely	Manageable	Low	High
	Disturbance to aquatic habitat (or biotypes)	Negative	Low	Low	Low	Likely	Manageable	Low	Medium

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
	Change in surface water drainage: Instream	Negative	Low	Medium	Low	Unlikely	Acceptable	Low	High
Recovery of sand: Pumping from riverbed via excavator fitted with a pump	Water quality: Increase in suspended solids	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Negative	Medium	Medium	Low	Likely	Manageable	Medium	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Disturbance to aquatic habitat (or biotypes)	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
	Change in surface water drainage: Instream	Negative	Low	Medium	Low	Likely	Manageable	Low	High
Recovery of sand: Excavating sand from the riverbed via excavator (only during dry periods)	Water quality: Increase in suspended solids	Negative	Low	Medium	Low	Unlikely	Acceptable	Low	High
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Negative	Low	Medium	Low	Likely	Manageable	Low	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Disturbance to aquatic habitat (or biotypes)	Negative	Low	Low	Low	Unlikely	Manageable	Low	High
	Change in surface water drainage: Instream	Negative	Low	Medium	Low	Unlikely	Manageable	Low	High
Settling pond on the riverbank	Change in surface water drainage	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Surface water quality: Increase in suspended solids	Negative	Low	Medium	Low	Unlikely	Manageable	Low	Medium
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Low	High
Sifting	Dust generation	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Stockpiling	Dust generation	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Change in surface water drainage	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Erosion & loss of topsoil	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Establishment of alien vegetation	Negative	Low	Low	Low	Likely	Manageable	Low	High
Loading & hauling	Dust generation	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Deterioration of the gravel access road	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Change in surface water drainage	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Erosion	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Loss of topsoil	Negative	Medium	Low	Low	Likely	Manageable	Low	Medium
Storage of material and substances with the potential to pollute (e.g. fuel, oil, gas)	Soil contamination from spillages	Negative	Low	Low	Low	Unlikely	Manageable	Low	Medium
	Water quality: Spillage of hydrocarbons, e.g. diesel	Negative	Medium	Medium	Low	Unlikely	Manageable	Medium	Medium
	Fire risk	Negative	Medium	Low	Low	Unlikely	Manageable	Low	Medium
Waste generation: General and domestic solid waste	Littering	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Fire risk	Negative	Medium	Low	Low	Unlikely	Manageable	Low	Medium
Waste generation: Sewage	Water quality: Spillage of sewage	Negative	Medium	Medium	Low	Unlikely	Manageable	Medium	Medium
	Soil contamination from spillages	Negative	Low	Low	Low	Unlikely	Manageable	Low	Medium

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
General operational activities (Especially in respect of I&APs and employees)	Visual scarring & impact on the general aesthetics of the area	Negative	Low	Low	Low	Likely	Acceptable	Low	High
	Elevated noise levels	Negative	Medium	Low	Low	Likely	Acceptable	Low	Medium
	Risk of injury to people entering the operational area	Negative	Low	Low	Low	Unlikely	Manageable	Low	Medium
	Risk of injury to employees working with machinery/equipment on site	Negative	Low	Medium	Low	Likely	Manageable	Medium	Medium
	Change in land use (Loss of agriculture potential)	Negative	Low	Low	Low	Highly likely	Manageable	Low	High
	Impact on terrestrial fauna	Negative	Low	Low	Low	Unlikely	Acceptable	Low	High
	Establishment of alien vegetation	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Damage or destruction of objects/artefacts of heritage importance	Negative	Low	Medium	Low	Unlikely	Manageable	Low	Medium
	Indirect loss of sales of existing sand recovery operations	Negative	Medium	Low	Low	Likely	Manageable	Low	Medium
	Job creation & skills upliftment	Positive	Low	Low	Low	Definite	Acceptable	Medium	-
	Economic development in the region	Positive	Medium	Low	Low	Highly likely	Acceptable	Medium	-
Cumulative impacts considering other activities within 1km (including sand mining & farming)	Dust generation	Negative	Medium	Low	Low	Likely	Manageable	Low	High

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Cumulative impacts considering other activities within 1km (including sand mining & farming)	Visual scarring & impact on the general aesthetics of the area	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Elevated noise levels	Negative	Medium	Low	Low	Likely	Acceptable	Low	Medium
	Clearance of riparian vegetation	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Erosion	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Change in land use (Loss of agriculture potential)	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Change in surface water drainage	Negative	Medium	Medium	Low	Likely	Manageable	Medium	High
	Habitat loss and effect on the general biodiversity	Negative	Medium	Low	Low	Likely	Manageable	Low	High
	Destabilisation of the riverbank	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
Decommissioning Phase									
Rehabilitation (e.g. removal of equipment, reshaping & reinstating disturbed areas, etc.)	Soil contamination from spillages and waste disposal	Negative	Low	Low	Low	Unlikely	Manageable	Low	Medium
	Water pollution due to spillages and waste disposal	Negative	Medium	Medium	Low	Unlikely	Manageable	Low	Medium
	Elevated noise levels	Negative	Medium	Low	Low	Likely	Acceptable	Low	Medium
	Change in surface water drainage	Positive	Low	Low	Low	Likely	Acceptable	Low	-
	Destabilisation of the riverbank	Negative	Low	Low	Low	Unlikely	Manageable	Low	High
	Erosion	Negative	Low	Low	Low	Likely	Manageable	Low	High
	Loss of topsoil	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
	Establishment of alien vegetation	Negative	Low	Low	Low	Likely	Manageable	Low	High

Name of activity	Potential impact	Positive / Negative	Extent	Intensity / nature	Duration	Probability	Level of acceptability	Significance	Mitigatory potential (Reversibility)
Post Monitoring Phase									
Closure	Stabilisation of the riverbank	Positive	Low	Low	Medium - high	Highly likely	Acceptable	Medium	-
	Establishment of a self-sustaining ecosystem	Positive	Low	Medium	Medium - high	Highly likely	Acceptable	Medium	-
	Job creation & skills upliftment: Retrenchment	Negative	Low	Low	Low	Likely	Manageable	Low	Medium
	Economic development in the region	Negative	Medium	Low	Low	Likely	Manageable	Low	Medium

