

Table 2 Environmental management and mitigation related to the development phases of the preferred alternative:

Aspect	Potential impacts- and impact management objectives	Mitigation measures	Phase
1. Biodiversity and ecology	<p>1.1 Fragmentation of natural habitat</p> <p>Specialist recommendations must be followed for site preparation to minimize potential negative impacts on biota and habitats.</p>	<ul style="list-style-type: none"> • Site preparation, including vegetation removal must be kept to the necessary minimum only. • It is recommended that prominent trees are not affected or removed and be accommodated. • Potential removal of protected trees must be consulted with DAFF. • The site footprints must be investigated by a specialist prior to construction in order to identify and to relocate important biota that may not have been identified during the first screening and to recommend on vegetation that must remain on site. 	Planning
	<p>1.2 Irresponsible construction activities will lead to the unnecessary loss of biota and disturbance to natural habitat.</p>		
		<ul style="list-style-type: none"> • Construction activities must be supervised and be respectful of the environment. • Damage and disturbance to vegetation must be limited to the necessary minimum only. • Spoil material may be used for firewood. Firewood may not be sourced from trees in the surrounding area. • Animals may not be hunted, snared or purposefully disturbed or harmed. Problem animals and snakes that create problems must be removed or managed by a specialist. 	Construction
	<p>1.3 Spreading of alien and invasive vegetation</p> <p>Prevent unnecessary disturbance to the natural environment.</p>	<ul style="list-style-type: none"> • Damage and disturbance to vegetation must be limited to the necessary minimum only. 	Construction
	<p>Control the presence and spreading of alien and invasive vegetation</p>	<ul style="list-style-type: none"> • Alien invasive vegetation, weeds and bush encroachment must be monitored and controlled. 	Construction Operational
	<p>1.4 Loss of biota</p>		
	<p>Site preparation, vegetation clearing, temporary structures, construction camp and roads must be supervised and planned to minimize the loss of vegetation and fauna (including important taxa).</p>	<ul style="list-style-type: none"> • The development areas must be investigated by a specialist prior to construction in order to identify and to relocate important biota and to recommend on vegetation that must remain on site. • It is recommended that protected and special trees that are affected be removed and replanted in a suitable area nearby given that the necessary permits are obtained. As alternative is to replace trees that are lost with similar trees obtained legally elsewhere. • It is recommended that prominent trees are not affected or removed and be accommodated within the final development. • Potential removal of protected trees must be consulted with DAFF. • Temporary roads, stockpile sites and temporary structures must be approved by the ECO before commencement. 	Pre-construction
		<ul style="list-style-type: none"> • Natural vegetation must be conserved wherever possible in order to provide habitat for fauna (and to maintain biodiversity). 	Construction
	<p>Illegitimate harvesting / use or destruction of flora must be prohibited.</p>	<ul style="list-style-type: none"> • Potential removal of protected trees must be consulted with DAFF. • Plants or plant material may not be sourced from the sites or surrounding areas for medicinal or any other use. • Damage and disturbance to vegetation must be limited to the necessary minimum only. • Firewood may not be sourced from trees in the surrounding area. 	Planning Construction

