


Environmental Impacts (and Mitigations)

Table 1. Document control table.

ACTION	NAME	STATUS	REVISION	DATE	SIGNATURE
Prepared	Hlengile Mtsweni	Draft	00	April 2019	
Reviewed	Philip Radford	Draft	01	25 April 2019	
Prepared	Hlengile Mtsweni	Draft	02	26 April 2019	
Approved	Justin Bowers	Draft	03	29 April 2019	

“(d) through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine—

- (i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
- (ii) the degree to which these impacts—
 - (aa) can be reversed;
 - (bb) may cause irreplaceable loss of resources; and
 - (cc) can be avoided, managed or mitigated.” (Appendix 1, Regulation 2. (2) (d) of the EIA Regulations (2014) as amended).

The general objective of integrated environmental management is, *inter alia*, to “identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management” (Section 23(2)(b) of NEMA, 1998).

Ecoleges sets out to identify impacts and suggest mitigations by following the logical sequence of steps illustrated in **Figure 1**. The first step is to identify the potential listed activities. A clearly defined scope is absolutely critical for creating the mould within which the EMPr shall be cast. Environmental impacts are defined as any change to the environment, whether adverse or beneficial, wholly or partially resulting from those elements of the proposed activities that interact with the environment. Consequently, the activities need to be identified (step 2) before their impacts (step 3) can be predicted. Step 4 is incorporated as a safety net to capture those elements that are not identified in the previous two steps. Finally, mitigations are sought and tailored to counteract the project-specific impacts and achieve particular goals and objectives in line with environmental best practices.



Figure 1. Procedure for identifying project-specific mitigation of activities.

Identification of Activities

The activities summarised below (Table 1) were considered within the scope implicit in the potential listed & associated activities. The final column identifies the associated physical activities required for the successful implementation of the listed or actual activities.

Table 1. Typical physical activities associated with construction projects which shall apply to the construction of the Bospoort pipeline and reservoir.

Phased physical activities associated with pipeline & reservoir construction		
Activities	Yes/ No	Comments
Planning and Design		
Compliance with legal requirements by acquiring authorisations, permits and/or licenses for activities/uses undertaken during construction and operation	Yes	A Basic Impact Assessment in order to obtain Environmental Authorisation as well as an application for a Water Use License.
Sustainable resource requirements (water, energy, etc.) for lifespan of project	Yes	Construction water (dust suppression, wetting of bedding material etc.) can be sourced from several potential locations. 1. Bospoort WTW

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		<p>from the filter backwash sump; 2. Final effluent release point from Boitekong WWTW following permission from the operator (WSSA); in both above cases water must first be tested and show compliance with irrigation water quality standards GN 665, 6 September 2013); and 3. Bospoort Dam following granting of access from Department of Water & Sanitation – DWS). Potable water & electricity for the construction camp will need to be arranged by the contractor. Electricity will also need to be supplied on the pipeline for temporary Cathodic Protection until the anode beds have been installed. Operationally raw water will be abstracted from the Bospoort Dam and treated at the Bospoort WTW, stored at the new reservoir site before being distributed to the Rustenburg and its surrounds by the pipeline.</p>
<p>Layout and design including consideration of alternatives</p>	<p>Yes</p>	<p>There are three alignment alternatives for the pipeline route and two site alternatives for the treated water storage reservoirs. Various other alternatives have been considered in the “Alternatives” section (Appendix L, Annexure L1) of the Basic Assessment Report.</p>
<p>Taking and storing water. Altering, impeding or diverting the flow of water in a watercourse. Discharging waste or water containing waste into a water resource. Disposing of waste in a manner</p>	<p>Yes</p>	<p>A Water Use Authorisation will be obtained for these activities.</p>

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which may detrimentally impact on a water resource.		
Construction		
Site establishment (construction camp, sanitation, temporary accommodation and surveying)	Yes	One site camp will be established with necessary services, offices, storage, sanitation and laydown areas.
Contractor's employees (staff conduct, movement)	Yes	The construction areas will be appropriately demarcated in order to limit/keep a minimum footprint and ensure only authorised access.
Construction and use of temporary and permanent access roads	Yes	The project area is well serviced by provincial and district roads. Many of the existing access roads will be used, some of which will be widened (e.g. dirt dirt roads leading to the reservoir site) and additional temporary access roads constructed only where necessary.
Sourcing building material/sand	Yes	Commercial sources will be used.
Stockpiling and material laydown areas	Yes	Stockpiling and laydown areas will be established at the proposed construction camp which has been historically disturbed.
Clearing and grubbing	Yes	Clearing and grubbing will be done and included in the topsoil windrow/stockpile at commencement of construction and reinstated once construction is complete and rehabilitation is undertaken.
Blasting	Yes	Blasting may be required to remove several of the small rocky koppies to create adequate space for the new infrastructure.
Waste management (solid waste including 'spoil', liquid waste, separation, storage and disposal)	Yes	During construction and operation, waste will be

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		managed through an integrates waste management approach including avoidance, reuse, recycling and compliant disposal.
Hazardous material (fuel/oil, cement) management (storage and handling)	Yes	Fuel/oil and cement will be used, handled and stored during construction. Disposal of hazardous material will be dealt with under waste management.
Plant management (parking, driving, repair and maintenance, and refuelling)	Yes	There will be an area for plant management in the camp sites.
Building work (concrete work)	Yes	There will be concrete work for foundations of the reservoir, scour & air valve chambers and pump shafts.
Disturbing natural areas	Yes	The project area is already heavily transformed by mining, urbanisation and existing services but additional disturbance to the receiving environment will take place during construction.
Site rehabilitation	Yes	After all construction has taken place, any residual material will be removed and rehabilitation implemented to stabilise and restore ecological function where possible.
Operation (including maintenance)		
Operation employment	Yes	The municipality and its operators (service providers) will ensure adequate human resourcing to manage the pipeline which includes undertaking necessary preventative and emergency maintenance.
Consumption (energy, water, and other resources)	Yes	Limited resources will be required as the majority of the

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		pipeline is a gravity line, but electricity will be required for cathodic protection and pumping on the rising pipeline section to the reservoir.
Maintenance	Yes	The system will be maintained throughout its lifespan.
Waste management	Yes	Limited waste will be generated during the operational phase of the project. Waste water limits will need to be implemented during scour events.
Terrestrial and aquatic ecological management	No	Watercourse crossings and associated structures pose the greatest risk to the environment. These risks should already be largely addressed through appropriate design. Maintenance activities in these areas must be done with sensitivity and least impact possible.
Decommissioning		
Compliance with legal requirements by acquiring authorisations, permits and/or licenses for activities/uses undertaken during decommissioning.	Yes	Adherence to the approved EA, EMP & WUL.

In summary, the associated activities for the construction of the new Bospoort pipeline and reservoir include:

- Compliance with legal requirements,
- Limited site establishment and clearing and grubbing,
- Sourcing, storage/stockpiling and handling of material including water for construction,
- Construction of temporary construction & permanent operational (reservoir) access roads and/or widening of existing ones,
- Earthworks (infilling or depositing, dredging, excavation, removal or moving) and building/concrete work,
- Limited disturbance of natural areas and altering water courses,
- Management of employees, waste, hazardous material and plant,
- Site rehabilitation,
- Maintenance and waste management during operation, and
- Decommissioning.

IDENTIFICATION OF ACTUAL AND POTENTIAL IMPACTS

The impacts are considered within the scope implicit within the listed and associated activities. The relevant impacts resulting from the listed, actual and associated activities, including environmental, socio-economic and cultural heritage, comments received from Interested & Affected Parties and, where applicable, the findings contained in specialist studies (**Figure 2**).

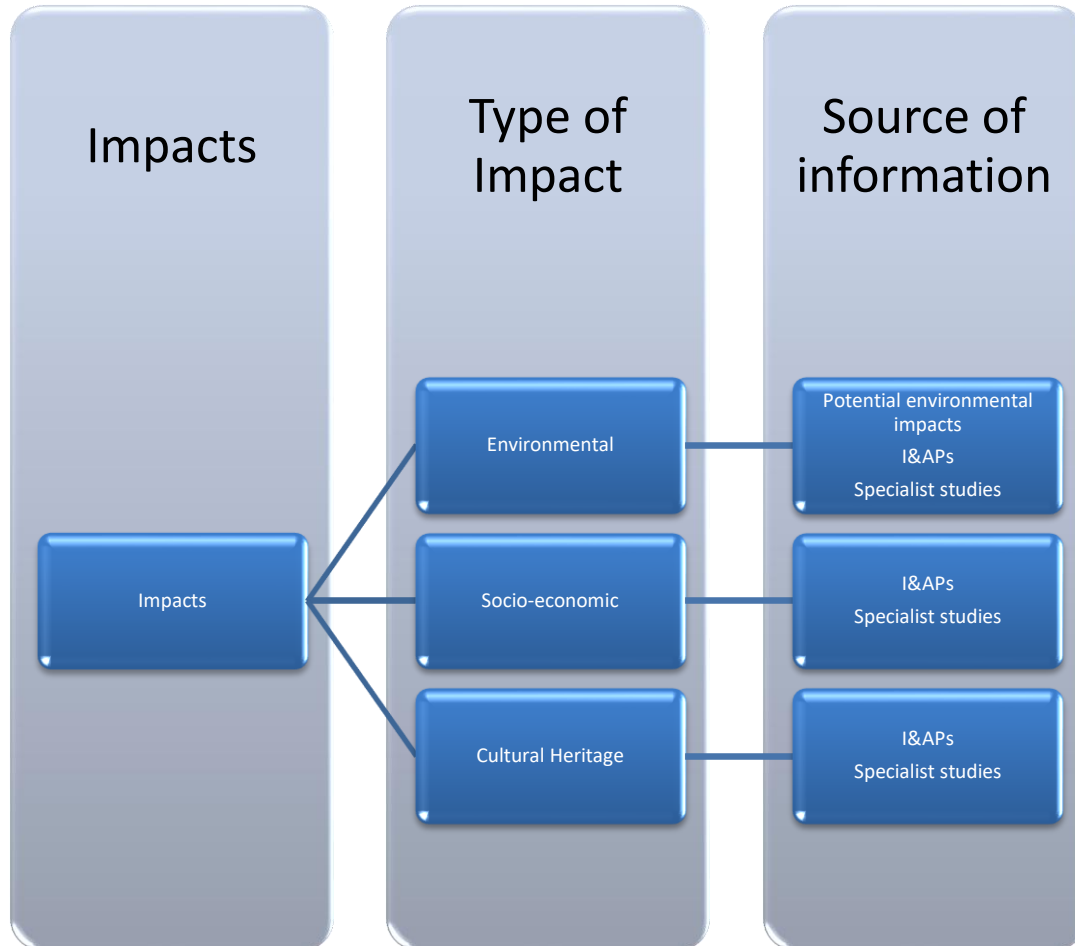


Figure 2: A breakdown of the different types of impacts including the resources used to identify them.