Table 10: Significance of the potential impacts/risks expected in respect of the preferred locality and final site layout (without and with mitigation measures)

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Site establishment (Clearance of vegetation; establishment of equipment; establish access points; access road; etc.)	Clearance of riparian vegetation	Aesthetics; Land use; Vegetation; Biodiversity	Development	Low	Avoid through site locality & layout; Remedy current degraded status through rehabilitation; Limit footprint.	Low
	Destabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Development	Medium	Limit through site layout & number of access points to the river; Avoid unnecessary clearance of riparian vegetation; Limit footprint; Remedy through rehabilitation.	Low
	Establishment of alien vegetation	Vegetation; Biodiversity; Ecosystem function	Development	Medium	Remedy through rehabilitation; Limit footprint; Monitor establishment of invasive species; Control through management plan.	Low
	Habitat destruction	Vegetation; Fauna; Biodiversity; Ecosystem function	Development	Low	Limit through site locality & layout; Remedy current degraded status through rehabilitation; Limit footprint.	Low
	Impact on terrestrial fauna	Fauna; Biodiversity; Ecosystem function	Development	Low	Remedy current degraded status through rehabilitation; Limit footprint; Avoid poaching.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Site establishment (Clearance of vegetation; establishment of equipment; establish access points; access road; etc.)	Erosion	Aesthetics; Land use; Water quality; Soil	Development	Medium	Remedy through rehabilitation; Limit through site locality & layout; Limit footprint; Monitor occurrence of erosion and extent thereof; Control through storm water control and erosion measures.	Low
	Loss of topsoil	Soil; Land use	Development	Low	Limit through site locality & layout; Limit footprint; Control through appropriate topsoil stockpiling (where topsoil is present); Control through storm water control and erosion measures; Monitor occurrence of erosion and extent thereof; Remedy through rehabilitation; Avoid steep slopes for access routes.	Low
	Visual scarring	Aesthetics; Visual; I&APs	Development	Low	Remedy through rehabilitation; Limit footprint; Limit through locality and site layout; Limit with good housekeeping.	Low
	Elevated noise levels	Noise; I&APs; Health and Safety	Development	Low	Limit through operational procedures (including working hours); Limit by using good operating machinery.	Low
	Change in land use (Loss of agricultural potential)	Land use	Development	Low	Limit through site locality & layout; Remedy through rehabilitation; Limit footprint.	Low
	Damage or destruction of objects/artefacts of heritage importance	Heritage; I&APs	Development	Medium	Avoid through site locality & layout informed by the HIA (2019); Create awareness with employees;	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
					Limit footprint.	
Recovery of sand: Pumping from riverbed via floating bed	Water quality: Increase in suspended solids	Water quality	Operational	Medium	Limit through operational procedures.	Medium
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Water quality	Operational	Medium	Limit through operational procedures; Control through monitoring and repairing leakages on equipment.	Medium
	Destabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Operational	Low	Limit through number of access points to the river; Avoid unnecessary clearance of riparian vegetation; Limit footprint; Avoid through operational procedures (including buffers along the riverbank).	Low
	Disturbance to aquatic habitat (or biotypes)	Biodiversity; Ecosystem function	Operational	Low	Limit through operational procedures; Limit footprint.	Low
	Change in surface water drainage: Instream	Natural flow path	Operational	Low	Control through operational procedures; Limit access points to the river; Remedy through rehabilitation.	Low
Recovery of sand: Pumping from riverbed via excavator fitted with a pump	Water quality: Increase in suspended solids	Water quality	Operational	Medium	Limit through operational procedures; Limit access points and movement along the riverbank and/or ramps.	Medium
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Water quality	Operational	Medium	Limit through operational procedures; Control through monitoring and repairing leakages on equipment.	Medium
	Destabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Operational	Low	Limit through number of access points to the river; Avoid unnecessary clearance of riparian vegetation; Limit footprint; Avoid through operational procedures (including buffers along the riverbank).	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Recovery of sand: Pumping from riverbed via excavator fitted with a pump	Disturbance to aquatic habitat (or biotypes)	Biodiversity; Ecosystem function	Operational	Low	Limit through operational procedures; Limit footprint.	Low
	Change in surface water drainage: Instream	Natural flow path	Operational	Low	Control through operational procedures; Limit access points to the river; Remedy through rehabilitation.	Low
Recovery of sand: Excavating sand from the riverbed via excavator (only during dry periods)	Water quality: Increase in suspended solids	Water quality	Operational	Low	Limit through operational procedures; Avoid backwater area; Limit access points and movement along the riverbank and/or ramps.	Low
	Water quality: Spillage of hydrocarbons, e.g. oil, diesel	Water quality	Operational	Medium	Limit through operational procedures; Control through monitoring and repairing leakages on equipment.	Low
	Destabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Operational	Medium	Limit through number of access points to the river; Avoid unnecessary clearance of riparian vegetation; Limit footprint; Avoid through operational procedures (including buffers along the riverbank).	Low
	Disturbance to aquatic habitat (or biotypes)	Biodiversity; Ecosystem function	Operational	Low	Limit through operational procedures; Limit footprint.	Low
	Change in surface water drainage: Instream	Natural flow path	Operational	Low	Control through operational procedures; Limit access points to the river; Remedy through rehabilitation.	Low
Settling pond on the riverbank	Change in surface water drainage	Topography; Storm water; Water quantity	Operational	Low	Limit through site layout; Control through operational procedures; Control through storm water controls; Remedy through rehabilitation.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Settling pond on the riverbank	Surface water quality: Increase in suspended solids	Water quality	Operational	Medium	Limit footprint; Control through operational procedures; Avoid backwater area; Control through storm water controls; Remedy through rehabilitation.	Low
	Destabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Operational; Decommissioning	Low	Avoid unnecessary clearance of riparian vegetation; Limit footprint; Avoid through operational procedures; Remedy through rehabilitation.	Low
Sifting	Dust generation	Air quality; I&APs	Operational	Low	Limit through operational procedures; Control through implementation of dust control measures.	Low
Stockpiling	Dust generation	Air quality; I&APs	Operational	Low	Control through operational procedures; Limit through dust control and monitoring; Prevent through rehabilitation of disturbed areas.	Low
	Change in surface water drainage	Topography; Storm water; Natural flow path	Operational	Low	Control through storm water controls; Limit through site layout; Avoid backwater area; Remedy through rehabilitation.	Low
	Erosion & loss of topsoil	Aesthetics; Land use; Soil	Operational	Medium	Control through storm water controls; Limit through site layout; Avoid backwater area; Remedy through visual checks and reinstatement of eroded areas; Remedy through rehabilitation.	Low
	Establishment of alien vegetation	Vegetation; Biodiversity	Operational	Medium	Control through monitoring and clearance of invasive species;	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
					Remedy through rehabilitation; Limit footprint disturbance; Control through implementation of a weed management plan.	
Loading & hauling	Dust generation	Air quality; I&APs	Operational	Low	Control through operational procedures; Limit through dust control measures; Limit through speed control; Control through monitoring; Remedy through rehabilitation.	Low
	Deterioration of the gravel access road	Infrastructure; I&APs; Road safety	Operational; Decommissioning	Medium	Remedy through visual checks and maintenance of the road; Control through speed control.	Low
	Change in surface water drainage	Natural flow path; Water quantity; Ecosystem function	Operational; Decommissioning	Medium	Control through storm water controls; Limit through site layout; Remedy through visual checks and maintenance of the road; Remedy through rehabilitation.	Low
