In terms of Regulation 19(3) of GN R.326 of the NEMA Environmental Impact Assessment Regulations, 2014, as amended (07 April 2017), the impact assessment for the proposed Loubos WWTW is as follows:

Construction phase:

Potential impacts on geographical and physical aspects:	**Potential impact on freshwater ecosystems**
Nature of impact:	Loosening of soil during construction phase, washing of soil down the drainage lines and into the Hakskeen Pan during a storm event.
Extent and duration of impact:	Regional, during construction
Probability of occurrence:	Probable
Degree to which the impact can be reversed:	Reversible
Degree to which the impact may cause irreplaceable loss of resources:	Negligible
Cumulative impact prior to mitigation:	None expected
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Medium
Degree to which the impact can be mitigated:	Medium
Proposed mitigation:	- Construction only during the dry season. - Keep footprint as small as possible. - Prevent damage to riparian zones - Appoint ECO • The new WWTW should be sited as far as possible from drainage lines. If possible at all it should not be sited in a drainage line. As it stands now, it would be hard to find a locality at least 100m away from drainage lines, as these are densely distributed over the landscape. Drainage lines migrate over time across the sandy landscape. Even where there are no drainage lines, signs of water movement are evident. The siting of the new WWTW poses challenges and demand serious consideration. • The new WWTW should be located as far as possible from the banks of Hakskeen Pan. • If possible at all the new WWTW should be sited in the catchment area of the Swartbas Dam. The dam could serve as a buffer, in case of an accidental spillage. • During the construction phase only one access route should be allowed. Vehicles should not be allowed to move anywhere but on the access road. The footprint should be kept as small as possible. • Likewise, the WWTW's site should be kept as small as possible, with construction activities limited to a demarcated area. • Riparian zones should be kept intact, as far as possible. Where damaged, rehabilitation should take place. • Special care should be taken during the design of the new WWTW with regard to storm water management. Cut-off berms and erosion resistant materials should be included in the design. The design should make provision for a worst-case scenario

	• At least 500mm freeboard should be maintained in the ponds at all times. Additional ponds should be considered prior to the reaching of the design capacity of the new WWTW. • Written contingency plans should be drafted for implementation, should a spill ever occur. • Clean-up kits should be available, in case of a spill from tanker trucks. • The de-sludging of anaerobic ponds poses special challenges. A new pond should be ready for use prior to the de-sludging operation. The pond in need of maintenance should be allowed to properly dry out before the sludge is removed. Sludge should preferably not be disposed of in the direct Hakskeen Pan catchment area, but should be moved elsewhere so that there is no chance left for any of it to move into Hakskeen Pan during floods. • Given the ecological realities, treated sewage effluent should preferably not be used for irrigation of crops in the Hakskeen Pan catchment area. The effluent should rather be allowed to evaporate from a pond designed for this purpose. The very high evaporation rate of the Kalahari Desert would aid the process. • An ECO should be appointed for the construction of the new WWTW. • Staff operating the WWTW should be properly qualified and experienced.
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Low

Potential impact on biological aspects:	
Nature of impact:	**Loss of vegetation** - Loss of Kalahari Karroid Shrubland
Extent and duration of impact:	Local, long-term
Probability of occurrence:	High probability
Degree to which the impact can be reversed:	Low
Degree to which the impact may cause irreplaceable loss of resources:	Very low
Cumulative impact prior to mitigation:	Low Negative
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low negative
Degree to which the impact can be mitigated:	Low
Proposed mitigation:	- Given the sparse vegetation and low sensitivity habitat, the requirement for mitigation would be low. The only mitigation necessary in the case of Alternatives 1—4 would be to avoid the seasonal drainage lines and to ensure that they are buffered i.e. treated as watercourses and construction should not be within 32 m of the drainage lines. If this is properly applied and the season watercourses are protected, the mitigation would lower the impacts to **Very Low Negative** for Alternatives 1—4.
Cumulative impact post mitigation:	Very-Low

Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Very-Low Negative

Potential impacts on socio-economic aspects:	
Nature of impact:	**Temporary jobs will be created in the construction industry during the construction phase.**
Extent and duration of impact:	Local. During the construction phase of the activity
Probability of occurrence:	Definite
Degree to which the impact can be reversed:	NA. This is a positive impact
Degree to which the impact may cause irreplaceable loss of resources:	NA
Cumulative impact prior to mitigation:	Low - positive
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low - positive
Degree to which the impact can be mitigated:	Medium
Proposed mitigation:	No mitigation measures are required. Temporary jobs will be created during the construction phase
Cumulative impact post mitigation:	Low - positive
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Low - positive