Predetermined Potential Environmental Impacts

The Impact Categories (**Table 2**) were determined by the manner in which the different potential environmental elements respond to human activities.

Table 2: Categorisation of Potential Environmental Impacts.

Impact Category	Receiving Environment	Description of Response
Abiotic elements (component scale impacts)		
Air pollution	Atmosphere	Air quality is changed.
Surface/Ground pollution	water Surface/Ground water	Water quality is changed.
Surface/Ground	water Surface/Ground water	Water quantity is changed.

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loss/gain		
Soil pollution	Soil	Soil quality is changed.
Soil/Rock loss/gain	Soil/Rock	Soil/Rock quantity is changed.
Biotic elements (component scale impacts)		
Terrestrial animal replacement*	Terrestrial fauna	Animal species are changed.
Terrestrial animal loss/gain	Terrestrial fauna	Animal numbers are changed.
Terrestrial plant replacement	Terrestrial flora	Plant species are changed.
Terrestrial plant loss/gain	Terrestrial flora	Plant numbers are changed.
Aquatic animal replacement	Aquatic fauna	Aquatic fauna species are changed.
Aquatic animal loss/gain	Aquatic fauna	Aquatic fauna abundance are changed.
Aquatic plant replacement	Aquatic flora	Plant species are changed.
Aquatic plant loss/gain	Aquatic flora	Plant numbers are changed.
Habitat (biotic and abiotic elements) (ecosystem scale impacts)		
Aquatic habitat loss/gain	Aquatic	Habitat size is changed.
Aquatic habitat transformation	Aquatic	Habitat is changed to an alternative state.
Aquatic habitat fragmentation	Aquatic	Habitat is broken up and no longer continuous.
Terrestrial habitat loss/gain	Terrestrial	Habitat size is changed.
Terrestrial habitat transformation	Terrestrial	Habitat is changed to an alternative state.
Terrestrial habitat fragmentation	Terrestrial	Habitat is broken up and no longer continuous.

- “replacement” of one species by another and “transformation” naturally includes the “loss” of all or some of the original species.
- Redundancy is avoided. For example, if an impact affects a tree, it is not recorded as affecting the habitat as well.

The relevant environmental impacts (**Table 3**) were determined through a process of elimination by establishing which Impact Categories (**Table 2**) are influenced by the identified physical activities within 32m of a watercourse (**Figure 1**).

Table 3: Relevant Environmental Impacts.

Impact Category	Description of Impact and Phase
Abiotic elements (component scale impacts)	
Air pollution	Construction: Clear and grub activities can liberate topsoil and cause entrainment. The construction camp can create light pollution at night. Smoke from open fires/burning waste.

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	<p>Noise from Contractor’s employees (when communicating verbally and/or when playing radios etc.).</p> <p>Dust may be generated from constructing and driving on access roads and when handling and stockpiling material/cement in windy conditions.</p> <p>Chemical toilets and other organic waste can produce an unpleasant odour.</p> <p>The operation of construction plant and equipment can generate noise, dust and emissions.</p> <p>Hauling of bedding material and selected backfill can cause dust entrainment.</p> <p>Operation: Limited noise pollution during certain maintenance activities.</p>
Surface water pollution	<p>Planning: Offence in respect of unlawful section 21 (a), (b), (c), (i), (f) & (g) water uses (Obtain authorisation from the DWS in terms of the NWA, 1998).</p> <p>Construction: Discharge or pumping dirty water from the works area, discharge of grey water from washing equipment, plant, or persons, and discharge of temporary sewage facilities from improper sanitation. Contamination from poor waste management (littering) including the incorrect handling, storage or disposal of waste. Contamination from spills when refuelling, parking, driving, repairing and operating plant nearby or within the watercourse. Contamination from improper handling and storage of fuel, oil and cement (slurry). Sedimentation resulting from the erosion of access roads. Sedimentation from stockpiling too close to the watercourse.</p> <p>Operation: Water released during scour events likely to influence receiving watercourse water quality including increases in turbidity and total suspended solids and decreased dissolved oxygen.</p>
Surface water loss/gain	<p>Construction: Water required for building work, including mixing concrete, and dust suppression including watering or compacting gravel roads can be used excessively/wastefully. Wetting of bedding material to assist with compaction will require a water supply.</p> <p>Operation: The pipeline takes raw water from the Bospoort Dam and as a result removes available water from the catchment below the dam wall.</p>
Soil pollution	<p>Construction: Contamination from improper sanitation. Contamination from improper waste management including the handling, storage and disposal of waste. Contamination from improper handling and storage of fuel, oil and cement. Contamination from spills when refuelling, parking, repairing and operating plant.</p>

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		Contamination from mixing cement on the ground. Operation: Residual waste left on the ground following maintenance work, especially concrete work likely to contaminate affected soil.
Soil/Rock loss/gain		Planning: Offence in respect of illegal sand mining (ensure that the commercial source used is licenced). Construction: Topsoil may unacceptably be used for building, specifically mixing concrete on unprotected surface. Gravel roads and pipeline excavations are also sources of erosion if not maintained or managed because they channel surface water flow. Contamination of sand from spills and when used as an absorbent in bunds and drip trays. Operation: Poor stormwater management will result in erosion. Scouring onto unprotected or poorly protected surfaces will result in erosion and export of soil.
Biotic elements (component scale impacts)		
Terrestrial replacement*	animal	N/A.
Terrestrial loss/gain	animal	Construction: Entrapment in excavations, suffocation from swallowing waste, and accidents from driving into or over animals. Clear and grub operations associated with the establishment of the construction camp, clearing of the fence line and the construction of temporary & permanent access roads can destroy mammals and birds directly. Material stockpiles and lay down areas can be located in undisturbed areas, covering tunnels, burrows or nesting fauna in/on the ground. The presence of contractors and labourers increases the risk of poaching for food or traditional medicine. Vehicle movement (driving) and placement (parking), including other construction equipment, can collide with and trample fauna, respectively. Blasting activities required to remove several rocky koppies is likely to discourage animal presence in and around the works. Operation: The removal of several small rocky koppies may remove suitable habitat to reptile species, and decrease the ecological value of the servitude.
Terrestrial replacement	plant	Construction: The disturbance created by clearing activities within plant communities removes naturally occurring species and creates favourable habitat for the life history strategies of undesirable plant species. Alien plants can also be introduced by importing foreign contaminated material including topsoil.

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<p>Terrestrial plant loss/gain</p>	<p>Planning: Offence in respect of disturbing, cutting or destroying any found protected plants in terms of the relevant legislation.</p> <p>Construction: The establishment of the construction camp, the demarcation of the additional footprint and the construction of temporary/permanent access roads will destroy plants. Construction activities, such as clearing, may extend beyond the development footprint, known as construction creep. Vegetation stockpiles, material stockpiles and lay down areas can be located in undisturbed areas, smothering living plants. Excessive traffic and dust can smother plants growing on the verge of gravel access roads. Concrete work, specifically mixing on bare ground can smother living plants and create a hard pan layer that prevents recovery. The immigration of contractors and labourers increases the risk of plants being harvested for firewood and/or traditional medicine. The movement of people, driving and parking of vehicles, and location of other construction equipment can trample plants. Loss of sensitive species (Threatened, Near-Threatened, Rare, Declining or Protected species).</p> <p>Operation: The new structures might have a shading effect that limits the recruitment of species, by predisposing these areas to only shade tolerant species. Access roads within the permanent servitude may limit the re-establishment of vegetation.</p>
<p>Aquatic animal replacement</p>	<p>N/A</p>
<p>Aquatic animal loss/gain</p>	<p>Construction: Pollutants (hydrocarbons, sediment, concrete/cement) may enter affected watercourses and water bodies through surface water runoff. Trenching through watercourses will cause damage to the beds and banks of the watercourse. Diverting the watercourse while trenching will affect the hydrology of the watercourse and the aquatic fauna upstream and downstream.</p>
<p>Aquatic plant replacement</p>	<p>N/A</p>
<p>Aquatic plant loss/gain</p>	<p>Construction: Pollutants (hydrocarbons, sediment, concrete/cement) may enter affected watercourses and water bodies through surface water runoff and cause a die-off of aquatic plants.</p>
<p>Habitat (biotic and abiotic elements) (system scale impacts)</p>	
<p>Aquatic habitat loss/gain</p>	<p>Construction: Significant pollution events in close proximity to watercourses (hydrocarbons, sediment, concrete/cement) may enter affected watercourses and water bodies through surface water runoff and cause a systemic change to the habitat, potentially of a temporary nature.</p>

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		<p>Operation: Periodic scouring events, that release sediment build-up in the pipeline into low lying areas and surface water bodies, may silt up aquatic habitat. Concrete encasement of installed pipeline will remove that section of natural habitat.</p>
Aquatic habitat transformation*		<p>Construction: Pollution events in close proximity to watercourses (hydrocarbons, sediment, concrete/cement) may enter affected watercourses and water bodies through surface water runoff and cause a systemic transformation to the habitat changing its characteristics.</p> <p>Operation: Periodic scouring events, that release sediment build-up in the pipeline into low lying areas and surface water bodies, may silt up aquatic habitat and transform sections into pseudo-terrestrial environments over time.</p>
Aquatic habitat fragmentation		<p>Construction: Pollution events in close proximity to watercourses (hydrocarbons, sediment, concrete/cement) may enter affected watercourses and water bodies through surface water runoff and cause fragmentation of the aquatic environment through a stratification of water quality and available habitat.</p> <p>Operation: Periodic scouring events, that release sediment build-up in the pipeline into low lying areas and surface water bodies, may silt up aquatic habitat and fragment it into different habitat sub-types.</p>
Terrestrial habitat loss/gain		<p>Construction: There will be some limited removal of vegetation both indigenous and exotic from the pipeline servitude, laydown areas & construction camp. Loss of habitat owing to the removal of vegetation at the proposed development.</p> <p>Operation: Poor rehabilitation effort across the full servitude length will result in lost habitat.</p>
Terrestrial habitat transformation		<p>Construction: There will be some limited removal of vegetation both indigenous and exotic from this area, transforming the servitude from a vegetated zone to one devoid of stabilizing vegetation cover. Loss of connectivity and conservation corridor networks in the landscape. Contamination of soil during construction in particular by hydrocarbon spills. An increased infestation of exotic or alien invasive plant species owing to disturbance.</p> <p>Operation: Poor or incomplete rehabilitation can result in an altered state of vegetation cover and habitat strongly aligned with pioneer and alien invasive species.</p>
Terrestrial habitat		<p>Construction:</p>

fragmentation	<p>Construction will impact on habitats and fragment them on a temporary basis through constant human activity and presence as well as stockpile and laydown areas.</p> <p>Operation: The pipeline servitude fragments the indigenous vegetation landscape, no more though than the adjacent roads and land uses.</p>
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- * “replacement” of one species by introducing another and “transformation” naturally includes “loss” of the original species.
- Redundancy is avoided. For example, if an impact affects a plant, it is not recorded as affecting the habitat as well.