	Erosion	Aesthetics; Land use; Soil	Operational; Decommissioning	Medium	Control through storm water controls; Limit through site layout; Remedy through visual checks and reinstatement of eroded areas; Remedy through rehabilitation.	Low
	Loss of topsoil	Soil; Land use	Operational; Decommissioning	Medium	Control through storm water controls to prevent and/or limit erosion; Limit through appropriate topsoil stockpiling and site layout; Remedy through visual checks and reinstatement of eroded areas; Remedy through rehabilitation.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Storage of material and substances with the potential to pollute (e.g. fuel, oil, gas)	Soil contamination from spillages	Soil; Land use	Operational; Decommissioning	Medium	Avoid through operational procedures; Prevent through management; Remedy through rehabilitation	Low
	Water quality: Spillage of hydrocarbons, e.g. diesel	Water quality	Operational; Decommissioning	Medium	Prevent through site layout; Avoid through operational and management procedures; Remedy through cleaning and rehabilitation.	Medium
	Fire risk	Health & safety; I&APs; Biodiversity	Operational	Low	Avoid through operational procedures; Avoid through management & appropriate storage control; Limit risks through training and awareness to staff.	Low
Waste generation: General and domestic solid waste	Littering	Land use; Aesthetics; Water quality	Development; Operational; Decommissioning	Low	Prevent through proper waste management.	Low
	Fire risk	Health & safety; I&APs; Biodiversity	Operational	Low	Avoid through operational procedures; Avoid through management & appropriate waste management control; Limit risks through training and awareness to staff.	Low
Waste generation: Sewage	Water quality: Spillage of sewage	Water quality	Development; Operational; Decommissioning	Medium	Avoid through management & appropriate waste management control; Limit through site layout; Remedy through cleaning and reinstatement of affected areas.	Medium
	Soil contamination from spillages	Health & safety; Soil	Development; Operational; Decommissioning	Low	Avoid through management & appropriate waste management control; Remedy through cleaning and reinstatement of affected areas; Remedy through rehabilitation.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
General operational activities (Especially in respect of I&APs and employees)	Visual scarring & impact on the general aesthetics of the area	Aesthetics; I&APs	Operational; Decommissioning	Low	Remedy through rehabilitation; Limit footprint; Limit through locality and site layout; Limit with good housekeeping and operational procedures.	Low
	Elevated noise levels	Noise; I&APs; Health and Safety	Operational; Decommissioning	Low	Limit through operational procedures (including working hours); Limit by using good operating machinery.	Low
	Risk of injury to people entering the operational area	Health & safety; I&APs	Operational; Decommissioning	Medium	Prevent through access control; Avoid through rehabilitation at closure; Prevent through creating awareness through induction.	Low
	Risk of injury to employees working with machinery/equipment on site	Health & safety	Development; Operational; Decommissioning	Medium	Prevent and/or limit through appropriate PPE; Prevent by using good working equipment with required safety standards and mechanisms; Prevent through creating awareness through induction; Prevent through appropriate training to staff on site.	Medium
	Change in land use (Loss of agriculture potential)	Land use	Operational; Decommissioning	Low	Limit through site locality & layout; Remedy through rehabilitation; Limit footprint.	Low
	Impact on terrestrial fauna	Fauna; Biodiversity; Ecosystem function	Operational; Decommissioning	Low	Remedy current degraded status through rehabilitation; Limit footprint; Avoid poaching.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
General operational activities (Especially in respect of I&APs and employees)	Establishment of alien vegetation	Vegetation; Biodiversity; Ecosystem function	Operational; Decommissioning	Medium	Remedy through rehabilitation; Limit disturbance footprint; Monitor establishment of invasive species; Control through clearance and management plan.	Low
	Indirect loss of sales of existing sand recovery operations	I&APs; Socio-economics	Operational	Low	Limit through sustainable mining.	Low
	Job creation & skills upliftment	Community; Economy	Development, Operational; Decommissioning	Medium (Positive)	Achieve through continuation with proposed operation; Achieve through training of staff; Achieve through employment to local people.	Medium (Positive)
	Economic development in the region	Community; Economy	Operational	Low (Positive)	Achieve through continuation with proposed operation; Achieve through delivery of product to Wepener and surroundings, and possibly the larger Free State region (dependent on market).	Medium (Positive)
Cumulative impacts considering other activities within 1km (including sand mining & farming)	Dust generation	Air quality; I&APs	Operational	Low	Control through operational procedures; Limit through dust control measures; Limit through speed control; Control through monitoring; Remedy through rehabilitation.	Low
	Visual scarring & impact on the general aesthetics of the area	Aesthetics; Visual	Development; Operational; Decommissioning	Medium	Remedy through rehabilitation; Limit footprint; Limit through locality and site layout; Limit with good housekeeping and operational procedures.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Cumulative impacts considering other activities within 1km (including sand mining & farming)	Elevated noise levels	Noise; I&APs	Operational	Low	Limit through operational procedures (including working hours); Limit by using good operating machinery.	Low
	Clearance of riparian vegetation	Aesthetics; Land use; Vegetation; Biodiversity	Development; Operational	Medium	Avoid through site locality & layout; Remedy current degraded status through rehabilitation; Limit footprint.	Low
	Erosion & loss of topsoil	Aesthetics; Land use; Soil	Development; Operational; Decommissioning	Medium	Control through storm water controls; Limit through site layout; Remedy through visual checks and reinstatement of eroded areas; Remedy through rehabilitation.	Low
	Change in land use (Loss of agriculture potential)	Land use	Development; Operational	Medium	Limit through site locality & layout; Limit footprint; Remedy through rehabilitation to an end land use potential of agriculture after Closure.	Low
	Change in surface water drainage	Topography; Storm water flow; Water quantity; Ecosystem function	Development; Operational; Decommissioning	Medium	Control through storm water controls; Limit through site layout; Limit through operational procedures; Remedy through rehabilitation.	Medium
	Habitat loss and effect on the general biodiversity	Biodiversity; Ecosystem function	Development; Operational; Decommissioning	Low	Control through operational procedures; Remedy through landscaping and rehabilitation of disturbed areas; Remedy current degraded status through establishment of natural vegetation; Limit through site locality & layout; Limit footprint.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Cumulative impacts considering other activities within 1km (including sand mining & farming)	Destabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Development; Operational	Medium	Avoid unnecessary clearance of riparian vegetation; Limit disturbance by limiting access points to the river; Limit footprint; Avoid through operational procedures; Remedy through rehabilitation.	Low
Rehabilitation (e.g. removal of equipment, reshaping & reinstating disturbed areas, etc.)	Soil contamination from spillages and waste disposal	Soil; Land use	Decommissioning	Medium	Avoid through rehabilitation procedures and waste management; Remedy through clearance and reinstatement.	Low
	Water pollution due to spillages and waste disposal	Water quality	Decommissioning	Medium	Avoid through rehabilitation procedures and waste management.	Low
	Elevated noise levels	Noise; I&APs	Decommissioning	Low	Limit through rehabilitation procedures (including working hours).	Low
	Change in surface water drainage	Topography; Storm water flow; Water quantity; Ecosystem function	Decommissioning; Closure	Medium (Positive)	Achieve through landscaping and rehabilitation of disturbed areas; Achieve through storm water control measures, e.g. berms.	Low (Positive)
	Destabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Decommissioning	Low	Remedy through rehabilitation.	Low
	Erosion & loss of topsoil	Aesthetics; Land use; Soil	Decommissioning	Low	Control through storm water controls; Remedy through rehabilitation and reinstatement of affected areas; Control through erosion control & monitoring.	Low
	Establishment of alien vegetation	Vegetation; Biodiversity; Ecosystem function	Decommissioning	Medium	Remedy through rehabilitation; Control through monitoring and removal of invasive plants.	Low

