Geographical and Physical

1. Soil erosion and dust

Dam Expansion	Geographical and Physical Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Disturbance to soil which is caused during the construction of the dam wall may lead to erosion of the site and surrounds.**
Extent and duration of impact:	**Extent 1 (footprint) & Duration 1**
Magnitude:	**2**
Consequence of impact or risk:	**Clearing and excavation activities can result in erosion and dust.**
Probability of occurrence:	**2 (I)**
Degree to which the impact may cause irreplaceable loss of resources:	**2 (PR)**
Degree to which the impact can be reversed:	**PR**
Indirect impacts:	**Disturbance to surface area can result in erosion and dust generation**
Cumulative impact prior to mitigation:	**Exposing soil may lead to erosion and dust generation if not mitigated.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**8 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**1 (CM)**
Proposed mitigation:	• **Access to roads and other areas must be controlled to avoid disturbance of areas outside the development footprint. Personnel should be restricted to the immediate construction areas only.** • **Monitor construction areas frequently for signs of erosion and if signs of erosion are detected implement repair and preventative measures immediately.** • **Strict compliance with the EMPr and MMP.**
Residual impacts:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Cumulative impact post mitigation:	**It is not anticipated that the impact will be high if the mitigation measures are adhered to.**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Soil erosion and dust**
Nature of impact:	**Similar to that in the development phase.**

Ecological and Biological

2. Loss of freshwater ecological habitat

Dam Expansion	Biological Aspect Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Habitat destruction is the alteration of a natural habitat to the point that it is rendered unfit to support the species dependent upon it as their home territory. Many organisms previously using the area are displaced or destroyed, thereby reducing biodiversity. Modification of habitats for agriculture as well as surface mining and urban development are the main causes of habitat destruction in this case. Additional causes of habitat destruction include water pollution, introduction of alien species and overgrazing. The non-perennial riverine systems have very low flows as part of their annual hydrological cycles and are particularly susceptible to changes in habitat condition. The proposed development project has the potential to lead to habitat loss and/or alteration of the aquatic and riparian resources on the study area. It is however important to note that the freshwater ecology, and especially aquatic habitats of most of the systems has been**

	impaired or impacted already as a result of existing dams, road crossings, channelization upstream and historical agricultural impacts and as such the risk to the receiving environment as a result of the proposed project is reduced to some degree.
Extent and duration of impact:	**Extent 2 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Loss of freshwater ecological habitat**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of freshwater ecological habitat**
Cumulative impact prior to mitigation:	***Riparian zone*** **Earthworks in the vicinity of drainage systems leading to increased runoff and erosion and altered runoff patterns.** **Construction of the dam wall.** **Alien invasive vegetation encroachment.** ***Instream zone*** **Loss of aquatic refugia.** **Altered substrate conditions due to the deposition of silt.** **Altered depth and flow regimes in the non-perennial river.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**Essential mitigation measures:** • **Limit the footprint area of the construction activity to what is absolutely essential in order to minimise the loss of aquatic habitats in the area.** • **Keep all demarcated sensitive zones outside of the construction area off limits during the construction phase of the project. The non-impacted areas of the non-perennial river, its riparian zones and 32m buffer areas is regarded as no-go and no impact areas.** • **On-going aquatic ecological monitoring must take place as per the water use authorization by a suitably qualified assessor.** • **Contractor laydown areas and stockpiles to be established outside of the 100m Zone of Regulation implemented around the watercourses.** • **Vehicles to be serviced at the contractor laydown area and all re-fuelling is to take place outside of all relevant zones of regulation.** • **Care must be taken to ensure that all concrete mixing is done on batter boards or within suitably bunded areas and no cement laden run-off may enter into the preferential surface flow pathway or the downstream ephemeral stream.** **Recommended mitigation measures** • **Permit only essential construction personnel within 32m of all riparian systems;** • **Restrict construction activities to the drier summer months, if possible, to avoid sedimentation and siltation of riparian features in the vicinity of the proposed development and aim for completion in early spring at which time revegetation should take place allowing for a full summer growing season to become established.**
Residual impacts:	**Loss of freshwater ecological habitat**
Cumulative impact post mitigation:	**Loss of freshwater ecological habitat**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Loss of freshwater ecological habitat**
Nature of impact:	**Not Applicable.**