Methodology for Assessing Environmental Aspects & Impacts

Requirement of Appendix 1, Regulation 3. 1 (h) (vi): *“the methodology used in identifying and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives”.*

Natural environmental, socio-economic, cultural heritage and terrestrial impacts were assessed using the approach outlined below.

Natural environmental, socio-economic, cultural heritage and terrestrial impacts were identified systematically by considering how the site-specific activities for each phase of development will interact with all elements of the receiving environment. All impacts, including those identified by I&APs and Specialists, will be measured against the current land-use activity (the no-go option / option of not implementing the activity) and systematically assessed by rating a suite of criteria (**Tables 4, 5 & 6**) informed and adapted from the Department of Environmental Affairs and Tourism (DEAT 2002). The criteria are:

- Extent or spatial scale,
- Intensity or severity of the impact,
- Duration of the impact,
- Mitigatory potential,
- Social acceptability,
- Degree of certainty,
- Status of the impact, and
- Legal requirements.

The magnitude and significance of impacts were determined by describing the impacts in terms of the above criteria. The criteria provide a consistent and systematic basis for the comparison and application of judgements.

The suite of criteria was sought for its applicability to EIA regulations, specifically by making provision for the variety of perspectives. Significance is an anthropocentric concept that makes use of value judgements and science-based criteria. Judgement and values are used to greater extent in EIA than

science-based criteria and standards (DEAT 2002). Considering value judgements can vary greatly amongst different stakeholders, professional judgement, such as that of the EAP, should ideally be used in conjunction with the different value judgements expressed by various stakeholders. In other words, significance should be communicated from a variety of perspectives other than the professional opinion of a multidisciplinary study team, and include environmental, socio-economic or cultural attributes perceived by society to be significant. Despite the potential variety of perspectives, they can be categorized into three broad forms of recognition for determination of impact significance, namely institutional (laws, plans or policy statements), public and technical (scientific or technical knowledge or judgement of critical resource characteristics) (DEAT 2002). Consequently, the magnitude and significance of impacts were as far as possible determined by reference to legal requirements, accepted scientific standards and / or social acceptability.

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Table 4: Impact Evaluation Criteria, Ratings and Descriptors.

Assessment criteria for the evaluation of impacts		
CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	National	Within the country
	Regional	Within the province/ recognised region
	Local	On site or within 1000 m of the impact site
		Along the alignment and within 500m of the line on each side
		Within the immediate and operational Area
Magnitude of impact (at the indicated spatial scale)	High	Social and / or natural functions and / or processes are severely altered
	Medium	Social and / or natural functions and / or processes are notably altered
	Low	Social and / or natural functions and / or processes are slightly altered
	Very Low	Social and / or natural functions and / or processes are negligibly altered
	Zero	Social and / or natural functions and / or processes remain unaltered
Duration of impact	Short term	Construction period
	Medium Term	Up to 10 years after construction
	Long Term	More than 10 years after construction
*NOTE: Where applicable, the magnitude of the impact must be related to the relevant standard (threshold value specified, and source referenced).		

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Definition of significance

The “significance” of an impact is derived by considering the temporal and spatial scales and magnitude. Such significance is also informed by the context of the impact, i.e. the character and identity of the receptor of the impact. The means of arriving at the different significance ratings is explained in the following table, developed as a means of minimizing subjectivity in such evaluations, i.e. to allow for replicability in the determination of significance.

Table 5. Significance ratings with associated criteria.

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	High magnitude with a regional extent and long-term duration
	High magnitude with either a regional extent and medium-term duration or a local extent and long-term duration
	Medium magnitude with a regional extent and long-term duration
Medium	High magnitude with a local extent and medium-term duration
	High magnitude with a regional extent and construction period or a site-specific extent and long-term duration
	High magnitude with either a local extent and construction period duration or a site-specific extent and medium-term duration
	Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term
	Low magnitude with a regional extent and long-term duration
Low	High magnitude with a site-specific extent and construction period duration
	Medium magnitude with a site-specific extent and construction period duration
	Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term
	Very low magnitude with a regional extent and long-term duration
Very low	Low magnitude with a site-specific extent and construction period duration
	Very low magnitude with any combination of extent and duration except regional and long term
Neutral	Zero magnitude with any combination of extent and duration

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Table 6. Risk Rating categories and matrix

EXTENT	MAGNITUDE	DURATION	COMBINED	RISK RATING
Local	High	Long Term	LocalHighLong Term	High
Local	High	Medium Term	LocalHighMedium Term	Medium
Local	High	Short term	LocalHighShort Term	Low
Local	Low	Long Term	LocalLowLong Term	Low
Local	Low	Medium Term	LocalLowMedium Term	Low
Local	Low	Short term	LocalLowShort Term	Very Low
Local	Medium	Long Term	LocalMediumLong Term	Medium
Local	Medium	Medium Term	LocalMediumMedium Term	Medium
Local	Medium	Short term	LocalMediumShort Term	Low
Local	Very Low	Long Term	LocalVery LowLong Term	Low
Local	Very Low	Medium Term	LocalVery LowMedium Term	Very Low
Local	Very Low	Short term	LocalVery LowShort Term	Very Low
Local	Zero	Long Term	LocalZeroLong Term	Neutral
Local	Zero	Medium Term	LocalZeroMedium Term	Neutral
Local	Zero	Short term	LocalZeroShort Term	Neutral
National	High	Long Term	NationalHighLong Term	High
National	High	Medium Term	NationalHighMedium Term	High
National	High	Short term	NationalHighShort Term	High
National	Low	Long Term	NationalLowLong Term	Medium
National	Low	Medium Term	NationalLowMedium Term	Low
National	Low	Short term	NationalLowShort Term	Low
National	Medium	Long Term	NationalMediumLong Term	Medium
National	Medium	Medium Term	NationalMediumMedium Term	Medium
National	Medium	Short term	NationalMediumShort Term	Medium
National	Very Low	Long Term	NationalVery LowLong Term	Medium
National	Very Low	Medium Term	NationalVery LowMedium Term	Very Low
National	Very Low	Short term	NationalVery LowShort Term	Very Low
National	Zero	Long Term	NationalZeroLong Term	Neutral
National	Zero	Medium Term	NationalZeroMedium Term	Neutral
National	Zero	Short term	NationalZeroShort Term	Neutral

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Regional	High	Long Term	RegionalHighLong Term	High
Regional	High	Medium Term	RegionalHighMedium Term	High
Regional	High	Short term	RegionalHighShort Term	Medium
Regional	Low	Long Term	RegionalLowLong Term	Low
Regional	Low	Medium Term	RegionalLowMedium Term	Low
Regional	Low	Short term	RegionalLowShort Term	Low
Regional	Medium	Long Term	RegionalMediumLong Term	High
Regional	Medium	Medium Term	RegionalMediumMedium Term	Medium
Regional	Medium	Short term	RegionalMediumShort Term	Medium
Regional	Very Low	Long Term	RegionalVery LowLong Term	Low
Regional	Very Low	Medium Term	RegionalVery LowMedium Term	Low
Regional	Very Low	Short term	RegionalVery LowShort Term	Very Low
Regional	Zero	Long Term	RegionalZeroLong Term	Neutral
Regional	Zero	Medium Term	RegionalZeroMedium Term	Neutral
Regional	Zero	Short term	RegionalZeroShort Term	Neutral

Table 7. Mitigatory potential.

Criteria	Ratings and Descriptors			
	High (4)	Moderate (3)	Low (2)	No Impact (1)
Mitigatory Potential	High potential to mitigate and achieve objectives.	There is a moderate potential to mitigate and achieve objectives.	There is a potential to mitigate, but there remains a risk of the objectives not being met.	No mechanism for mitigation and achieving the objectives.
Acceptability	Unacceptable Abandon project or design.	Manageable with expensive regulatory controls and the project proponent's commitments.	Some risk to public health / environment, but it is easily averted using simple controls / mitigations.	Acceptable. No risk to public health / environment.
	Definite (D- 4)	Probable (P -3)	Improbable (I-2)	No Impact (N-1)
Degree of Certainty / Probability of the impact occurring	Substantial supportive data. Impact will occur regardless of preventive measures. High probability. >95%.	There is a chance / risk of the impact occurring. Moderate probability. 5-95%.	It is unlikely that the impact will occur. Low probability. <5%.	The impact will not occur. 0%.

Assessment of Impacts

The identified actual and potential Impacts, including the relevant environmental impacts, are segregated amongst the different phases of implementation (planning and design, pre-construction and construction, operation and decommissioning, where applicable) so that they can be logically managed/mitigated for by the responsible role players at the appropriate time. Apart from the afore-mentioned impacts, a number of mandatory impacts (for consideration during the planning and design phase) are included for evaluation in all environmental impact assessments, including, *inter alia*, Potential Offences and Consumption of Resources. Furthermore, 'Degradation' is defined and treated as an impact during construction.

The impacts of the proposed pipeline and reservoir are assessed as follows:

Alternative 1 (Preferred): The proposed pipeline route is to run on the north western side of the R510 outside of the existing road reserve.

Alternative 2: The proposed pipeline route is to run on the north western side of the R510 inside the existing road reserve.

Alternative 3: The proposed pipeline route is to run on the south eastern side of the R510 within the existing historical/old pipeline servitude.

No-go Option: The option of not implementing the activity.

Reservoir 1 (Preferred): The reservoir is to be constructed on top of the hill in an already disturbed and cleared area by mining activities.

Reservoir 2: The reservoir is to be constructed on top of a hill in an untransformed area.

Planning and Design Phase

Impact 1 Potential Offences

Description

- **Illegal commencement of activities.** Commencement of construction of the proposed pipeline prior to the issuance of an Environmental Authorisation issued by the North West Department of Rural, Environment and Agricultural Development (DREAD) will constitute an offence contemplated in the National Environmental Management Act (Act No. 107 of 1998)¹.
- **Protected Plants.** Clearing operations in the plant servitudes will disturb or destroy natural flora, including protected plants. Licenses / permits are required prior to impacting protected trees in terms of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004)², the National Forests Act (Act No. 84 of 1998) and any relevant provincial ordinances. According to the specialist report, the only protected species likely on the project footprint is *Sclerocarya birrea* (Marula).
- **Mining.** Material will be required for construction materials. Borrow pit licensing is classified as small-scale mining under the Mineral and Petroleum Resources Development Act, 1991 (Act 50 of 1991) and is administered by the Department of Minerals and Energy, through whom any permit applications must be submitted⁴.
- **Altering a watercourse and discharging water.** The new pipeline and reservoir will trigger the following Water Uses: Section 21 (c) & (i)⁵. The section 21(i) water use means any change affecting the resource quality within the riparian habitat or 1:100 year flood line, whichever is the greater distance⁶. Any person who contravenes any provision of section 151(1) of the NWA, 1998 is guilty of an offence and liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment.
- **Access Roads.** Any new construction of access roads will need to be authorised in terms of the NEMA listed activities, 2014 if they exceed certain thresholds⁷.
- **Compliance Monitoring.** Construction may commence prior to the appointment of an Environmental Control Officer (ECO), which is a condition of this EMPr.