Name of activity	Potential impact	Aspects affected	Phase	Significance (without mitigation)	Mitigation type	Significance (if mitigated)
Closure	Stabilisation of the riverbank	Riparian zone; Land use; Natural flow path	Post monitoring	Low (Positive)	Achieve through landscaping and rehabilitation of disturbed areas; Achieve through establishment of natural occurring vegetation.	Medium (Positive)
	Establishment of a self-sustaining ecosystem	Land use; Aesthetics; Biodiversity; Ecosystem function	Post monitoring	Low (Positive)	Achieve through landscaping and rehabilitation of disturbed areas; Achieve through establishment of natural occurring vegetation.	Medium (Positive)
	Job creation & skills upliftment: Retrenchment	Community; Economy	Post monitoring	Low	Limit through a retrenchment policy, aiming at re-employment at alternative sites (if possible); Limit impact through training to staff during operational phase.	Low

6. RECOMMENDED ENVIRONMENTAL MANAGEMENT AND MITIGATION MEASURES

Information gathered from the desktop study, specialist studies, site assessment and involvement from I&APs were used to identify the potential impacts expected to be associated with the proposed operation. Although there are impacts that have been identified that have been found to be associated with projects like this by experience, the actual occurrence of some of these impacts may be unlikely due to the specific nature, site layout, specific operational procedures that will be implemented and already degraded nature of the study area.

Refer to Table 11 for a description of the environmental management and mitigation measures to be implemented as minimum throughout all the phases of the operation to prevent and/or limit the environmental impacts. Also refer to Table 12 for a recommended monitoring programme to be followed during all the phases of the operation.