3. Degradation / loss of naturally occurring / indigenous flora and habitats

Dam Expansion	Biological Aspect Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**A localised loss of riparian habitat and modification of the stream bed or banks of the watercourse at the dam site and immediately downstream is likely to occur as a result of the dam construction as well as the pipeline construction. This impact is however likely to be small due to the fact that the habitat within the watercourse for the preferred dam site as well as the watercourse and dam basin catchment that will be impacted by the dam are already moderately to largely modified.** **Special precaution is to be taken during the construction of the infrastructure that falls within the regulated area as determined in the NWA. Construction activities must be controlled to ensure that the river and its buffer areas are not negatively impacted.**
Extent and duration of impact:	**Extent 3 & Duration 2**
Magnitude:	**4**
Consequence of impact or risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Probability of occurrence:	**4**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly Reversible (PR)**
Indirect impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact prior to mitigation:	**None as a result of the degraded habitat at the proposed dam impact area.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**36 - Medium**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	• **Undertake construction activities only in identified and specifically demarcated areas.** • **Invasive vegetation to be removed during construction to be disposed of at landfill site if not use for fire wood, in such a manner that seeds must not be able to spread from the disposal site or during transportation.** • **At no point may construction equipment stand unauthorised within or near the river.** • **All excess sediment removed from the watercourses must be utilised as part of the building activities or be removed from site. At no point may this material be dumped on site or within any of the other freshwater features identified within the surrounding area. Topsoil will have a high density of alien invasive seeds which will need to be controlled into the operational phase.** • **Soil surrounding the wingwalls must be suitably backfilled and sloped (minimum of a 1:3 ratio) and concrete aprons as well as gabion mattresses should be installed both up and downstream for energy dissipation and sediment trapping.**
Residual impacts:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Cumulative impact post mitigation:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Degradation / loss of naturally occurring / indigenous flora and habitats**
Nature of impact:	**Not Applicable.**

4. Impact on sensitive environments (rivers, wetlands etc.)

Dam Expansion	Biological Aspect Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**Not Applicable**
OPERATIONAL PHASE	
Potential impact and risk:	**Flow modification**
Nature of impact:	**The proposal is to store 55 000 cubic meters of allocated water from the Berg River in a newly constructed dam that would be constructed within a minor tributary of the Berg. Flow within the minor tributary would only occur for a short period of time in winter.**
Extent and duration of impact:	**Extent 1 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Flow modification**
Probability of occurrence:	**2**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Loss of significantly impacted upon habitat and bed/bank modification.**
Cumulative impact prior to mitigation:	**There is only likely to be surface water runoff from the catchment of the minor tributaries between the months of April/May and October. The Environmental Water Requirement of the watercourses within the study area for the recommended ecological category for these streams of a C category (moderately modified) would be approximately 20% of the Mean Annual Runoff (MAR) of the watercourses. This would equate to an environmental flow requirement of approximately 6 600 m³. There is however only a very short stretch of the watercourse (about 45m) downstream of the proposed dam that would benefit from any environmental flow release.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**The tributary in which the dam is proposed as well as that associated with the pump station and pipeline still contains some indigenous vegetation within the watercourse but also contains invasive alien plants. It is important that the disturbed area is rehabilitated and that ongoing monitoring and management of invasive alien plants with the watercourses are undertaken. The erosion within the watercourse in which the dam is proposed should be addressed and where possible re-vegetated with suitable vegetation. Follow up work should be carried out after rehabilitation to ensure that no invasive alien plants establish themselves within the watercourse adjacent to the dam as well as downstream of the dam. All of the above recommendations should be included in a River Management Maintenance Plan (MMP) for the project that would form part of the Environmental Management Plan.**
Residual impacts:	**Flow modification**
Cumulative impact post mitigation:	**Flow modification**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Impact on sensitive environments (rivers, wetlands etc.)**
Nature of impact:	**Similar to that in the development phase.**