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Uncertainties & limitations with predicting this impact

- None known.

Assumptions made when assessing the impact

- Certain protected plants may be disturbed during construction for which permits will be required.
- Construction material will be sourced from a commercial source.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	H
	With	3	2	Negative	
Alternative 2	Without	4	3	Negative	H
	With	3	2	Negative	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	3	Negative	H
	With	2	2	Positive	
Reservoir 2	Without	3	3	Negative	H
	With	2	2	Positive	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

1. National Environmental Management Act (Act 107 of 1998).
2. National Environmental Management: Biodiversity Act (Act No. 10 of 2004).
3. The National Forests Act (Act No. 84 of 1998), including Schedule in Government Notice No. 1042, dated 10 September 2004.
4. Mineral and Petroleum Resources Development Act (Act 28 of 2002).
5. National Water Act (Act No. 38 of 1998).
6. DWA (2007), Guideline for Developments within a Flood line (Edition 1), Department of Water Affairs and Forestry, Pretoria, South Africa.
7. GN No. R. 985, 17th April, 2017 (LN3).

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Section 24G of NEMA allows for the rectification of unlawful commencement or continuation of a listed activity.
- Non-compliance with other legislation may result in criminal prosecution or other actions provided for in the relevant legislation.

Mitigations

Goal: Achieve compliance.

Objective(s) (including targets):

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- Comply with all relevant legislation.

Impact 1 Potential Offences		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Applicant	No upgrade or expansion shall commence prior to the issuance of an Environmental Authorisation (EA) by the DREAD.
Avoidance	Applicant EAP	The Applicant shall apply for and obtain a water use license for and prior to commencing with the following water uses: <ul style="list-style-type: none"> • Section 21(a) "Taking of water" from a water resource. The pipeline will abstract water from the Bospoort Dam. • Section 21(b) "Storing of water". • Section 21 (c) "altering the beds or banks of a watercourse". • Section 21 (i) "impeding or diverting flow within a watercourse".
Avoidance	Applicant ECO	No trees whether in the construction camp or in the construction site, may be removed without the necessary permission being in place, where applicable.
Avoidance	Applicant	A suitably experienced and independent ECO shall be appointed prior to the commencement of construction to oversee construction, including the ensuring the identification and permitting/licensing of protected plants prior to clearing.
Avoidance	Applicant, Engineer, Design Engineer	All structures within the 1:100-year flood line or riparian zone must minimise restriction of flow of the affected watercourse as far as possible.
Avoidance	Applicant, Engineer, Design Engineer	The 1:100-year flood line and/or riparian zone shall be indicated on all layout plans.
Avoidance	Applicant	The Contractor shall obtain imported material from a licensed, commercial source.

Construction Phase

Impact 1 Pollution of air (quality) directly through the generation of dust, noise and emissions

Description

- Smoke from open fires/burning waste,
- Noise from Contractor's employees (when communicating verbally and/or when playing radios etc.),
- Dust may be generated from constructing and driving on gravel access roads,
- Dust may be generated when transporting, handling and stockpiling material/cement in windy conditions,
- Chemical toilets and other inorganic/organic waste can produce an unpleasant odour,
- The operation of construction plant and equipment can generate noise, dust and emissions,

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- Clear and grub activities can result in the liberation of topsoil with subsequent dust entrainment,
- Hauling of bedding and selected backfill can result in dust entrainment.

Uncertainties & limitations with predicting this impact

- The magnitude of the impact, specifically the effects on ambient air quality, was not known.

Assumptions made when assessing the impact

- Construction vehicles will not generate any more dust on existing gravel roads than currently experienced and will remain within acceptable limits².
- Noise will not become a nuisance or disturbance¹ as construction activities are of a small-scale and limited plant will be used during construction. Controlled blasting will be undertaken to reduce noise and dust emissions.
- Dust generation will be restricted to delivering, handling and stockpiling of material.
- None of the activities require an atmospheric emissions license³.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

1. Schedules 4 and 5 of the National Regulations regarding Noise Control made under section 25 of the Environment Conservation Act, 1989 (Act 73 of 1989) in GN No. R 154 of Government Gazette No. 13717 dated 10 January 1992. Note that section 25 of the Environment Conservation Act is not repealed by NEMA (107 of 1998).
2. National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) and the National Dust Control Regulations (GN No. R. 827, 1 November 2013).
3. List of activities which result in atmospheric emissions. Government Notice No. 248 in Government Gazette No. 33064 of 31 March 2010.

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

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- Impact reversibility is determined by nature and extent of the impact on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage.
- Air pollution contributes to a global concern called the greenhouse effect.

Mitigations

Goal: Control air pollution

Objective(s) (including targets):

- To reduce noise levels to within locally, socially & regulatory acceptable limits such that it does not become a disturbing noise or noise nuisance.
- To reduce dust emissions to within locally, socially & regulatory acceptable limits.
- To reduce foul-smelling odours from the chemical toilets or waste.
- To prevent the generation of smoke from activities other than cooking.
- To prevent windblown dust from delivering material.
- To reduce windblown dust from handling material and/or cement.
- To reduce dust emissions and noise from blasting activities.

Impact 1: Pollution of air directly through the generation of light, dust, noise and emissions		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Contractor	Noise levels should be in accordance with Schedules 4 and 5 of the National Regulations regarding Noise Control made under section 25 of the Environment Conservation Act.
Avoidance	Contractor	Construction shall be limited to daylight hours to be determined by the Rustenburg Local Municipality.
Avoidance	Contractor	Refuse bins must be cleared and cleaned on a daily basis. All waste bins shall have lids.
Avoidance	Contractor	Do not litter, burn or bury waste on any property.
Avoidance	Contractor	Open fires are prohibited.
Avoidance	Contractor	Trucks transporting material shall be covered.
Avoidance	Contractor	In the event of complaints received, dust fallout will be measured against compliance with the National Dust Control Regulations.
Avoidance	Design Engineer	The Design Engineer must be aesthetically sensitive in terms of location and design. Do not jeopardize the visual integrity & the 'sense of place' of the region concerned through inappropriate location or design.
Reduction	Contractor	Construction plant and equipment shall be kept in good working order.
Reduction	Contractor	Chemical toilets shall be kept hygienic and cleaned daily.
Reduction	Contractor	Chemical toilets shall be emptied when the drums are half full.
Reduction	Contractor	Do not handle material and cement during excessively windy conditions.
Reduction	Contractor	Controlled blasting must be undertaken to reduce noise and dust emissions.

Impact 2 Loss of surface and ground water (quantity) directly through construction activities and alien plants

Description

- Water required for human needs (drinking, sanitation and food preparation) and building work, including mixing concrete and watering gravel roads can be used excessively/wastefully.
- Alien plants are a threat to our natural water resources.

Uncertainties & limitations with predicting this impact

- The magnitude of the impact, specifically the quantities of water required for human needs and construction activities, including the amount likely to be wasted, was not known.
- The amount of water required for construction purposes was unknown including dust suppression on gravel roads.

Assumptions made when assessing the impact

- Limited dust suppression will be required on gravel access roads due to RLM being a water scarce area. Alternative dust suppression technologies should be investigated and considered.
- Water will be required by staff for human needs.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

- None

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

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- Water is a limited resource in South Africa. However, the potential impact of water loss associated with construction activities will be once-off and does not constitute an additional and permanent off-take from the resource. The extent to which it is replaceable is dependent on subsequent rainfall and regeneration of the resource. The offtake for construction purposes could be permitted under the revised abstraction allocation assigned in the WUL according to the increased operation quota.

Mitigations

Goal: Control water use during construction.

Objective(s) (including targets):

- To prevent the excessive use or wasteful loss of water.
- To use only the absolute minimum amount of water required for human needs and construction.

Impact 2 Wasteful loss of water (quantity) directly through construction activities		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Contractor	Water leaks shall be repaired immediately upon being found.
Avoidance	Contractor	Water shall be used sparingly for construction activities.
Avoidance	Contractor	Water taps shall be closed when not in use.
Avoidance	Contractor	The Contractor shall water gravel access roads sparingly. To reduce water usage, a suitable soil binder must be used in dust suppression activities.
Avoidance	Contractor	Exercise measures to protect and conserve the water resources by removing existing alien plants and discourage recruitment and recolonisation of the alien plants at and around the disturbed area(s).
Reduction	Applicant/Architect	Reuse and recycling of water could be considered for the operational aspects of the pipeline and reservoir e.g. further treatment of effluent for sanitation and landscaping purposes.

Impact 3 Loss of soil/rock (quantity) directly from erosion, sand mining, contamination and mixing

Description

- Topsoil can be mixed with cement, subsoil or pulverised by trucks.
- The contamination of topsoil with other soil types when stockpiling.
- The clearing of vegetation for the pipeline & reservoir construction will create exposed surfaces that channel uninterrupted flow and cause erosion, particularly on steep slopes.
- Gravel roads and excavations are also sources of erosion if not maintained or managed.
- Lost soil from erosion of access roads.
- Loss of soil from removal of in situ material to be used in foundation and mixing cement.
- Contamination of sand from spills and contamination of sand used as an absorbent in bunds and drip trays.
- The damming or ponding of water may cause soil erosion.

Uncertainties & limitations with predicting this impact

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- The magnitude of the impact, specifically the amount of soil that will be infilled and removed, and lost to erosion and contamination, is not known.

Assumptions made when assessing the impact

- The contractor will construct/expand limited additional access roads.
- Erosion is a natural phenomenon and cannot be prevented without permanent and/or hard structures. It can, however, be controlled and reduced.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

- None.

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Lost topsoil cannot be replaced, unless imported from elsewhere, given the geological scale required for its creation through the weathering of parent material/rock.
- The extent of reversibility is dependent on the severity of the erosion, including the nature of the remaining *in situ* material, the amount of soil that has been exported from a site and whether or not the exported soil is recoverable. For example, soil washed from a gravel road into a mitre drain can be graded back onto the surface of the road, whereas soil that is washed from a gully into a water course is not recoverable and the source cannot be reinstated without significant intervention and cost. Although erosion has the potential to irreversibly change the relief, eroded sites can be stabilized through rehabilitation measures.

Mitigations

Goal: Control the loss of soil, especially topsoil.

Objective(s) (including targets):

- To avoid/reduce erosion in the works area.
- To reduce and prevent the contamination of soil.

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- To preserve the topsoil.
- To restrict sand mining to authorized areas.