Table 11: Recommended environmental management/mitigation measures

Aspect	Recommended management/mitigation	Phase	Responsible person
Site establishment (Clearance of vegetation; establishment of equipment; establish access points; access road; etc.)	A Designated Environmental Officer (DEO) should be appointed and must be responsible for the daily environmental aspects related with the operation on site.	During commissioning, operational and decommissioning phases	Site manager
	All mining activities will be undertaken within the 1:100 year floodline and the 1:50 year floodline is uncertain. The alternative site layout with placement of the sifting and product stockpiles 100 m from the river and a buffer of 50 m will limit potential impacts on the backwater system and risks for an increase in sedimentation load during flooding (except in a 1:100 year flood).	During commissioning, operational and decommissioning phases	Site manager
	The route alignment of the access road must exclude the area of the stone-wall remains. The road alignment must also consider the safety guides of a powerline.	During commissioning and operational phases	Site manager
	Keep a photograph record of the site before any clearance during site establishment.	Prior to site clearance during commissioning.	Site manager / DEO
	No permanent infrastructure will be constructed on site, within the river or on the riverbank.	During commissioning	Site manager
	Limit removal of vegetation and topsoil to areas directly affected by the proposed operation.	During commissioning and operational phase	Site manager

Site establishment (Clearance of vegetation; establishment of equipment; establish access points; access road; etc.)	Clear any proclaimed weed or invasive vegetation on disturbed areas before seeding. Due to the locality of the site, the use of chemical substances will only be used if necessary and in accordance with the user specifications. The chemical should also be certified to be safe for use near a water resource.	During commissioning, operational and decommissioning phases	Site manager / DEO
	No fires will be allowed within the mining permit area if not in adequate facilities for this purpose.	During commissioning, operational and decommissioning phases	Site manager / DEO / ECO
	Storm water management measures, e.g. berms and channels will be implemented to control storm water at the site and on the gravel access road to prevent erosion.	During commissioning, operational and decommissioning phases	Site manager / DEO
	Any areas where erosion is evident will be repaired and appropriate measures will be implemented to prevent re-occurrence.	During commissioning, operational and decommissioning phases	Site manager / DEO
	A Water Use Authorisation for operational activities within the floodline and/or 100 m of the banks of the river must be obtained from the competent authority.	During commissioning; Prior to continuation of such activities	Site manager
	No toilet facilities or containers with substances likely to cause pollution will be situated within 100 m of the river.	During commissioning, operational and decommissioning phases	Site manager / DEO
	Ponding of water on site and stockpile areas will be managed and limited through storm water control measures, e.g. diversion berms and channels.	During operational phase	Site manager / DEO
	Nuisance dust is expected to be low due to the type of activity to be undertaken. However, dust will be controlled through the implementation of operational procedures, speed control on the access road and limiting loading of material during high wind periods.	During operational phase	Site manager / DEO
	Due to the locality and type of activities that will be associated with the proposed operation, the potential impact of nuisance noise is anticipated to be low. Mining activities will be limited to daytime working and speed control will be enforced on the access roads.	During commissioning, operational and decommissioning phases	Site manager / Drivers
Recovery of sand: Pumping and/or excavation (during dry periods only)	The site must be left in a safe and clean condition at the end of every day to limit any environmental risks/impacts.	During commissioning, operational and decommissioning phases	Site manager / Safety officer / DEO
	A floating pump will be located on the river and no permanent structure will be constructed in the river.	During operational phase	Site manager / DEO

Recovery of sand: Pumping and/or excavation (during dry periods only)	Pumping of sand will not be deeper than the bedrock.	During operational phase	Site manager / / DEO / Operator
	Excavation of sand from the riverbed during dry periods will not be deeper than the bedrock.	During operational phase	Site manager / DEO
	Recovery should be undertaken in such manner as to not negatively impact on the flow of the river. This includes the formation of depressions with standing water.	During operational phase	Site manager / DEO
	It is recommended that a buffer be implemented along the riverbank where limited pumping and/or removal of sand is undertaken to limit risks on the stability of the riverbank.	During operational phase	Site manager / DEO / ECO
	The implementation storm water control, erosion control and the re-vegetation of disturbed riparian areas will assist in maintaining stability of the riverbank.	During operational phase	Site manager / DEO
	Access points and ramps to the riverfront must be limited and unused points must be rehabilitated.	During operational phase	Site manager / DEO
	Ramps created with sand to gain access to the river must not affect the natural flow of the river. Unused ramps must be levelled to limit potential environmental risks.	During operational phase	Site manager / DEO
Containment area / Settling pond on the riverbank	The settling dams (if used) to be used for the settling of sand will be formed from sand on the site. No additional material will be imported and no physical structures will be constructed.	During commissioning and operational phases	Site manager / DEO
	Water from the settling dams or containment area will be allowed to drain back into the river via seepage or a channel. No consumptive water use will be undertaken as part of the operation.	During operational phase	Site manager / DEO
	Limit the number of containment areas on the riverbank to limit disturbed footprints.	During operational phase	Site manager / DEO
	Stockpiles of recovered sand on containment areas must not exceed a height of 2 m.	During operational phase	Site manager / DEO
Sifting and Stockpiling	Topsoil stockpiles will be placed in an area not prone to erosion for use during rehabilitation.	During commissioning and operational phases	Site manager / DEO
	Topsoil stockpiles will not exceed a height of 2m.	During commissioning and operational phases	Site manager / DEO
	Storm water management measures such as berms must be implemented to divert storm water around the stockpile area.	During operational phase	Site manager / DEO
	It is recommended that the alternative site layout be implemented. This will include placement of the sifting and product stockpile area at least 100 m from the river, limiting the potential impact of increased sedimentation load during high flow and flooding.	During operational phase	Site manager
	The sifting area and product stockpiles will be placed outside the backwater system. A buffer of at 32 m – 50 m from the system is recommended.	During operational phase	Site manager

