

## APPENDIX F: IMPACT ASSESSMENT

# 1. IMPACTS AND RESIDUAL RISKS ASSESSMENT

## 1.1 Introduction

---

Impact assessment must take account of the nature, scale and duration of effects on the environment, whether such effects are positive (beneficial) or negative (detrimental).

It is also imperative that each issue / impact is also assessed according to the project stages from planning, through construction and operation to the decommissioning phase.

Where necessary, the proposal for mitigation or optimisation of an impact is noted.

The environmental impact assessment is focused on the following phases of the project namely: **Construction** and **Operational Phases** only.

As the project entails upgrades and development of new infrastructure which will be permanent, decommissioning is not applicable to this project.

## 1.2 Methodology

---

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- **Nature:** A brief written statement of the environmental aspect being impacted upon by a particular action or activity;
- **Extent:** The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration:** Indicates what the lifetime of the impact will be;
- **Intensity:** Describes whether an impact is destructive or benign;
- **Probability:** Describes the likelihood of an impact actually occurring; and
- **Cumulative:** In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

**Table 1: Criteria to be used for the rating of impacts**

Criteria		Description		
<b>EXTENT</b>	<b>National (4)</b> The whole of South Africa	<b>Regional (3)</b> Provincial and parts of neighbouring provinces	<b>Local (2)</b> Within a radius of 2 km of the construction site	<b>Site (1)</b> Within the construction site
<b>DURATION</b>	<b>Permanent (4)</b> Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	<b>Long-term (3)</b> The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	<b>Medium-term (2)</b> The impact will last for the period of the construction phase, where after it will be entirely negated	<b>Short-term (1)</b> The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase
<b>INTENSITY</b>	<b>Very High (4)</b> Natural, cultural and social functions and processes are altered to extent that they permanently cease	<b>High (3)</b> Natural, cultural and social functions and processes are altered to extent that they temporarily cease	<b>Moderate (2)</b> Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	<b>Low (1)</b> Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
<b>PROBABILITY OF OCCURRENCE</b>	<b>Definite (4)</b> Impact will certainly occur	<b>Highly Probable (3)</b> Most likely that the impact will occur	<b>Possible (2)</b> The impact may occur	<b>Improbable (1)</b> Likelihood of the impact materialising is very low

**Table 2: Criteria for the rating of classified impacts**

Class		Description
<b>+</b>	<b>Any value</b>	<b>Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken.</b>
<b>-</b>	<b>Low impact (4 - 6 points)</b>	<b>A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.</b>
	<b>Medium impact (7 - 9 points)</b>	<b>Mitigation is possible with additional design and construction inputs.</b>
	<b>High impact (10 - 12 points)</b>	<b>The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.</b>
	<b>Very high impact (12 - 14 points)</b>	<b>Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.</b>
<b>Status</b>	<b>Denotes the perceived effect of the impact on the affected area.</b>	
<b>Positive (+)</b>	<b>Beneficial impact.</b>	
<b>Negative (-)</b>	<b>Deleterious or adverse impact.</b>	
<b>Neutral (/)</b>	<b>Impact is neither beneficial nor adverse.</b>	
<b>It is important to note that the status of an impact is assigned based on the <i>status quo</i> – i.e. should the project not proceed. Therefore, not all negative impacts are equally significant.</b>		

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented.

Mitigation measures identified as necessary will be included in an EMPr.

## **1.3 Rating of Potential Impacts**

---

The potential impacts identified are explained per phase of the project and mitigation measures are provided. The impacts are explained per pre-construction, construction and operational phases.