Impact 3 Irretrievable loss of soil through erosion, sand mining, and contamination		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Contractor	Use drip trays for refueling, repair/maintenance work and all moveable & stationary construction plant and equipment that can leak, such as TLB's, compressors and generators.
Avoidance	Contractor	Sand or soil is prohibited from being used as an absorbent in drip trays, bunds or to cover spills.
Avoidance	Contractor	The contractor shall obtain imported material from a licensed, commercial borrow pit.
Avoidance	Contractor	The Contractor is prohibited from driving on topsoil stockpiles and windrows. Vehicles and other construction equipment shall be confined to the construction camp site, roads and demarcated work areas when being driven, operated and parked/placed.
Avoidance	Contractor	Topsoil shall not be used for building or mixed with cement. It is to be used for rehabilitation only.
Avoidance	Contractor	Topsoil shall be windrowed separately from the subsoil and opposite the working side of the trench (where applicable).
Avoidance	Contractor	All manholes on site must be raised above natural ground level to avert storm water ingress and subsequent loss of soil.
Avoidance	Contractor	Excess soil/rock shall be used to rehabilitate erosion gullies.
Reduction	Contractor	Protect all areas susceptible to erosion by installing all the necessary, temporary and/or permanent mechanisms for controlling/diverting storm water run-off, dissipating water energy and encouraging infiltration as soon as possible.
Rectification	Contractor	Correct any cause of erosion at the onset thereof by controlling/diverting storm water run-off, immediately repairing and stabilizing/rehabilitating impacted areas in the most appropriate manner.
Reduction	Contractor	Appropriate mitigation to control/reduce sediment input into rivers shall be implemented during construction.
Reduction	Contractor	Construction plant and equipment shall be kept in good working order.

Impact 4 Pollution (quality) of soil and surface water directly through contamination by construction activities and sedimentation

Description

The same types of activities that can pollute the ground, can impact the watercourse given the proximity of the activities to the watercourse and the potential for storm water run-off to carry pollutants into the watercourse.

- Construction activities will produce solid and liquid waste, which can contaminate the ground and watercourse if inappropriately handled, stored or disposed.
- Construction plant and equipment can drive through and/or be washed into the watercourse.

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- Hazardous materials (fuel, oil, cement & paint) can contaminate the ground and watercourse if inappropriately stored and handled, such as concrete mixing (slurry).
- Prolonged exposure of disturbed areas, including trenches, within a watercourse will increase the risk of seasonal flows, causing erosion and sedimentation.
- Stockpiled/windrowed material can wash into a watercourse.
- Discharge or pumping dirty water from the works area.
- Discharge of grey water from washing equipment, plant, or persons.
- Discharge of sewage from improper sanitation within the watercourse.
- Contamination from spills when refuelling, parking, driving, repairing and operating plant nearby or within the watercourse.
- Spills can be covered with virgin soil or be washed into the watercourse by storm water run-off.
- Sedimentation of the watercourse can result from the erosion of exposed areas adjacent to or within the watercourse, including access roads.
- Contamination of the ground and watercourse from improper sanitation.

Uncertainties & limitations with predicting this impact

- The magnitude of the impact, specifically the extent and severity of the soil and water pollution, is not known.
- The volumes and types of different waste produced by individuals, construction and plant are unknown.

Assumptions made when assessing the impact

- The mitigation(s) proposed for addressing erosion will concurrently control sedimentation.
- Fuel tanks including their bunds will not be constructed within 32m from the edge of the watercourse/wetland. They will be constructed within the main construction camp.
- Fuel drums, if any, will be stored and handled at the main construction camp.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

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Reference (legal, scientific, social or other criteria)

1. The National Water Act (Act 36 Of 1998) is administered by the DWS.
2. Furthermore, the impact is assessed against the natural conditions that occurred before the immigration of man or machine. In other words, the contractor has to leave a site in the same condition or better than he/she found it (as close as possible to baseline conditions).

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Soil is a valuable and finite resource given the geological scale required for its creation through the weathering of parent material/rock. The adoption of a site-specific and integrated waste management strategy can avoid the impact entirely, apart from unforeseen accidents. In the latter case impact is reversible if prompt action is taken to confine the waste, dispose of it appropriately and rehabilitate the affected site.
- The reversibility of surface water pollution is dependent on the nature and extent of the pollution.

Mitigations

Goal: Control soil and surface water pollution.

Objective(s) (including targets):

- To prevent all manner of waste from entering the pristine environment.
- To reduce soil and water contamination, including *inter alia* sedimentation, associated with construction activities.

Impact 4 Pollution of soil (quality) and surface water (quality) directly through contamination by construction activities, sedimentation or fishing		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Contractor	No waste material of any nature is to be left alongside the road or disposed of by dumping in the bush.
Avoidance	Contractor	Do not litter, burn or bury waste on any property.
Avoidance	Contractor	A dustbin shall be available at each work front during working hours.
Avoidance	Contractor	The contractor shall return used oil to the supplier or an oil recycling company.
Avoidance	Contractor	Construction plant and equipment shall be cleaned using a water-filled bucket. Washing of construction plant and mechanical equipment including paint brushes shall not occur on site or in the watercourse, but shall be restricted to the construction camp.
Avoidance	Contractor	The contractor shall contain contaminated water from washing paint brushes in a conservancy tank until sufficient volume warrants disposal by a registered hazardous waste management company.
Avoidance	Contractor	Use of paints that do not contain Volatile Organic Compounds (VOC's) should be considered due to their non-hazardous nature.

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Avoidance	Contractor	Care should be taken with the handling of bitumen and associated products to avoid spillage and contamination of the surrounding soil.
Avoidance	Contractor	Imported soil must be free of foreign seed or material, including weed, invader and alien species.
Avoidance	Contractor	The Contractor is prohibited from driving on topsoil stockpiles and windrows.
Avoidance	Contractor	The Contractor shall locate the construction camp on existing disturbed or the least sensitive sites above the 1:100 year flood line or further than 32m from the edge of a watercourse, whichever is greatest.
Avoidance	Contractor	No maintenance workshop is permitted within 100m from the edge of a watercourse.
Avoidance	Contractor Applicant	All substances or material in use, that is likely to pollute the water or watercourses / rivers must not be allowed to leak, spread or diffuse in to the watercourse.
Avoidance	Contractor	The contractor shall restrict the following activities to the construction camp: Accommodation, Sanitation, Waste storage, Parking, Storing hazardous materials, Repair/maintenance, Re-fuelling, Bulk material stockpiles, and Lay down areas.
Avoidance	Contractor	Designate a temporary waste storage area, enclose it in a fence that cannot be breached by fauna, and provide sufficient scavenger proof dust bins with black bags inside the construction camp.
Avoidance	Contractor	All storm water control measures should be implemented especially around stockpiled soil, excavated areas, trenches etc. so that export of soil into the streams is avoided.
Avoidance	Contractor	The contractor shall provide sufficient (1:10) chemical toilets, unless existing facilities can be used.
Avoidance	Contractor	Chemical toilets shall be located in the shade and outside the demarcated 1:100 year floodline and / or riparian zone.
Avoidance	Contractor	Use chemical toilets that contain the sewage in a closed and removable 'tank', i.e. do not use open drums. Environmentally friendly toilets should also be considered e.g. E-loo's.
Avoidance	Contractor	All persons shall use only the provided facilities for sanitation.
Avoidance	Contractor	Chemical toilets shall be kept hygienic and cleaned daily.
Avoidance	Contractor	The contents of the portable chemical toilets should be disposed of at a sewage works facility to avoid pollution of both ground and surface water resources. No pollution

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		associated with the use of chemical toilets is expected in the nearby river.
Avoidance	Contractor	The contractor is prohibited from discharging waste water, including domestic water from sanitation facilities, and grey water from washing equipment or plant into a watercourse.
Avoidance	Contractor	Construction vehicles and equipment are prohibited from injudiciously entering the ephemeral stream.
Avoidance	Contractor	The contractor shall store hazardous material within a secure, safe and bunded facility at the construction camp, with a 110% capacity of the stored content.
Avoidance	Contractor	Use drip trays for refuelling, repair/maintenance work and all stationary construction plant and equipment that can leak, such as TLB's, compressors and generators.
Avoidance	Contractor	Remove topsoil from the area within the perimeter of the construction camp and stockpile separately for use during rehabilitation of the site.
Avoidance	Contractor	Spills shall not be covered with sand or soil. It merely increases the disposal cost for a greater volume of hazardous waste.
Avoidance	Contractor	Do not mix concrete on open ground. Mix in a wheel barrow or mixing tray.
Avoidance	Contractor	The contractor shall prevent the run-off of slurry or cement contaminated water from concrete/plaster mixing sites.
Rectification	Contractor	Immediately remove contaminated soil to the depth of penetration and temporarily store in a designated solid hazardous waste container until sufficient volume warrants disposal at a registered hazardous waste dump site.
Rectification	Contractor	Break up all concrete hard pan layers and dispose of appropriately (at a legitimate dump site) or re-use the concrete.
Reduction	Contractor	The contractor shall implement appropriate procedures, such as the use of a ground cover, to prevent the contamination of the ground when handling hazardous materials, including re-fuelling.
Reduction	Contractor	Appropriate mitigation to control/reduce sediment input into watercourses shall be implemented during construction.
Reduction	Contractor	As far as possible, commence construction (clearing) at the onset of the dry season in order to prevent erosion, siltation and wash-away of topsoil and sedimentation into the reservoir.
Reduction	Contractor	Construction plant and equipment shall be kept in a good state of repair to reduce hydrocarbon leakages and emissions.
Reduction	Contractor	Emergency repairs or maintenance shall include procedures to minimise contamination of the ground.
Reduction	Contractor	Establish and implement an Integrated Waste

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		Management Strategy including avoidance, reduction, re-using, recycling and disposal, i.e. the production of hazardous waste can be avoided by providing drip trays, reduce waste by using the correct quantities, re-use concrete rubble as back fill or recycle steel off-cuts and dispose of non-hazardous solid waste at a registered municipal dump site.
Reduction	Contractor	Induct all labourers on the waste management strategy and enforce it through regular toolbox talks.
Reduction	Contractor	Separate general, recyclable, natural (vegetation and soil/rock) and hazardous waste, and demarcate different containers for different waste types using colour codes.
Reduction	Contractor	Remove ineffective danger tape/netting that has begun to litter the site or surrounding areas.
Reduction	Contractor	Re-fuelling with a mobile fuel bowser shall take place outside any watercourse.