Sifting and Stockpiling	Clear any proclaimed weed/alien species on stockpiles before seeding.	During commissioning, operational and decommissioning phases	Site manager / DEO
Loading & hauling	Material will be loaded directly from stockpiles onto transporting trucks.	During operational phase	Site manager / DEO
	Speed limits of maximum 40km/h will be enforced on transportation trucks on the gravel access road to prevent accidents and to limit dust generation.	During operational phase	Safety officer / Site manager
	The gravel access road on the property to the mining area will be maintained as and when necessary.	During commissioning, operational and decommissioning phases	Site manager
Water use activities	No consumptive water will be used as part of the operation.	During commissioning, operational and decommissioning phases	Site manager
	Due to the nature of the proposed activity, a Water Use Authorisation for a Section 21(c) and 21(i) water use in terms of the NWA, 1998 (Act 36 of 1998) will be required. The necessary approvals must be obtained from DWS prior to the commencement of any Water Use.	During commissioning, operational and decommissioning phases	Applicant / Site manager
Storage of material and substances with the potential to pollute (e.g. fuel, oil, gas)	Fuel, oil and lubrication products will be delivered to the site in acceptable containers as needed. No permanent storage of potential hazardous substances is recommended within the 1:100 year floodline of the river.	During commissioning, operational and decommissioning phases	Site manager / DEO
	If any products need to be temporary kept on site, it will be in a secured and bunded area with an impermeable lining to prevent pollution. This area will be located at least 100 m from the river.	During commissioning, operational and decommissioning phases	Site manager / DEO / ECO
Waste generation (i.e. domestic solid waste, sewage, hazardous waste)	Appropriate waste management and waste minimisation shall be implemented on site.	During commissioning, operational and decommissioning phases	Site manager
	Solid waste will be collected in appropriate bins on site and final disposal shall be at the nearest authorised landfill site on a weekly basis or more regularly if necessary.	During commissioning, operational and decommissioning phases	Site manager / DEO
	Any hazardous waste, e.g. used oil, lubricants and cleaning materials will be collected in a holding tank and sent back to the supplier or collected by a specialist oil recycling company.	During commissioning, operational and decommissioning phases	Site manager / DEO
	A temporary chemical toilet facility will be placed on site at least 100 m from the river. The facility will be cleaned regularly and any waste resultant from this facility will be disposed of appropriately.	During commissioning, operational and decommissioning phases	Site manager / DEO

Waste generation (i.e. domestic solid waste, sewage, hazardous waste)	No littering and/or disposal of any waste will be allowed on site.	During commissioning, operational and decommissioning phases	Site manager / DEO
	All sections of the NEM: Waste Act, 2008 (Act 59 of 2008) pertaining to the disposal of waste must be adhered to.	During commissioning, operational and decommissioning phases	Site manager / DEO
General operational activities	All mining equipment will be maintained in a good working condition and operations will be limited to daytime to limit noise disturbance.	During commissioning, operational and decommissioning phases	Site manager / Supervisor
	Any major services and/or repairs will be undertaken at a workshop. Only minor services will be allowed within a dedicated area during which appropriate management measures, e.g. drip trays, should be implemented to prevent any spillage of oil, diesel etc.	During commissioning, operational and decommissioning phases	Site manager / Supervisor
	Equipment, especially the pumping equipment must be checked daily for leakages to prevent contamination of the river.	During operational phase	Site manager / Supervisor
	Drip trays should be used at stationary vehicles to prevent and/or limit any spillages to the surrounding environment.	During commissioning, operational and decommissioning phases	Site manager / Supervisor
	Any spillage of a substance with a pollution risk should be cleaned immediately and the affected footprint reinstated.	During commissioning, operational and decommissioning phases	Site manager / DEO
	Any contaminated soil will be removed and placed into suitable receptacles for disposal at an appropriately permitted waste disposal facility. No treatment of waste or contaminated material must be undertaken within the floodline of the river.	During commissioning, operational and decommissioning phases	Site manager / DEO
	A register must be kept to record any complaints received from I&APs and any environmental incidents.	During commissioning, operational and decommissioning phases	Site manager / / DEO / ECO
	In the case of a major spill the responsible departments (i.e. DMR, DWS and DESTEA FS) will be notified within 24 hours.	During commissioning, operational and decommissioning phases	Site manager / DEO / ECO
	Employees will commute to site daily and no accommodation facilities will be established on site.	During commissioning, operational and decommissioning phases	Site manager / DEO / ECO

Heritage	Should any object or site of heritage importance be unearthed, activities in the immediate vicinity must be stopped and the South African Heritage Resource Agency will be contacted.	During commissioning, operational and decommissioning phases	Supervisor / Site manager
Health & Safety	PPE must be provided to employees on site. No person or contractor will be allowed on site without the necessary PPE.	During commissioning, operational and decommissioning phases	Site manager / Safety officer
	Health & Safety legislation must be adhered to at all times and the necessary induction will be provided to employees as per the required time frames.	During commissioning, operational and decommissioning phases	Site manager / Safety officer
	Access to the operational area must be controlled to limit safety risks.	During operational and decommissioning phases	Site manager / Safety officer
	All employees working with mining equipment and machinery should be properly trained in their specific tasks to limit injuries.	During commissioning and operational phases	Site manager / Safety officer / Operator trainer
	A register must be kept to record any incidents related to Health and Safety aspects.	During commissioning, operational and decommissioning phases	Site manager / Safety officer
	Raw water from the river is not considered to be safe for human consumption and should not be used for drinking and/or cooking purposes.	During commissioning, operational and decommissioning phases	Site manager / Safety officer / DEO
Environmental awareness	All employees should be given an induction on environmental awareness. This should include awareness of the environmental risks of their work and mitigation measures to be implemented in the event of an incident such as a major oil spill, etc. Proof of such induction will be kept on site for inspection on request.	During commissioning and operational phases	Site manager / DEO / ECO
Rehabilitation (e.g. removal of equipment, reshaping & reinstating disturbed areas, etc.) and Closure	Concurrent rehabilitation is to be undertaken where areas become available. Due to the nature and limited extent of physical disturbance footprints, the majority rehabilitation activities are expected during the decommissioning phase.	During operational and decommissioning phase	Site manager / DEO
	No equipment, waste or settling dams will remain on site after rehabilitation.	During decommissioning and Closure	Site manager / DEO / ECO
	Any waste on site during the Decommissioning Phase will be disposed of appropriately at a registered waste disposal facility.	During decommissioning and Closure	Site manager / DEO / ECO
	Final rehabilitation of disturbed areas, e.g. stockpile areas will include shaping, topsoil and establishment of vegetation.	During decommissioning and Closure	Site manager / DEO / ECO
	If it is found that vegetation does not establish within a reasonable time after rehabilitation the area must be seeded with a natural occurring vegetation to enhance stabilisation of the disturbed areas.	During decommissioning and Closure	Site manager / DEO / ECO