## Soils and Agriculture

**Table 3: Earth-works – soils and agricultural impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Construction activities (site clearing).  <b>Impact:</b> Physical degradation due to the removal and compaction of soil during construction activities.	<b>Without</b>	2	2	2	2	-8	Medium
		<b>With</b>	1	1	1	1	-4	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Strip topsoil prior to any construction activities.</li> <li>Topsoil must be kept separate from overburden and must not be mixed with other layer of soil and sub-soil.</li> <li>Topsoil must not be stockpiled for an extended period of time.</li> <li>Soil must be returned to the trench in the correct order, with topsoil on top. The top-soil must then be de-compacted.</li> </ul>							
	<b>Aspect:</b> Construction activities (site clearing).  <b>Impact:</b> Physical degradation due to soil erosion as a result of exposed soil and topsoil.	<b>Without</b>	2	2	2	3	-9	Medium
		<b>With</b>	1	1	1	2	-5	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Soil erosion is related to the water velocity and volume as well as the presence of well-established vegetation.</li> <li>Mitigation measures therefore include the development of velocity barriers for stormwater run-off and ensuring exposed areas are rehabilitated as detailed in the EMP.</li> <li>The stormwater management plan (SWMP) must be complied with.</li> </ul>							
	<b>Aspect:</b> Establishment of contractor laydown area (camp).  <b>Impact:</b> Impact on land use and land capability – disturbance of soils and/or agricultural land use potential due to the location of the construction camp and associated infrastructure.	<b>Without</b>	1	2	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>The contractor laydown area must be placed in an area where agricultural activities are not undertaken.</li> <li>The contractor laydown area may not be placed in or in close proximity to any watercourse.</li> <li>No material may be stored or equipment repaired beyond the boundaries of the contractor laydown area.</li> </ul>							

## Geology and Topography

**Table 4: Geology and topography impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Foundations. <b>Impact:</b> Disturbance of surface geology resulting in site instability due to inadequate drainage and/or inappropriate engineering planning and interventions.	<b>Without</b>	1	2	3	3	-9	Medium
		<b>With</b>	1	2	1	2	-6	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>It is important to allow for on-site inspections and evaluations by an experienced engineering geologist / geotechnical engineer so that stability problems can be timeously identified and remedied.</li> <li>All earth-works should be carried out in a manner to promote stable development of all infrastructure.</li> <li>It is recommended that earth-works be carried out along the guidelines given in SANS 1200 (current version).</li> <li>Earth-works and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the sites.</li> <li>The geology must be returned to pre-construction condition.</li> </ul>							
	<b>Aspect:</b> Construction activities (site clearing). <b>Impact:</b> Gully or 'donga' erosion by concentrated, uncontrolled water-flow.	<b>Without</b>	1	2	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Cut embankments must be protected against surface erosion by the establishment of vegetation immediately after construction.</li> <li>Suitable subsoil drainage, stormwater control and preventable solutions to avoid soil erosion will be required in areas with sandy soils, and particularly in close proximity to watercourses.</li> <li>Adequate stormwater surface drainage as per the stormwater management plan must be adopted.</li> </ul>							

## Air Quality and Odour

**Table 5: Air quality and odour impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Construction activities (site clearing; operation of vehicles, equipment etc.). <b>Impact:</b> Fugitive dust emissions from debris handling and debris	<b>Without</b>	2	2	2	3	-9	Medium
		<b>With</b>	1	1	1	2	-5	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Dust must be suppressed on the construction-site during dry periods by the regular application of water.</li> <li>Water used for this purpose must be used in quantities that will not result in the generation of run-off.</li> </ul>							