Impact 5 Loss/gain of terrestrial animals including mammals directly through clearing, smothering, poaching, colliding, trampling, excavation, and littering

Description

- Clear and grub operations associated with the establishment of the construction camp, the demarcation of the development footprint and the construction of temporary access roads can destroy mammals and birds directly, and indirectly through habitat loss.
- Material stockpiles and lay down areas can be located in undisturbed areas, smothering tunnels, burrows or nests of fauna in/on the ground.
- The presence of contractors and labourers increases the risk of poaching for food or traditional medicine.
- Vehicle movement (driving) and placement (parking), including other construction equipment, can collide with and trample fauna, respectively.
- Open excavations can trap terrestrial fauna causing injury or death.
- Solid and liquid waste can be harmful to fauna if swallowed/ingested or if the creature becomes entangled or impaled.

Uncertainties & limitations with predicting this impact

- A full suite of the potentially affected fauna is not known.

Assumptions made when assessing the impact

- Fauna are highly mobile organisms, which can flee from dangers posed by construction activities. With the exception of smaller tunnelling, burrowing or nesting fauna (in the ground or tree trunks), fauna will instinctively flee, upon an intrusion of their personal space, specifically the 'flight' zone, until the animal has extended the distance to its 'comfort' zone.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet)
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					objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

- None

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- With the exception of critically endangered species or populations, the loss of life can be recovered through the reproduction of surviving individuals/populations.

Mitigations

Goal: Control loss of terrestrial and avifauna

Objective(s) (including targets):

- To reduce harm to terrestrial and avifauna.

Impact 5 Loss of terrestrial animals including mammals and birds directly through clearing, smothering, poaching, colliding, trampling, excavation, and littering		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Contractor ECO	With the exception of search and rescue operations authorised by the ECO, no mammal, bird, reptile, invertebrate or fish shall be intentionally caught and/or killed.
Avoidance	Contractor	Designate a temporary waste storage area, enclose it in a fence that cannot be breached by fauna, and provide sufficient scavenger proof dustbins with black bags inside the construction camp.
Avoidance	Contractor	The vegetation, including hollow tree trunks, and ground in all areas that will be physically disturbed shall be searched for nesting birds & small fauna prior to commencing clearing operations. If found, creatures shall be rescued and reported to the SECO for subsequent guidance.
Avoidance	Contractor	Termitaria (Termite mounds) shall not be disturbed.

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Avoidance	Contractor	Wholly or partially dead tree trunks showing signs of wood borer activities shall not be destroyed, but relocated elsewhere in the reserve.
Avoidance	Contractor	Of importance here are the impacts that may occur to resident listed threatened and protected fauna (As listed by Schedule in NEMBA). This could include bird nesting sites (vultures), baboon spiders (All protected) as well as the impacts that electric fences could have on fauna (pangolins, tortoises and reptiles).
Avoidance	Contractor	Design aspects need to be borne in mind to overcome these possible impacts such as the height of the lowest electrified wire above the ground, sloping the fence out and not in, etc.
Avoidance	Contractor	The effect that the proposed development/construction may have on local fauna, including listed Threatened and Protected species, must be mitigated as far as possible.
Avoidance	Contractor	Poaching could be a significant threat. If any external labour teams are used during construction, then these teams should preferably be accommodated off site; and carefully monitored to ensure that no unsupervised access to plant and animal resources takes place.
Reduction	Contractor	Material stockpiles shall be located outside the demarcated riparian zone and on a disturbed site or other site approved by the ECO as a stockpile area.
Reduction	Contractor	The end of installed pipes shall be covered at the end of each day to prevent the entry of small fauna.
Reduction	Contractor	The site will be kept tidy at all times. All waste shall be picked up daily.

Impact 6 Loss/gain of terrestrial plants directly through the clearing, smothering, trampling, and harvesting of plants

Description

- Clearing operations associated with sand mining, the establishment of the construction camp and perimeter fence, the demarcation of the development footprint and the construction of temporary/permanent access roads will destroy plants.
- Construction activities, such as clearing, may extend beyond the development footprint, known as construction creep.
- Vegetation stockpiles, material stockpiles and lay down areas can be located in undisturbed areas, smothering living plants.
- Excessive traffic and dust can smother plants growing on the verge of gravel access roads.
- Concrete work, specifically mixing on bare ground can smother living plants and create a hard pan layer that prevents recovery.
- The movement of people, driving and parking of vehicles, and location of other construction equipment can trample plants.
- Contractors and labourers increase the risk of plants being harvested for firewood and/or traditional medicine.

Uncertainties & limitations with predicting this impact

- The number of labourers onto the construction site is unknown.

Assumptions made when assessing the impact

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- Material will be imported from a commercial and licensed source. Sand mining will not occur locally.
- Dust is unlikely to impact plants because vehicular movement will be minimal and dust suppression implemented.
- Grassed servitudes will be incorporated into the topsoil in the event of any clear and grub operations. There will be no vegetation stockpiles.
- No temporary access roads will be constructed.
- The construction camp will be located at the staff unit and parking bays.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

- None

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Temporary construction footprints such as access roads and the construction camp can be rehabilitated. The rate of recovery will depend on the nature of the rehabilitation, prevailing weather conditions, and the diversity and density of local fauna/measures taken to protect the plants from browsers.

Mitigations

Goal: Control the loss of vegetation.

Objective(s) (including targets):

- To avoid the unnecessary destruction of flora resulting from construction activities.

Impact 6 Loss of terrestrial plants directly through the clearing, smothering, harvesting, trampling and cutting of plants		
Type of	Responsible	Mitigation

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mitigation	authority	
Avoidance	Contractor	All construction activity should be limited to the existing footprint and remain within the existing fenced off area.
Avoidance	Contractor	Do not mix concrete on open ground. Mix in a wheel barrow, mixing tray or other suitable bunded surface. Break up all hard pan layers.
Avoidance	Contractor	No dry wood, living plant or part thereof may be harvested from any plant community.
Avoidance	Contractor	The movement of construction vehicles will be restricted to existing roads and certain demarcated areas (to turn around or passing lanes)
Avoidance	Contractor	Debushing of the construction camp or construction site may not commence until the site has been inspected and confirmed that no listed threatened or protected species will be damaged.
Avoidance	Contractor	The SECO/ECO must search for plants of conservation concern, mark them with danger tape and record protected plants that are going to be disturbed or destroyed.
Avoidance	Contractor	Where such plants are encountered the first consideration should be to move the site if possible so as not to impact on the plant.
Avoidance	Contractor	If the site cannot be moved all plants of conservation concern on permanent development footprints, excluding large trees that exceed the capabilities of the contractor's excavator, must be translocated outside the working servitude, i.e. seedlings, saplings & mature trees.
Avoidance	Contractor	The applicant must allocate a sufficient budget for rescuing and nursing plants of conservation concern, including translocation or transplanting, training, supervision, labour, black bags, compost, watering and maintenance.
Avoidance	Contractor	The SECO/ECO must induct, and train the contractor's labourers and supervisor how to successfully translocate and transplant local plants.
Avoidance	Contractor	No vegetation is to be damaged outside of the demarcated area.
Avoidance	Contractor	The contractor may not dump cleared vegetation onto living plants unless it is on a site that has been searched for plants of conservation concern and approved by the ECO for stockpiling cleared vegetation.
Avoidance	Contractor	Translocated trees shall be watered.
Reduction	Contractor	The contractor may not dump any material onto living plants unless it is on a site that has been searched for plants of conservation concern by the ECO and approved as a stockpile or laydown area.
Reduction	Contractor	All contractors and their labourers must be inducted before commencing work. The induction must include mitigations identified in this report (all aspects regarding their actual and potential interaction with the environment).

Impact 7 Replacement of terrestrial plants directly through the establishment of alien plant species

Description

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- The disturbance created by clearing activities within plant communities creates favourable habitat for the life history strategies of undesirable plant species¹. There is an ongoing threat for invasion because alien plants have effective dispersal mechanisms, such as birds. Cleared patches can become invaded and act as sources to colonize other vulnerable areas.
- Alien plants can also be introduced by importing foreign contaminated material for construction or rehabilitation.

Uncertainties & limitations with predicting this impact

- The magnitude of the impact, specifically the extent and severity of the potential replacement of natural vegetation, was not known.

Assumptions made when assessing the impact

- Material (soil) will be imported, but recently excavated subsoil should not introduce any foreign seeds, which are mostly found within the topsoil horizon.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

1. Conservation of Agriculture Resources Act (Act 43 of 1983) as amended, and administered by the DALA.
 - Section 15A(1) of CARA, 1983, as amended: Category 1 plants may not occur on any land or inland water surface other than in biological control reserves.
 - Section 15A(2) of CARA, 1983, as amended: A land user shall control any category 1 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
 - Section 15B(1) of CARA, 1983, as amended: Category 2 plants may not occur on any land or inland water surface other than a demarcated area or a biological control reserve.

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- Section 15B(8) of CARA, 1983, as amended: A land user shall control any category 2 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
- Section 15C(1) of CARA, 1983, as amended: Category 3 plants shall not occur on any land or inland water surface other than in a biological control reserve.
- Section 15C(3)(a) of CARA, 1983, as amended: No land user shall allow category 3 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Reversibility is influenced by the extent and longevity of alien plant invasion. If controlled timeously the impact can be negligible. However, if allowed to grow unabated, alien invasive species can replace entire plant communities with homogeneous stands. Biodiversity is significantly reduced and ecosystem function is altered. In the later case, rehabilitation will require significant intervention and cost.

Mitigations

Goal: Control the replacement of indigenous vegetation.

Objective(s) (including targets):

- To prevent the maturation and reproduction of weed, invader and exotic plant species from occurring on any land that is disturbed during construction.

Impact 7 Replacement of terrestrial plants directly through the establishment of alien plant species		
Type of mitigation	Responsible authority	Mitigation
Reduction	Contractor	The contractor shall search for weed, invader and exotic plant species on all disturbed sites every two weeks during construction.
Rectification	Contractor	The contractor shall collect and destroy all seeds of weed, invader and alien plant species occurring within the servitude during construction.
Rectification	Contractor	The contractor shall immediately remove weed, invader and exotic plant species upon being identified on all areas that are disturbed by construction activities including stockpiles.

Impact 8 Degradation

Description

The degradation of disturbed sites can result from erosion and plant replacement.

- Disturbed sites will comprise mostly cleared/denuded areas.
- Disturbed areas are vulnerable to degradation, including erosion, leading to a loss of biodiversity and ecosystem functions and processes.
- Disturbed areas, including those recently rehabilitated by the contractor are susceptible to weed, invader and alien plant³ recruitment and the replacement of indigenous plant communities if not controlled.
- Gravel roads are also sources of erosion if not maintained or managed because they channel uninterrupted flow.

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- Water courses intersected by the pipelines are susceptible to degradation during and after construction if not adequately protected or rehabilitated, respectively.

Uncertainties & limitations with predicting this impact

- The magnitude of the impact, specifically the extent and severity of the erosion and sedimentation, was not known.
- The magnitude of the impact, specifically the extent of the invasion onto rehabilitated areas, was not known.