Rehabilitation (e.g. removal of equipment, reshaping & reinstating disturbed areas, etc.) and Closure	Depending on the end land use decided upon at the time, the mining permit area must be rehabilitated to an end land use potential of agriculture. Final rehabilitation of the access road will be depend on whether the landowner will use it for daily farming tasks.	During decommissioning and Closure	Site manager / / DEO / ECO
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Table 12: Recommended environmental monitoring programme

Aspect	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
Site establishment (Clearance of vegetation; establishment of equipment; establish access points; access road; etc.)	Clearance of riparian vegetation. Destabilisation of the riverbank. Establishment of alien vegetation. Habitat destruction. Impact on terrestrial fauna. Erosion and loss of topsoil. Change in land use (Loss of agricultural potential). Damage or destruction of objects/artefacts of heritage importance.	Visual checks; Verify compliance with conditions of the EA and EMP; Identify non-compliances; Monitor key parameters, e.g. noise levels.	Site manager Designated Environmental Officer Environmental Control Officer (when required)	Weekly visual checks for erosion and extent of vegetation clearance. Weekly visual checks for establishment of declared weeds or invasive plants. Clear and reinstate affected areas. Annual medical tests for employees on site. Report environmental incidents as soon as possible. Report findings of objects of potential heritage importance to the site manager. Record incidents and non-compliances. Implement management measures throughout the commissioning phase. Limit the footprint during commissioning. Management during commissioning, operational and decommissioning phases. Removal of equipment during decommissioning. Final rehabilitation of disturbed areas upon cessation of sand mining.
Recovery of sand: Pumping via floating pump or excavator equipped with a pump	Water quality: Increase in suspended solids. Water quality: Spillage of hydrocarbons, e.g. oil, diesel. Destabilisation of the riverbank.	Visual checks; Verify compliance with conditions of the EA and EMP; Identify non-compliances; Monitor key parameters, e.g. water quality.	Site manager Designated Environmental Officer Environmental Control Officer (when required)	Daily visual checks on equipment for leakage and/or malfunctioning. Report major pollution incidents to the Provincial Head: DWS within 24 hours. Water sampling of the river if there is reason to believe the water quality may be affected. Record incidents and non-compliances. Weekly visual checks on the stability of the riverbank. This includes any signs of subsidence and erosion. Management during operational and decommissioning phases. Concurrent rehabilitation as disturbed areas becomes available for rehabilitation. Final rehabilitation upon cessation of mining.

Recovery of sand: Excavating sand from the riverbed via excavator (only during dry periods)	Water quality: Increase in suspended solids. Water quality: Spillage of hydrocarbons, e.g. oil, diesel. Destabilisation of the riverbank.	Visual checks; Verify compliance with conditions of the EA and EMPr; Identify non-compliances; Monitor key parameters, e.g. water quality.	Site manager Designated Environmental Officer Environmental Control Officer (when required)	Daily visual checks on equipment for leakage and/or malfunctioning. Report major pollution incidents to the Provincial Head: Department of Water and Sanitation within 24 hours. Water sampling of the river if there is reason to believe the water quality may be affected. Record incidents and non-compliances. Weekly visual checks on the stability of the riverbank. This includes any signs of subsidence and erosion. Management during operational and decommissioning phases. Concurrent rehabilitation as disturbed areas becomes available for rehabilitation. Final rehabilitation upon cessation of mining during decommissioning.
Containment area / Settling pond on the riverbank	Surface water quality: Increase in suspended solids. Destabilisation of the riverbank.	Visual checks; Verify compliance with conditions of the EA and EMPr; Identify non-compliances; Monitor key parameters, e.g. water quality.	Site manager Designated Environmental Officer Environmental Control Officer (when required)	Weekly visual checks of the riverbank to identify any unstable areas. This includes any signs of subsidence and erosion. Record incidents and non-compliances. Management during operational phase. Final rehabilitation upon cessation of pumping during decommissioning.
Sifting	Dust generation	Visual checks; Verify compliance with conditions of the EA and EMPr; Identify non-compliances; Monitor key parameters.	Site manager Designated Environmental Officer Environmental Control Officer (when required)	Monitor dust fallout only when dust generation during sifting becomes problematic. Site layout determination during planning. Management during operational phase. Final rehabilitation during decommissioning phase.
Stockpiling	Dust generation. Change in surface water drainage. Erosion Establishment of alien vegetation.	Visual checks for loss of topsoil and alien vegetation; Verify compliance with conditions of the EA and EMPr; Identify non-compliances; Monitor key parameters.	Site manager Designated Environmental Officer Environmental Control Officer (when required)	Monitor dust fallout only when dust generation during sifting becomes problematic. Weekly visual checks for erosion and extent of vegetation clearance. Implement storm water management measures during establishment and operational phase to limit erosion from stockpiles. Weekly visual checks for establishment of declared weeds or invasive plants. Clear and reinstate affected areas. Site layout determination during planning.