2. Soil and water resources	1.5 Negative impact on freshwater ecosystems (e.g. riparian areas, streams and wetlands)		
	Permanent loss of biota and modification / fragmentation of wetland habitat must be prevented by planning and mitigation.	<ul style="list-style-type: none"> • Construction of these structures must be conducted during the dry season. 	Planning
		<ul style="list-style-type: none"> • The development areas must be investigated by a specialist prior to construction in order to identify and to relocate important biota. 	Pre-construction
		<ul style="list-style-type: none"> • Vegetation removal must be limited to the absolute minimum. • Excavations must be completed and backfilled in as short a period of time as possible. • Beds and embankments must be protected during construction and restored to original shape at completion. 	Construction
		<ul style="list-style-type: none"> • All disturbances must be fully rehabilitated in order to prevent erosion, siltation and invasive and alien vegetation. 	Rehabilitation
		<ul style="list-style-type: none"> • Alien invasive vegetation monitoring and management will be necessary. 	Operational
	2.1 Negative impacts on soil and water resources		
	Plan and establish efficient storm water management and prevent erosion and loss of topsoil (and erosion).	<ul style="list-style-type: none"> • The drainage areas susceptible to erosion must be identified prior to construction and measures must be taken to prevent/manage erosion at these locations. 	Pre-construction
		<ul style="list-style-type: none"> • Vegetation clearing and disturbance of soil must be limited to the minimum and must not be removed within 30m of any watercourse (excluding the footprints intended for infrastructure and pipeline crossings). • Topsoil that is removed will be stockpiled for use in rehabilitation or landscaping. 	Construction
		<ul style="list-style-type: none"> • The occurrence of erosion and siltation must be constantly monitored and corrective or preventive action must be taken to address the occurrence thereof. 	Construction Operational
	Modification of watercourses and impeding and diversion of flow in watercourses must be prevented where possible and the consequences must be reduced by mitigation.	<ul style="list-style-type: none"> • Construction of these structures must be conducted during the dry season. 	Planning
		<ul style="list-style-type: none"> • Vegetation removal must be limited to the absolute minimum. • Excavations must be completed and backfilled in as short a period of time as possible. • Beds and embankments must be protected during construction and restored to original shape at • It is important that hydraulic continuity is maintained at a level approximating that at which the E horizon was encountered. This can be achieved by providing a layer of permeable material of equivalent depth to the depth of the E horizon exposed in the trench. • It is also important to recognize that the soil profile reflects seasonal saturation, and if voids in the trench fill with water, the pipe may, depending on its specific gravity, float. If this is likely to occur, then it might be advisable to consider placing saddles or other anchoring devices over the pipe. 	Construction
		<ul style="list-style-type: none"> • All disturbances must be fully rehabilitated in order to prevent erosion, siltation and invasive and alien vegetation. 	Rehabilitation
		<ul style="list-style-type: none"> • Alien invasive vegetation monitoring and management will be necessary. 	Operational
		<ul style="list-style-type: none"> • All structures within the delineated watercourses must be monitored to ensure that the watercourses are not negatively affected. • Routine and emergency maintenance must be employed to prevent or correct negative impacts on the watercourses. 	Operational
Water use must be monitored and water must be used responsibly.		<ul style="list-style-type: none"> • Water storage facilities and reticulation must be maintained and monitored for leaks. • Water use must be responsible and water may not be wasted. 	Operational
Inadequate waste management and sanitation will lead to pollution of soil and water.		<ul style="list-style-type: none"> • Hazardous substances, including chemicals, paint, fuel and lubricants must be stored and handled according to standards. Any spills that may occur must be contained and cleaned up immediately after occurring. • Refueling and servicing of vehicles and equipment must be performed at designated areas with protected surfaces that will contain spills and can be cleaned easily. • Cement must be stored under cover and concrete must be prepared on lined or hardened surfaces in order to protect the environment. Handling and application of cement substances and concrete must be carefully done in order to prevent spills. Spills must be cleaned up immediately after occurring. 	Construction