Assumptions made when assessing the impact

- The disturbance including areas that are vulnerable to alien plant invasion are relatively small in extent. Disturbed areas will degrade if left alone.
- The Contractor will not construct temporary access roads so there will be no compacted areas.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	4	3	Negative	M
	With	3	2	Negative	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	4	3	Negative	H
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

1. The Principles of NEMA require that a proponent is responsible for any development s/he has initiated from the beginning to the end of the project (“From the cradle to the grave”). This responsibility is passed on from one title deed holder to the next.
2. Conservation of Agriculture Resources Act (Act 43 of 1983) as amended, and administered by the DALA, including the following:
 - Section 15A(1) of CARA, 1983, as amended: Category 1 plants may not occur on any land or inland water surface other than in biological control reserves.
 - Section 15A(2) of CARA, 1983, as amended: A land user shall control any category 1 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.

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- Section 15B(1) of CARA, 1983, as amended: Category 2 plants may not occur on any land or inland water surface other than a demarcated area or a biological control reserve.
- Section 15B(8) of CARA, 1983, as amended: A land user shall control any category 2 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
- Section 15C(1) of CARA, 1983, as amended: Category 3 plants shall not occur on any land or inland water surface other than in a biological control reserve.
- Section 15C(3)(a) of CARA, 1983, as amended: No land user shall allow category 3 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Disturbed areas can be rehabilitated. The cost thereof will depend on the severity and extent of the degradation.
- The extent of reversibility is dependent on the severity of the erosion, including the nature of the remaining *in situ* material, the amount of soil that has been exported from a site and whether or not the exported soil is recoverable. For example, soil washed from a gravel road into a mitre drain can be graded back onto the surface of the road, whereas soil that is washed from a gully into a water course is not recoverable and the source cannot be reinstated without significant intervention and cost. Although erosion has the potential to irreversibly change the relief, eroded sites can be stabilized through rehabilitation measures.
- If controlled timeously the impact of alien plant species can be negligible. However, if allowed to grow unabated, alien invasive species can replace entire plant communities with homogeneous stands. Biodiversity is significantly reduced and ecosystem function is altered. In the later case, rehabilitation will require significant intervention and cost.

Mitigations

Goal:

Facilitate the natural rehabilitation of disturbed areas and control the replacement of indigenous vegetation by weed, invader and exotic plant species.

Objective(s) (including targets):

- To avoid long-term degradation including erosion of the construction servitude, access roads, and affected watercourses.
- To prevent the maturation and reproduction of weed, invader and exotic plant species from occurring on any land that is rehabilitated after construction.

Impact 8 Degradation		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Contractor	Kikuyu grass (<i>Pennisetum clandestinum</i>) is a highly invasive plant that threatens wetland habitats and must not be used in areas adjacent to wetland habitats and drainage lines. Non-invasive indigenous grasses such as <i>Cynodon dactylon</i> must be used.

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Reduction	Contractor Applicant	The rehabilitated areas shall be monitored for two years following the completion of the construction for the recruitment of weed, invader and alien plant species.
Reduction	Contractor	Ensure storm water run-off is adequately controlled on disturbed sites before rehabilitating them (ripping, replacing the topsoil and mulching/brush packing), i.e. cut-off berms.
Reduction	Contractor	The Contractor shall monitor the rehabilitated servitudes for the duration of the contract defects and liability period for signs of erosion.
Rectification	Contractor	Bulk-shape the areas where material is introduced to mimic or blend in with the surrounding, natural topography. Fine-shaping should retain an uneven surface which will impede surface water run-off and facilitate infiltration.
Rectification	Contractor	Topsoil shall be returned to the source areas during rehabilitation of the disturbed sites.
Rectification	Contractor	Ensure a quick and adequate cover with indigenous and local grass species on all servitudes.
Rectification	Applicant Contractor	If erosion is found to occur during the aforesaid monitoring, the Contractor/ Applicant shall immediately correct (the 'source') and repair (the 'symptom') the erosion using method(s) that are an improvement on the mitigations proposed in this EMP or on the unsuccessful mitigations originally used on site.
Rectification	Contractor Applicant	The Contractor/ Applicant shall immediately uproot, cut or debark weed, invader and alien plant species upon being identified.
Rectification	Contractor Applicant	The Contractor/ Applicant shall collect and destroy all seeds of weed, invader and alien plant species occurring within disturbed and/or rehabilitated areas.
Rectification	Contractor Applicant	Any degraded/damaged water courses must be rehabilitated to encourage its functionality.
Rectification	Contractor Applicant	Compacted areas will be ripped/scarified perpendicular to the prevailing slope/gradient.
Rectification	Contractor Applicant	Vegetation stockpiles must be used as mulch for the rehabilitation of exposed areas, i.e. filling erosion gullies and brush packing to stabilise topsoil. Ensure branches are placed perpendicular to the direction of the run-off.
Rectification	Contractor Applicant	Plants rescued prior to clear and grub operations are to be used in rehabilitation and landscaping.
Rectification	Contractor Applicant	The applicant shall replace lost plants with like species within the riparian habitat and maintain those plants until they are no longer susceptible to browsers and fire.
Rectification	Contractor Applicant	All structures, including fences, have to be broken down and all building rubble removed from the reserve to a registered landfill site.
Rectification	Contractor Applicant	The area has to be levelled-out/landscaped to fit in with the surrounding landscape.
Rectification	Contractor Applicant	If necessary the surface must be ripped to break the crust and promote germination of plants. Where appropriate endemic grasses must be sown to promote recovery of the area and prevent erosion.
Rectification	Contractor	All excess material, including sand, must be removed from the site

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	Applicant	on completion.
Rectification	Contractor Applicant	In instances where temporary roads were constructed to access the site or to deliver materials these roads have to be rehabilitated on completion of the construction phase.
Rectification	Contractor Applicant	Any other road that is no longer required for whatever reason has to be rehabilitated in the same fashion as described below. The road has to be effectively blocked off with heavy branches so that it is no longer used.
Rectification	Contractor Applicant	Before it is blocked off the road has to be effectively drained by means of mitre drains and/or berms.
Rectification	Contractor Applicant	Where berms and mitre drains are used on slopes, attention needs to be paid to the fact that water should not be deposited on soils that are prone to erosion (duplex and sodic soils), as the soils within and surrounding the plant looked like they were prone to erosion.
Rectification	Contractor Applicant	Berms/drains should also be spaced according to the slope to ensure that run-off water does not build up either in volume or velocity so as to constitute a soil erosion risk.
Rectification	Contractor Applicant	The road between berms should be ripped to create favourable conditions for plant seed germination. This can be accelerated by brush packing the road after ripping.
Rectification	Contractor Applicant	In some instances it could be advisable to sow the ripped road with endemic grass seed to accelerate rehabilitation
Rectification	Contractor Applicant	In the removal process care must be taken to damage the veld as little as possible no large trees may be removed.
Rectification	Contractor Applicant	All residual construction materials must be removed from the works area.
Rectification	Contractor Applicant	Water from berms must be deposited safely (not at high velocity or volume, not onto bare soil and not onto sensitive sodic or duplex soils).
Rectification	Contractor Applicant	Any roads that may develop as a result of this action must be rehabilitated according to the specifications on roads.

Operation Phase

Impact 1 Degradation

Description

The degradation of disturbed sites can result from erosion and plant replacement:

- Disturbed sites will comprise mostly cleared/denuded areas, including the pipeline servitudes.
- Disturbed areas are vulnerable to degradation, including erosion, leading to a loss of biodiversity and ecosystem functions and processes.
- Disturbed areas, including those recently rehabilitated by the contractor are susceptible to weed, invader and alien plant² recruitment and the replacement of indigenous plant communities if not controlled.
- Alien plants are a threat to natural resources by consuming water that would normally flow into rivers, intensifying flooding and causing erosion.

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Uncertainties & limitations with predicting this impact

- The magnitude of the impact, specifically the extent and severity of the erosion and sedimentation, was not known.
- The magnitude of the impact, specifically the extent of the invasion onto rehabilitated areas, was not known.

Assumptions made when assessing the impact

- The disturbance including areas that are vulnerable to alien plant invasion will be restricted to the pipeline servitudes. Disturbed areas will degrade if left alone.
- The Contractor will not construct temporary access roads so there will be no compacted areas.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	3	2	Negative	H
	With	2	1	Positive	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	3	2	Negative	H
	With	2	1	Positive	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

1. The Principles of NEMA require that a proponent is responsible for any development s/he has initiated from the beginning to the end of the project (“From the cradle to the grave”).
2. Conservation of Agriculture Resources Act (Act 43 of 1983) as amended, and administered by the DALA, including the following:
 - Section 15A(1) of CARA, 1983, as amended: Category 1 plants may not occur on any land or inland water surface other than in biological control reserves.
 - Section 15A(2) of CARA, 1983, as amended: A land user shall control any category 1 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
 - Section 15B(1) of CARA, 1983, as amended: Category 2 plants may not occur on any land or inland water surface other than a demarcated area or a biological control reserve.

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- Section 15B(8) of CARA, 1983, as amended: A land user shall control any category 2 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
- Section 15C(1) of CARA, 1983, as amended: Category 3 plants shall not occur on any land or inland water surface other than in a biological control reserve.
- Section 15C(3)(a) of CARA, 1983, as amended: No land user shall allow category 3 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Disturbed areas can be rehabilitated. The cost thereof will depend on the severity and extent of the degradation.
- The extent of reversibility is dependent on the severity of the erosion, including the nature of the remaining *in situ* material, the amount of soil that has been exported from a site and whether or not the exported soil is recoverable. For example, soil washed from a gravel road into a mitre drain can be graded back onto the surface of the road, whereas soil that is washed from a gully into a water course is not recoverable and the source cannot be re-instated without significant intervention and cost. Although erosion has the potential to irreversibly change the relief, eroded sites can be stabilized through rehabilitation measures.
- If controlled timeously the impact of alien plant species can be negligible. However, if allowed to grow unabated, alien invasive species can replace entire plant communities with homogeneous stands. Biodiversity is significantly reduced and ecosystem function is altered. In the later case, rehabilitation will require significant intervention and cost.

Mitigations

Goal:

Facilitate the natural rehabilitation of disturbed areas and control the replacement of indigenous vegetation by weed, invader and exotic plant species.

Objective(s) (including targets):

- To avoid long-term degradation.
- To reduce erosion of rehabilitated areas.
- To prevent the maturation and reproduction of weed, invader and exotic plant species from occurring on any land that is rehabilitated after construction.

Impact 1 Degradation		
Type of mitigation	Responsible authority	Mitigation
Reduction	Applicant	Applicant shall monitor the rehabilitated pipeline and reservoir servitudes for signs of erosion.
Reduction	Applicant	The rehabilitated pipeline and reservoir servitudes shall be monitored following the completion of the construction for the recruitment of weed, invader and alien plant species.
Rectification	Applicant	The Applicant shall immediately remove weed, invader and alien plant species upon being identified on all areas that are disturbed by construction activities including stockpiles.