Potential impacts on cultural-historical aspects:	
Nature of impact:	**The loss of cultural or historic aspects during construction**
Extent and duration of impact:	Local, during construction phase
Probability of occurrence:	Probable
Degree to which the impact can be reversed:	N/A
Degree to which the impact may cause irreplaceable loss of resources:	Low
Cumulative impact prior to mitigation:	Low – Negative
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low – Negative
Degree to which the impact can be mitigated:	Limited
Proposed mitigation:	- The lithic traces on the landscape of proposed Alternatives 1, 3, 4, and 5 are of low significance and the impact of the development on these resources are inconsequential. Alternative 5 lies within a flood plain, and although the impact on heritage resources is negligible, might not be a feasible option. No further mitigation is required regarding heritage resources. Therefore, from a heritage point of view we recommend that the proposed development can continue any of these proposed Alternatives. - Alternatives 2 and 6 have lithics scatters that are deemed as Medium Significance and should be mitigated before development can commence on these proposed Alternatives. Mitigation would require sampling, mapping and recording of sensitive areas. Furthermore, care should be taken to avoid these areas completely until its significance can be fully accessed by a professional, especially during construction at any of the more feasible Alternatives. - Due to the low palaeontological significance of the area, no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly

	discovered fossils. It is considered that the development of the proposed development is deemed appropriate and feasible and will not lead to detrimental impacts on the palaeontological resources of the area. If fossil remains are discovered during any phase of construction, either on the surface or unearthed by fresh excavations, the ECO in charge of these developments ought to be alerted immediately. These discoveries ought to be protected (preferably in situ) and the ECO must report to SAHRA so that appropriate mitigation (e.g. recording, collection) can be carried out by a professional palaeontologist (Butler 2018).
Cumulative impact post mitigation:	Low Negative
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Low Negative

Potential noise impacts:	
Nature of impact:	**Noise impact from machinery and plant on the neighbouring properties during construction**
Extent and duration of impact:	Local, Duration of construction phase
Probability of occurrence:	Probable
Degree to which the impact can be reversed:	Low
Degree to which the impact may cause irreplaceable loss of resources:	Negligible
Cumulative impact prior to mitigation:	Low – negative
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low – negative
Degree to which the impact can be mitigated:	Medium
Proposed mitigation:	The following measures should be implemented amongst others: • The Contractor shall endeavour to keep noise generating activities to a minimum. • Construction only to take place during normal working hours • Compliance with the appropriate legislation with respect to noise shall be mandatory.
Cumulative impact post mitigation:	Very Low – negative
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Very Low – negative

Potential visual impacts:	
Nature of impact:	**Unsightly views due to construction site.**
Extent and duration of impact:	Local, during duration of construction
Probability of occurrence:	Probable
Degree to which the impact can be reversed:	Possible
Degree to which the impact may cause irreplaceable loss of resources:	N/A
Cumulative impact prior to mitigation:	Low - negative
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low - negative
Degree to which the impact can be mitigated:	Probable

Proposed mitigation:	Visual impact mitigation measures will be dealt with in the EMP The EMP must be enforced and monitored by the ECO. • The Contractor shall restrict all his activities, materials, equipment and personnel to within the area specified. • Construction material must be stored in areas designated by the site agent and in a neat and orderly manner. • The Contractor must ensure that all structures, equipment, materials and facilities used or created on site for or during construction activities are removed once the project has been completed. The construction site must be cleared and cleaned to the satisfaction of the ECO. • Immediately after the demolition of the camp site, the contractor shall restore the site to its original state, paying particular attention to its appearance relative to the general landscape.
Cumulative impact post mitigation:	Very low - negative
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Very Low - negative

Operational phase:

Potential impacts on geographical and physical aspects:	**Potential impact on freshwater ecosystems**
Nature of impact:	Flood damage during operational phase, Washing of sewage, sludge or treated sewage effluent down the drainage lines and into Hakskeen Pan, Leakage and overflowing of WWTW Irrigation with treated sewage effluent
Extent and duration of impact:	Regional, during operational phase
Probability of occurrence:	Probable
Degree to which the impact can be reversed:	Irreversible
Degree to which the impact may cause irreplaceable loss of resources:	High
Cumulative impact prior to mitigation:	None expected
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	High
Degree to which the impact can be mitigated:	High
Proposed mitigation:	- Construction of storm water management structures - Proper operation of WWTW according to SOP - Evaporation of treated effluent • The new WWTW should be sited as far as possible from drainage lines. If possible at all it should not be sited in a drainage line. As it stands now, it would be hard to find a locality at least 100m away from drainage lines, as these are densely distributed over the landscape. Drainage lines migrate over time across the sandy landscape. Even where there are no drainage lines, signs of water movement are evident. The siting of the new WWTW poses challenges and demand serious consideration. • The new WWTW should be located as far as possible from the banks of Hakskeen Pan. • If possible at all the new WWTW should be sited in the catchment area of the Swartbas Dam. The dam could serve as a buffer, in case of an accidental spillage. • During the construction phase only one access route should be allowed. Vehicles should not be allowed to move anywhere but on the access road. The footprint should be kept as small as possible. • Likewise, the WWTW's site should be kept as small as possible, with construction activities limited to a demarcated area. • Riparian zones should be kept intact, as far as possible. Where damaged, rehabilitation should take place. • Special care should be taken during the design of the new WWTW with regard to storm water management. Cut-off berms and erosion resistant materials should be included in the design. The design should make provision for a worst-case scenario • At least 500mm freeboard should be maintained in the ponds

	at all times. Additional ponds should be considered prior to the reaching of the design capacity of the new WWTW. • Written contingency plans should be drafted for implementation, should a spill ever occur. • Clean-up kits should be available, in case of a spill from tanker trucks. • The de-sludging of anaerobic ponds poses special challenges. A new pond should be ready for use prior to the de-sludging operation. The pond in need of maintenance should be allowed to properly dry out before the sludge is removed. Sludge should preferably not be disposed of in the direct Hakskeen Pan catchment area, but should be moved elsewhere so that there is no chance left for any of it to move into Hakskeen Pan during floods. • Given the ecological realities, treated sewage effluent should preferably not be used for irrigation of crops in the Hakskeen Pan catchment area. The effluent should rather be allowed to evaporate from a pond designed for this purpose. The very high evaporation rate of the Kalahari Desert would aid the process. • An ECO should be appointed for the construction of the new WWTW. • Staff operating the WWTW should be properly qualified and experienced.
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Very Low

Potential impacts on geographical and physical aspects:	**Potential impact on freshwater ecosystems**
Nature of impact:	Maintenance of WWTW Desludging op anaerobic ponds,
Extent and duration of impact:	Regional, during operational phase
Probability of occurrence:	Probable
Degree to which the impact can be reversed:	Irreversible
Degree to which the impact may cause irreplaceable loss of resources:	High
Cumulative impact prior to mitigation:	None expected
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	High
Degree to which the impact can be mitigated:	High
Proposed mitigation:	- Proper planning and operation of desludging • The new WWTW should be sited as far as possible from drainage lines. If possible at all it should not be sited in a drainage line. As it stands now, it would be hard to find a locality at least 100m away from drainage lines, as these are densely distributed over the landscape. Drainage lines migrate over time across the sandy landscape. Even where there are no drainage lines, signs of water movement are evident. The siting of the new WWTW poses challenges and demand serious consideration.