Dam Expansion	Biological Aspect Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Water quality impairment**
Nature of impact:	**There is a potential for some sedimentation and contaminated run-off to impact on the aquatic features during the construction phase activities.**
Extent and duration of impact:	**Extent 1 & Duration 5**
Magnitude:	**2**
Consequence of impact or risk:	**Water quality impairment**
Probability of occurrence:	**2**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Irreversible (IR)**
Indirect impacts:	**Water quality impairment**
Cumulative impact prior to mitigation:	**Contamination and degrading of the water quality downstream of the proposed dam in the non-perennial river and Berg River.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 - Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2 - Partly mitigatable (PM)**
Proposed mitigation:	**The water quality impacts during the construction phase in particular should be addressed through the Construction Environmental Management Plan (CEMP) for the project and implemented by an on-site Environmental Officer (EO). Contaminated runoff from the construction site should be prevented from directly entering the water features. Construction should also preferably take place during the drier months when flow in the streams and run off from the surrounding land is low.**
Residual impacts:	**Water quality impairment**
Cumulative impact post mitigation:	**Water quality impairment**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**10 - Low**
OPERATIONAL PHASE	
Potential impact and risk:	**Water quality impairment**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Water quality impairment**
Nature of impact:	**Not Applicable.**

Socio-economic

5. Increase in jobs

Dam Expansion	Socio-Economic Impacts
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Temporary jobs will be created for the construction of the dam wall.**
Extent and duration of impact:	**Extent 2 (On site or within 100 m of the site) & Duration 1 (0 – 1 years)**
Consequence of impact or risk:	**Influx of contract workers due to lack of skills.** **Influx of job seekers due to jobs created.** **Littering.**
Probability of occurrence:	**4 (most likely)**
Degree to which the impact may cause irreplaceable loss of resources:	**NA – Positive**
Degree to which the impact can be reversed:	**NA – Positive**
Indirect impacts:	**NA – Positive**
Cumulative impact prior to mitigation:	**NA – Positive**
Significance rating of impact prior to mitigation	**8 – Low (positive)**

(e.g. Low, Medium, Medium-High, High, or Very-High)	
Degree to which the impact can be avoided:	**NA – Positive**
Degree to which the impact can be managed:	**NA – Positive**
Degree to which the impact can be mitigated:	**NA – Positive**
Proposed mitigation:	**Local contractors, employing or seeking to employ local (historically disadvantaged individuals (HDIs) from the region who are suitably qualified, should get preference. The municipality, local community and local community organizations should be informed of the project and potential job opportunities by the developer.**
Residual impacts:	**NA – Positive**
Cumulative impact post mitigation:	**NA – Positive**
Significance rating of impact after mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**Low (positive)**
OPERATIONAL PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**Increased jobs**
Nature of impact:	**Similar to that in the development phase.**

Heritage and cultural historic

6. Impact on archaeological, paleontological and heritage remains, etc.

Dam Expansion	**Cultural-Historical Impacts**
PLANNING, DESIGN AND DEVELOPMENT PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains**
Extent and duration of impact:	**Extent 1 (Footprint) & Duration 5 (Will not cease)**
Magnitude:	**2**
Consequence of impact or risk:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Probability of occurrence:	**2 (some possibility, but low likelihood)**
Degree to which the impact may cause irreplaceable loss of resources:	**2-Resource may be partly destroyed (PR)**
Degree to which the impact can be reversed:	**Partly reversible (PR)**
Indirect impacts:	**The proposed development, related facilities and infrastructure will have no impact on the cultural-historical aspects.**
Cumulative impact prior to mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact prior to mitigation (e.g. Low, Medium, Medium-High, High, or Very-High)	**16 – Low**
Degree to which the impact can be avoided:	**High**
Degree to which the impact can be managed:	**High**
Degree to which the impact can be mitigated:	**2-Partly mitigatable (PM)**
Proposed mitigation:	**Should any burials, fossils or other historical material be encountered during construction, work must cease immediately and HWC must be contacted.**
Residual impacts:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Cumulative impact post mitigation:	**Destruction of cultural-historical features at the site will contribute to the loss of such features in the general area due to other non-related activities. This can at all times be mitigated to prevent/ minimise the loss of such features.**
Significance rating of impact after mitigation	**Low**

(e.g. Low, Medium, Medium-High, High, or Very-High)	
OPERATIONAL PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**
DECOMMISSIONING AND CLOSURE PHASE	
Potential impact and risk:	**The potential impact of the proposed development on archaeological, paleontological and heritage remains.**
Nature of impact:	**Not Applicable.**