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Rectification	Applicant	Applicant shall collect and destroy all seeds of weed, invader and alien plant species occurring within disturbed and/or rehabilitated areas.
Rectification	Applicant	If erosion is found to occur during the aforesaid monitoring, the Applicant shall immediately correct (the 'source') and repair (the 'symptom') the erosion using method(s) that are an improvement on the mitigations proposed in this EMP or on the unsuccessful mitigations originally used on site.
Rectification	Contractor	Exercise measures to protect and conserve the water resources by removing existing alien plants and discourage recruitment and recolonisation of the alien plants at and around the disturbed area(s).

Impact 2 Maintenance

Description

The degradation of disturbed sites can result from erosion and plant replacement.

- Disturbed sites will comprise mostly cleared/denuded areas, including the pipeline servitudes.
- Disturbed areas are vulnerable to degradation, including erosion, leading to a loss of biodiversity and ecosystem functions and processes.
- Disturbed areas, including those recently rehabilitated by the contractor are susceptible to weed, invader and alien plant recruitment and the replacement of indigenous plant communities if not controlled.
- Alien plants are a threat to natural resources by consuming water that would normally flow into rivers, intensifying flooding and causing erosion.

Uncertainties & limitations with predicting this impact

- The magnitude of the impact, specifically the extent and severity of the erosion and sedimentation, was not known.
- The magnitude of the impact, specifically the extent of the invasion onto rehabilitated areas, was not known.

Assumptions made when assessing the impact

- The disturbance including areas that are vulnerable to alien plant invasion will be restricted to the plant servitude. Disturbed areas will degrade if left alone.

Assessment

Alternative Footprints	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	

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Alternative 3	Without	3	2	Negative	H
	With	2	1	Positive	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	3	2	Negative	H
	With	2	1	Positive	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

1. The Principles of NEMA require that a proponent is responsible for any development s/he has initiated from the beginning to the end of the project (“From the cradle to the grave”).

2. Conservation of Agriculture Resources Act (Act 43 of 1983) as amended, and administered by the DALA, including the following:

- Section 15A(1) of CARA, 1983, as amended: Category 1 plants may not occur on any land or inland water surface other than in biological control reserves.
- Section 15A(2) of CARA, 1983, as amended: A land user shall control any category 1 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
- Section 15B(1) of CARA, 1983, as amended: Category 2 plants may not occur on any land or inland water surface other than a demarcated area or a biological control reserve.
- Section 15B(8) of CARA, 1983, as amended: A land user shall control any category 2 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
- Section 15C(1) of CARA, 1983, as amended: Category 3 plants shall not occur on any land or inland water surface other than in a biological control reserve.
- Section 15C(3)(a) of CARA, 1983, as amended: No land user shall allow category 3 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Disturbed areas can be rehabilitated. The cost thereof will depend on the severity and extent of the degradation.
- The extent of reversibility is dependent on the severity of the erosion, including the nature of the remaining *in situ* material, the amount of soil that has been exported from a site and whether or not the exported soil is recoverable. For example, soil washed from a gravel road into a mitre drain can be graded back onto the surface of the road, whereas soil that is washed from a gully into a water course is not recoverable and the source cannot be reinstated without significant intervention and cost. Although erosion has the potential to irreversibly change the relief, eroded sites can be stabilized through rehabilitation measures.
- If controlled timeously the impact of alien plant species can be negligible. However, if allowed to grow unabated, alien invasive species can replace entire plant communities with homogeneous stands. Biodiversity is significantly reduced and ecosystem function is altered. In the later case, rehabilitation will require significant intervention and cost.

Mitigations

Goal:

Facilitate the natural rehabilitation of disturbed areas and control the replacement of indigenous vegetation by weed, invader and exotic plant species.

Objective(s) (including targets):

- To avoid long-term degradation.
- To reduce erosion of and rehabilitated access roads.
- To prevent the maturation and reproduction of weed, invader and exotic plant species from occurring on any land that is rehabilitated after construction.

Impact 1 Degradation		
Type of mitigation	Responsible authority	Mitigation
Reduction	Applicant	Applicant shall monitor the rehabilitated pipeline servitudes for signs of erosion.
Reduction	Applicant	The rehabilitated pipeline servitudes shall be monitored following the completion of the construction for the recruitment of weed, invader and alien plant species.
Rectification	Applicant	The Applicant shall immediately remove weed, invader and alien plant species upon being identified on all areas that are disturbed by construction activities including stockpiles.
Rectification	Applicant	Applicant shall collect and destroy all seeds of weed, invader and alien plant species occurring within disturbed and/or rehabilitated areas.
Rectification	Applicant	If erosion is found to occur during the aforesaid monitoring, the Applicant shall immediately correct (the 'source') and repair (the 'symptom') the erosion using method(s) that are an improvement on the mitigations proposed in this EMP or on the unsuccessful mitigations originally used on site.
Rectification	Contractor	Exercise measures to protect and conserve the water resources by removing existing alien plants and discourage recruitment and recolonisation of the alien plants at and around the disturbed area(s).

Decommissioning Phase

Complete decommissioning can occur should it no longer be economically feasible to continue the pipeline & reservoir operation; activities will include:

- Site preparation;
- Disassembly and recycling of existing components; and
- Rehabilitation of the site.

Impact 1 Potential Offences

Description

- **Illegal commencement of activities.** Decommissioning of the proposed pipeline without following the conditions of the Environmental Authorisation issued by the North West Department of Rural, Environment and Agricultural Development (DREAD) will constitute an offence contemplated in the National Environmental Management Act (Act No. 107 of 1998)¹.

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- **Compliance Monitoring.** Decommissioning may commence without the guidance of an Environmental Control Officer (ECO), which is a condition of the EMPr.

Uncertainties & limitations with predicting this impact

- None.

Assumptions made when assessing the impact

- The pipeline & reservoir is unlikely to be decommissioned.

Assessment

Alternative	Mitigation Action	Probability	Acceptability	Status	Mitigation potential (to meet objectives)
Alternative 1	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 2	Without	3	2	Negative	H
	With	2	1	Positive	
Alternative 3	Without	3	2	Negative	H
	With	2	1	Positive	
No-go	N/A	1	1	Neutral	N/A
Reservoir 1	Without	3	2	Negative	H
	With	2	1	Positive	
Reservoir 2	Without	4	3	Negative	M
	With	3	2	Negative	
No-go	N/A	1	1	Neutral	N/A

Reference (legal, scientific, social or other criteria)

1. The Principles of NEMA require that a proponent is responsible for any development s/he has initiated from the beginning to the end of the project (“From the cradle to the grave”). This responsibility is passed on from one title deed holder to the next.

Impact reversibility/The degree to which the impact may cause an irreplaceable loss of resources

- Disturbed areas can be rehabilitated. The cost thereof will depend on the severity and extent of the degradation.
- The extent of reversibility is dependent on the severity of the erosion, including the nature of the remaining *in situ* material, the amount of soil that has been exported from a site and whether or not the exported soil is recoverable. For example, soil washed from a gravel road into a mitre drain can be graded back onto the surface of the road, whereas soil that is washed from a gully into a water course is not recoverable and the source cannot be reinstated without significant intervention and cost. Although erosion has the potential to irreversibly change the relief, eroded sites can be stabilized through rehabilitation measures.
- If controlled timeously the impact of alien plant species can be negligible. However, if allowed to grow unabated, alien invasive species can replace entire plant communities with

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homogeneous stands. Biodiversity is significantly reduced and ecosystem function is altered. In the later case, rehabilitation will require significant intervention and cost.

Mitigations

Goal:

- Facilitate the natural rehabilitation of disturbed areas to almost the way they were before construction took place, as far as possible.

Objective(s) (including targets):

- To mitigate impacts in the unlikely event of decommissioning.

Impact 1 Potential Offences		
Type of mitigation	Responsible authority	Mitigation
Avoidance	Applicant	Should the applicant decide to decommission the pipeline &/or reservoir for any reason, he/she must interact with DREAD to the procedural correctness thereof, to mitigate impact on local environment.
Avoidance	Applicant	The applicant who intends on decommissioning the pipeline &/or reservoir must comply with the relevant conditions and requirements pertaining to EA.

Table 8. Summary of potential negative impacts of the planning & design phase.

	Extent	Magnitude	Duration	Risk Rating
Alternative 1	Local	Medium	Short-Term	Low
Alternative 2	Local	Medium	Short-Term	Low
Alternative 3	Local	Medium	Short-Term	Low
No-go	Local	Zero	Long-Term	Neutral
Reservoir 1	Local	Medium	Short-Term	Low
Reservoir 2	Local	Medium	Short-Term	Low
No-go	Local	Zero	Long-Term	Neutral

Table 9. Summary of potential positive impacts of the planning & design phase.

	Extent	Magnitude	Duration	Risk Rating
Alternative 1	Local	Low	Short-Term	Very Low
Alternative 2	Local	Low	Short-Term	Very Low
Alternative 3	Local	Low	Short-Term	Very Low
No-go	Local	Zero	Long-Term	Neutral
Reservoir 1	Local	Low	Short-Term	Very Low
Reservoir 2	Local	Low	Short-Term	Very Low
No-go	Local	Zero	Long-Term	Neutral

Table 10. Summary of potential negative impacts of the construction phase (No positive impacts were assessed).

	Extent	Magnitude	Duration	Risk Rating
Alternative 1	Local	Medium	Short-Term	Low
Alternative 2	Local	Low	Short-Term	Very Low

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Alternative 3	Local	Low	Short-Term	Very Low
No-go	Local	Zero	Long-Term	Neutral
Reservoir 1	Local	Low	Short-Term	Very Low
Reservoir 2	Local	High	Long-Term	High
No-go	Local	Zero	Long-Term	Neutral

Table 11. Summary of potential negative impacts of the operational phase (No positive impacts were assessed).

	Extent	Magnitude	Duration	Risk Rating
Alternative 1	Local	Low	Short-Term	Very Low
Alternative 2	Local	Low	Short-Term	Very Low
Alternative 3	Local	Low	Short-Term	Very Low
No-go	Local	Zero	Long-Term	Neutral
Reservoir 1	Local	Low	Short-Term	Very Low
Reservoir 2	Local	Very Low	Short-Term	Very Low
No-go	Local	Zero	Long-Term	Neutral

Table 12. Summary of potential negative impacts of the decommissioning phase (No positive impacts were assessed).

	Extent	Magnitude	Duration	Risk Rating
Alternative 1	Local	Medium	Long-Term	Medium
Alternative 2	Local	Very Low	Long-Term	Low
Alternative 3	Local	Very Low	Long-Term	Low
No-go	Local	Zero	Long-Term	Neutral
Reservoir 1	Local	Very Low	Long-Term	Low
Reservoir 2	Local	Very Low	Long-Term	Low
No-go	Local	Zero	Long-Term	Neutral