				Management during operational phase. Final rehabilitation during decommissioning phase.
Loading & hauling	Dust generation. Deterioration of the gravel access road. Erosion & loss of topsoil.	Visual checks of the road; Verify compliance with conditions of the EA and EMPr; Identify non-compliances; Monitor key parameters.	Site manager Safety Officer Designated Environmental Officer Environmental Control Officer (when required)	Weekly visual checks for signs of deterioration of the road. Record incidents and non-compliances. Weekly visual checks for erosion on the access road and loading area. Implement storm water management measures during establishment and operational phase to limit erosion. Management during operational phase. Maintenance of access road during operational and decommissioning phase. Final rehabilitation of loading areas and unused haul roads during decommissioning.
Storage of material and substances with the potential to pollute (e.g. fuel, oil, gas)	Storage facilities (locality, capacity, functionality, etc.). Soil contamination. Water quality: Spillage of hydrocarbons, e.g. diesel. Fire risk.	Visual checks for contamination, spillages and damaged containers; Verify compliance with conditions of the EA and EMPr; Identify non-compliances	Site manager Safety Officer Designated Environmental Officer Environmental Control Officer (when required)	Daily visual checks for any leakage from containers. Report occurrence of fires to the supervisor immediately. Report environmental incidents as soon as possible. Report major pollution incidents to the Provincial Head: Department of Water and Sanitation within 24 hours. Record incidents and non-compliances. Management during commissioning, operational and decommissioning phase. Final rehabilitation during decommissioning phase.
Waste generation: General and domestic solid waste	Littering Fire risk.	Visual checks for littering; Verify compliance with conditions of the EA and EMPr; Identify non-compliances	Designated Environmental Officer Supervisor	Daily visual checks for any signs of littering. Clean any littering and dispose of collected waste at an authorised landfill facility. Report occurrence of fires to the supervisor immediately. Report environmental incidents as soon as possible. Waste management during commissioning, operational and decommissioning phase. Removal and disposal of remaining waste at Closure.
Waste generation: Sewage	Water quality: Spillage of sewage Soil contamination from spillages	Visual checks for contamination and spillages; Verify compliance with conditions of the EA and EMPr; Identify non-compliances	Designated Environmental Officer Supervisor	Daily visual checks for any leakage from containers. In the event of spillage, the affected area must be cleaned and reinstated. Contaminated soil/material must be managed appropriately. Management during commissioning, operational and decommissioning phase. Removal of facility at Closure.

General operational activities (Especially in respect of I&APs and employees)	<p>Visual scarring & impact on the general aesthetics of the area.</p> <p>Elevated noise levels.</p> <p>Risk of injury to people entering the operational area.</p> <p>Risk of injury to employees working with machinery/equipment on site.</p> <p>Change in land use (Loss of agriculture potential).</p> <p>Impact on terrestrial fauna.</p> <p>Establishment of alien vegetation.</p>	<p>Verify compliance with conditions of the EA and EMPr; Identify non-compliances; Complaints register with comments from I&APs; Visual checks on fences for snares; Log sheets of legal entrances to the mining area; Record of employee awareness training</p>	<p>Site manager Safety Officer Designated Environmental Officer Environmental Control Officer (when required) Independent consultant</p>	<p>The mining permit (if considered for approval) should be renewed within the first 2 years of the date of issue, after which it should be renewed annually for another 3 years.</p> <p>The mining and rehabilitation process will be monitored and controlled on a daily basis. Environmental incidents must be recorded and disclosed to the ECO for inclusion in the annual performance assessment report.</p> <p>Record incidents and non-compliances.</p> <p>Determine the extent of disturbance and clearance of the riparian zone and riverbank bi-annually. Limit disturbed areas by limiting the operational footprint and rehabilitate unused areas.</p> <p>Annual medical tests for employees on site.</p> <p>Monitor noise levels in high operational areas at risk of elevated noise due to the type of equipment (if necessary). A baseline measurement is recommended.</p> <p>Record daily entrance of people on site.</p> <p>Weekly visual checks for erosion and extent of vegetation clearance.</p> <p>Any complaints received from I&APs and regarding non-compliance with the EMPr will be recorded and measures will be implemented to mitigate the non-compliance.</p> <p>Weekly visual checks for establishment of declared weeds or invasive plants. Clear and reinstate affected areas.</p> <p>Report any signs of poaching to the site manager.</p> <p>Management and monitoring during operational and decommissioning phases.</p> <p>An annual performance assessment must be undertaken in accordance with the EIA Regulations, 2014 as amended. A financial provision review must form part of this assessment.</p>
Rehabilitation (e.g. removal of equipment, reshaping & reinstating disturbed areas, etc.) and Closure	<p>Soil contamination.</p> <p>Water pollution.</p> <p>Elevated noise levels.</p> <p>Destabilisation of the riverbank.</p> <p>Erosion</p> <p>Establishment of alien vegetation.</p>	<p>Visual checks for contamination and spillages; Verify compliance with conditions of the EA and EMPr; Identify non-compliances</p>	<p>Site manager Designated Environmental Officer Environmental Control Officer (when required)</p>	<p>Weekly visual checks for erosion and establishment of declared weeds or invasive plants during decommissioning. Clear and reinstate affected areas until stabilised.</p> <p>Monitor noise levels in high operational areas at risk of elevated noise due to the type of equipment (if necessary). High pitch noise is not expected during Decommissioning.</p> <p>Weekly visual checks on the stability of the riverbank. This includes any signs of subsidence and erosion.</p> <p>Daily visual checks on rehabilitation equipment for leakage</p>

				<p>and/or malfunctioning.</p> <p>Report environmental incidents.</p> <p>Record incidents and non-compliances.</p> <p>Monitor rehabilitated areas for one year after final rehabilitation.</p> <p>Concurrent rehabilitation of available areas during operational phase.</p> <p>Final rehabilitation during decommissioning.</p> <p>Removal of any equipment from site during decommissioning and Closure.</p> <p>Post monitoring to monitor rehabilitation until Closure.</p> <p>Development of retrenchment policy and training during operational phase.</p>
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