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	piles; mobile plant / machinery and general construction activities.	<ul style="list-style-type: none"> <li>Dust dispersion from construction activities, roads, soil stockpiles and other construction locations will be limited and suppressed to the maximum extent practical.</li> <li>Surplus fill material sites and stockpiles will be positioned such that they are not vulnerable to wind erosion.</li> <li>Cover skips and trucks which are loaded with construction materials.</li> <li>All stockpiles should be maintained for as short a time as possible and should be enclosed by wind-breaking enclosures of similar height to the pile.</li> <li>Stockpiles should be situated away from the site boundary, watercourses and nearby receptors and should take into account the predominant wind direction.</li> <li>A speed limit of 40 km/hr should be set for all vehicles travelling over exposed areas or near stockpiles.</li> <li>Dust and mud should be controlled at vehicle exit and entry points to prevent the dispersion of dust and mud beyond the site boundary.</li> </ul>						
	<b>Aspect:</b> Construction activities (site clearing; operation of vehicles, equipment etc.).	<b>Without</b>	2	1	3	3	-9	Medium
	<b>Impact:</b> Generation of fumes from vehicle emissions may pollute the air.	<b>With</b>	2	1	2	2	-7	Medium
		<b>Mitigation measures:</b>						
		<ul style="list-style-type: none"> <li>All mobile plant and equipment must be in good working order.</li> <li>A register must be maintained for vehicle maintenance.</li> <li>All mobile plant that are unable to be repaired immediately must be removed from service until such time as they are in good working condition.</li> </ul>						
	<b>Aspect:</b> Chemical toilets.	<b>Without</b>	1	2	3	2	-8	Medium
	<b>Impact:</b> Release of odours as a result of the chemical toilets on-site.	<b>With</b>	1	1	1	2	-5	Low
	<b>Mitigation measures:</b>							
	<ul style="list-style-type: none"> <li>Chemical toilets must be provided and cleaned on a regular (weekly) basis.</li> <li>They must be situated at least 50 m from any watercourse. If no other exists except for being closer to the watercourse, this distance may be dropped to 32 m with consent of the ECO only.</li> <li>They must be provided at a ratio off 1:15 i.e. one toilet for every 15 labourers.</li> <li>Servicing receipts must be maintained and kept on site within the site environmental file.</li> </ul>							

## Noise

**Table 6: Noise impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Constructions staff, vehicles and equipment.  <b>Impact:</b> Increase in noise pollution from construction vehicles and construction staff.	<b>Without</b>	1	1	3	3	-8	Medium
		<b>With</b>	1	1	1	2	-5	Low
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>All construction activities must be undertaken according to daylight working hours.</li> <li>The Contractor may consider providing all equipment with standard silencers. Maintain silencer units in vehicles and equipment in good working order.</li> <li>All mobile plant and equipment must be regularly maintained to ensure their integrity and reliability.</li> <li>Construction staff working in an area where the 8-hour ambient noise levels exceed 85 dBA must have the appropriate Personal Protective Equipment (PPE).</li> <li>All operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993).</li> <li>Surrounding communities and adjacent landowners are to be notified upfront of noisy construction activities (blasting and excavations).</li> <li>A Complaints Register is to be kept at the Site Office at all times.</li> </ul>						

## Visual

**Table 7: Visual impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Construction activities.  <b>Impact:</b> During construction the clearing and grading of the site would create a visual scar in the landscape. Exposed bare soil would contrast with the prominently green multi-crop fields. Large construction vehicles and equipment may	<b>Without</b>	2	3	2	1	-8	Medium
		<b>With</b>	2	2	1	1	-6	Low
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Limited clearing of vegetation on the development site. This will retain the screening function of natural vegetation.</li> <li>Carefully plan to reduce the construction period.</li> <li>Locate the construction camp and storage areas in zones of low visibility i.e. behind dense bush or in lower lying areas.</li> <li>Minimise vegetation clearing and use a phased approach, only clearing vegetation when required.</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	also be visible to receptors within the study area.	<ul style="list-style-type: none"> <li>Areas of dense bush on the boundaries of the development site should be left intact.</li> <li>Rehabilitate cleared areas as soon as possible.</li> <li>Dust suppression techniques should be made use of.</li> <li>Maintain a neat construction site by removing rubble and waste materials regularly.</li> </ul>					

## Traffic

**Table 8: Traffic impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Construction activities. <b>Impact:</b> Increase in traffic from construction vehicles.	<b>Without</b>	1	2	2	3	-8	Medium
		<b>With</b>	1	1	1	2	-5	Low
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Arrangements must be made with local communities in order to accommodate construction vehicles on existing road networks.</li> <li>All damaged roads must be repaired by the contractor.</li> <li>Construction vehicles are to avoid main roads during peak traffic hours.</li> <li>All vehicles entering the site are to be roadworthy.</li> <li>Seatbelts are to be worn at all times.</li> <li>When using heavy or large vehicles / equipment, "spotters" are to be present to assist the driver with his blind spots.</li> <li>Any incident or damage to a vehicle must be reported immediately.</li> </ul>						

## Stormwater

**Table 9: Stormwater impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Construction activities.	<b>Without</b>	1	2	3	3	-9	Medium
		<b>With</b>	1	1	1	2	-5	Low