	• The new WWTW should be located as far as possible from the banks of Hakskeen Pan. • If possible at all the new WWTW should be sited in the catchment area of the Swartbas Dam. The dam could serve as a buffer, in case of an accidental spillage. • During the construction phase only one access route should be allowed. Vehicles should not be allowed to move anywhere but on the access road. The footprint should be kept as small as possible. • Likewise, the WWTW's site should be kept as small as possible, with construction activities limited to a demarcated area. • Riparian zones should be kept intact, as far as possible. Where damaged, rehabilitation should take place. • Special care should be taken during the design of the new WWTW with regard to storm water management. Cut-off berms and erosion resistant materials should be included in the design. The design should make provision for a worst-case scenario • At least 500mm freeboard should be maintained in the ponds at all times. Additional ponds should be considered prior to the reaching of the design capacity of the new WWTW. • Written contingency plans should be drafted for implementation, should a spill ever occur. • Clean-up kits should be available, in case of a spill from tanker trucks. • The de-sludging of anaerobic ponds poses special challenges. A new pond should be ready for use prior to the de-sludging operation. The pond in need of maintenance should be allowed to properly dry out before the sludge is removed. Sludge should preferably not be disposed of in the direct Hakskeen Pan catchment area, but should be moved elsewhere so that there is no chance left for any of it to move into Hakskeen Pan during floods. • Given the ecological realities, treated sewage effluent should preferably not be used for irrigation of crops in the Hakskeen Pan catchment area. The effluent should rather be allowed to evaporate from a pond designed for this purpose. The very high evaporation rate of the Kalahari Desert would aid the process. • An ECO should be appointed for the construction of the new WWTW. • Staff operating the WWTW should be properly qualified and experienced.
Cumulative impact post mitigation:	Low
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Very Low

Potential impact biological aspects:	
Nature of impact:	**No biological aspects are expected to be impacted during the operational phase**
Extent and duration of impact:	
Probability of occurrence:	
Degree to which the impact can be reversed:	
Degree to which the impact may cause irreplaceable loss of resources:	
Cumulative impact prior to mitigation:	
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	
Degree to which the impact can be mitigated:	
Proposed mitigation:	
Cumulative impact post mitigation:	
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	

Potential impacts on the socio-economic aspects:	
Nature of impact:	The project is expected to: - provide job opportunities during the construction and the operational phase.
Extent and duration of impact:	Local, Permanent
Probability of occurrence:	Definite
Degree to which the impact can be reversed:	NA
Degree to which the impact may cause irreplaceable loss of resources:	NA, the impact is a positive impact
Cumulative impact prior to mitigation:	NA
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	NA
Degree to which the impact can be mitigated:	NA, the impact is a positive impact
Proposed mitigation:	No mitigation measures are required
Cumulative impact post mitigation:	Low - Positive
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Low - Positive

Potential impacts on the cultural-historical aspects:	
Nature of impact:	**No cultural or historic impacts are expected during the operational phase of this activity.**
Extent and duration of impact:	
Probability of occurrence:	
Degree to which the impact can be reversed:	
Degree to which the impact may cause irreplaceable loss of resources:	
Cumulative impact prior to mitigation:	
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	
Degree to which the impact can be mitigated:	
Proposed mitigation:	
Cumulative impact post mitigation:	
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	

Potential noise impacts:	
Nature of impact:	**No significant noise impacts are expected during the operational phases**
Extent and duration of impact:	
Probability of occurrence:	
Degree to which the impact can be reversed:	
Degree to which the impact may cause irreplaceable loss of resources:	
Cumulative impact prior to mitigation:	
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	
Degree to which the impact can be mitigated:	
Proposed mitigation:	
Cumulative impact post mitigation:	
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	

Potential visual impacts:	
Nature of impact:	**The activity is not expected to have a visual impact during the operational phase as the development is rather small and fitting with the surrounding land-uses.**
Extent and duration of impact:	
Probability of occurrence:	
Degree to which the impact can be reversed:	
Degree to which the impact may cause irreplaceable loss of resources:	
Cumulative impact prior to mitigation:	
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	
Degree to which the impact can be mitigated:	
Proposed mitigation:	
Cumulative impact post mitigation:	
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	

Potential odour impacts:	
Nature of impact:	**Potential odours from the WWTW impacting on the residents of Loubos**
Extent and duration of impact:	Local, during the operational phase
Probability of occurrence:	Probable
Degree to which the impact can be reversed:	High
Degree to which the impact may cause irreplaceable loss of resources:	N/A
Cumulative impact prior to mitigation:	Low - negative
Significance rating of impact prior to mitigation (Low, Medium, Medium-High, High, or Very-High)	Low - negative
Degree to which the impact can be mitigated:	High
Proposed mitigation:	Final placement of the WWTW at Site Alternative 1 should ensure that any smells from the oxidation ponds d
Cumulative impact post mitigation:	Very low - negative
Significance rating of impact after mitigation (Low, Medium, Medium-High, High, or Very-High)	Very Low - negative

Decommissioning:

The project as proposed does not require ‘decommissioning’ or ‘closure’, as such the potential impacts thereof is considered irrelevant.