		<ul style="list-style-type: none"> Sufficient waste management and sanitation facilities must be available to provide for the construction and operational phases. Waste must be stored at a central collection area and must be regularly disposed. Waste may not be burned or buried as a method of disposal. The waste management system must be efficient and not deviated from. 	Construction
		<ul style="list-style-type: none"> The water purification plant must be operated and maintained by trained personnel. The water purification plant and pipeline must be maintained in good functional order and must be monitored for leaks. Measures must be in place to contain accidental spills originating from the STP and spills 	Operational
3. Visual	3.1 Negative visual impacts		
	Site management and waste management must be efficient	<ul style="list-style-type: none"> The construction sites and stockpiles must be kept tidy and litter free. 	Construction
	Inadequate maintenance of buildings and infrastructure will create an unacceptable visual intrusion.	<ul style="list-style-type: none"> The infrastructure must be well serviced and maintained in order to create a good image and does not appear untidy and dissipated. 	Operational
4. Heritage Resources	4.1 Loss of heritage sites and items		
	Archeological finds and artefacts of heritage importance may be discovered during the construction phase.	<ul style="list-style-type: none"> Archeological finds and artefacts of heritage importance that are found must be reported to the ECO or authorities and verified by a specialist. 	Construction
5. Social & Legal	5.1 Negative social impacts and legal requirements		
	Negative environmental and legal consequences must be prevented.	<ul style="list-style-type: none"> The contractors must comply with legal requirements. Contractors and personnel must be initiated on the legal requirements and conditions of the environmental authorization prior to commencement of construction. The owner of the authorization is responsible for compliance with the provisions for Duty of Care and Remediation of environmental damage as contained in section 28 of NEMA. 	Planning Construction Operational
	Personnel must be well managed and disciplined.	<ul style="list-style-type: none"> Personnel must be managed and disciplined in order to uphold an efficient workforce and to prevent unacceptable behavior. Personnel must be trained for the tasks that they are hired for and must have acceptable lodging and sanitation in order to prevent injury and ill health. 	Construction Operational
	Personnel that are not trained properly or are poorly disciplined may lead to negative environmental and social impacts.	<ul style="list-style-type: none"> Contractors and personnel must be trained and managed in an orderly fashion in order to avoid disturbing the local residents. 	Construction
	5.2 Damage to property and infrastructure		
	Construction and maintenance activities may lead to damage to property and infrastructure. E.g. fences, roads and powerlines may be damaged or affected by the proposed activities	<ul style="list-style-type: none"> Damage to property and infrastructure must be avoided. Where this cannot be avoided, the affected parties must be notified and the matter must be negotiated and resolved before commencement. Where accidental damage occurs, the applicant / contractor will be held responsible for damages (depending on the contract between the applicant and contractors). However, if such issues occur it must be resolved legally and to all parties' satisfaction. Specifically related to this project: Extreme care must be taken not to damage the fence line of the Loskop Dam Nature Reserve (and all other fence lines). Where damage occurs the applicant must ensure that it is repaired to the original specifications. 	Construction Operational (maintenance)
6. Atmosphere & sound	6.1 Generation of dust, noise, vibrations and air pollution		
	The construction activities will create significant levels of dust, noise and vibrations. Air pollution must be prevented.	<ul style="list-style-type: none"> Construction activities must be limited to normal working hours. Activities that create dust and noise must be monitored and must not be conducted on windy days. The speed of vehicles must be limited to prevent the generation of dust. Dust suppressive measures must be employed (e.g. watering bowser). In case that noise is found to be excessive, a specialist must be appointed to investigate and make recommendations to mitigate. Strict waste management must be enforced and the burning of waste will not be allowed. 	Construction

a7. Traffic	7.1 Construction vehicles and activities will cause traffic disruptions		
	Prevent delays and provide safety measures	<ul style="list-style-type: none"> • Provide traffic aids and alternative routes to ensure the safety of motorists and pedestrians. • Enforce a safe speed limit. 	Construction
8. Economic Development	8.1 Employment of local people and support of local businesses must be encouraged		
	Employment and business must be created for the local population. Local businesses must be supported if building materials and consumables are sourced locally.	<ul style="list-style-type: none"> • The contractors and owner must plan to employ as many as possible individuals of the local area. • The contractors and owner must plan to support businesses of the local area. 	Construction Operational
9. Rehabilitation & maintenance	9.1 Failure to complete efficient rehabilitation and cleanup of the site will lead to cumulative environmental consequences		
	Adequate funds must be available for rehabilitation	<ul style="list-style-type: none"> • The contractors and owner must plan to have sufficient resources and funds available in order for rehabilitation of the environment after construction is completed. 	Planning
	The ECO will have to oversee that rehabilitation is conducted according to the EMPr and any other conditions as included with the Environmental Authorization.	<ul style="list-style-type: none"> • All disturbances in the watercourses and riparian zone must be adequately rehabilitated in order to prevent negative impacts on the physical and biological environment. • Rehabilitation of disturbed areas and temporary structures and roads must be efficient to prevent soil erosion and negative visual impacts. • Proper cleanup of spoil material, construction waste and spillages must be conducted during construction and be completed to the satisfaction of the ECO. • Aftercare must be conducted to ensure that rehabilitation is successful. 	Rehabilitation
	Maintenance of buildings and infrastructure must be conducted regularly.	<ul style="list-style-type: none"> • The buildings, roads and important infrastructure (e.g. storm water management, waste water management and waste management) must be maintained in good visual and functional order. 	Operational