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	<p><b>Impact:</b> Increased run-off as a result of construction activities and bare, exposed ground. Potential knock-on impacts to nearby watercourses and their related wetlands through erosion and siltation.</p>	<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ Sandbag berms must be placed at regular intervals on all steep slopes on the trench line before and after backfilling in order to minimise erosion and contaminate stormwater run-off into water courses.</li> <li>▪ When the trench line runs across sloping ground, the topsoil excavated from the trench must be stored on the down-slope side of the trench and the sub-soil on the up-slope side. <ul style="list-style-type: none"> <li>○ This is important for two reasons: (1) the larger volume of soil is stored upslope of the trench so that if soil fines and silt are washed off the stockpile during rainfall events, these are washed into the trench and not into a water course, and (2) it is important to separate the two so that the topsoil is placed on top of the subsoil when the trench is backfilled.</li> <li>○ This is essential to promote rapid growth of vegetation during the rehabilitation phase.</li> </ul> </li> <li>▪ Newly excavated pipeline trenches on steep slopes must have sandbag berms placed on either side of the trench line radiating out from the soil stockpiles at 10 m intervals. <ul style="list-style-type: none"> <li>○ The berms must point very slightly downhill to prevent stormwater build up.</li> <li>○ These berms will greatly reduce the volume of stormwater polluted with silt and soil fines which could impact on rivers and streams below the pipelines and will minimise erosion of bare areas.</li> <li>○ Silt and soil fines that build up on the inside of these berms must be removed and placed back on the soil stockpiles.</li> <li>○ Stone packs should be placed at the discharge points at the ends of these berms to prevent erosion if necessary.</li> </ul> </li> <li>▪ Once the trenches have been backfilled and the soil compacted, sandbag berms must be placed across the trench lines at 10 m intervals. <ul style="list-style-type: none"> <li>○ Berms must be angled just off 90° to the slope to prevent the build-up of stormwater on the inside of the berm.</li> <li>○ Wattle or Gum Poles must be pegged in place between the berms to further reduce the flow of stormwater. The poles must be at least 130 mm in diameter.</li> <li>○ The berms will minimise erosion and pollution and will contribute to vegetation growth in a shorter time frame.</li> <li>○ Stone packs should be placed at the ends of the berms to prevent erosion at discharge points if necessary.</li> </ul> </li> <li>▪ Standpipes are often a source of soil erosion hence concrete surrounds (i.e. aprons) shall be provided for each standpipe and the area where the water runs-off covered in a stone pack.</li> <li>▪ At stream and river crossing points the construction area must be isolated by a sandbag bund in order to protect the area from possible silt contaminated run-off.</li> <li>▪ Suitable erosion control measures shall be implemented at stormwater discharge points, exposed areas and embankments. These measures could include: <ul style="list-style-type: none"> <li>○ The suitable use of sand bags or soil saver;</li> <li>○ The prompt rehabilitation of exposed embankment areas with indigenous vegetation; and</li> <li>○ The removal of vegetation, only as it becomes necessary for work to proceed.</li> </ul> </li> </ul>					

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<ul style="list-style-type: none"> <li>Over-wetting, saturation and unnecessary run-off during dust control activities and irrigation must be avoided.</li> <li>Surface water and stormwater must be minimised and not allowed to flow down cut or fill slopes or along pipeline routes without erosion protection measures, as previously discussed, being in place.</li> <li>All overflow and scours channels shall be lined with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge from these channels must be at a point where there is dense natural grass cover or should have a suitable diffuser mechanism linked to the discharge point.</li> <li>Channels shall not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient.</li> <li>All run-off must be collected and channelled to discharge via surface spreaders into drainage lines.</li> <li>Upon completion of backfilling, sandbag berms must be placed across the bare area created by the trench line. These berms must be angled just off 90°.</li> <li>The intention is to have a minimum distance of open trench with stockpiled soils exposed to rainfall and storm water flow at any one time. It is essential that construction and rehabilitation is completed as quickly as is reasonably possible.</li> <li>The contractor is to adhere to and implement the SWMP.</li> </ul>					

## Biodiversity

**Table 10: Biodiversity impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Clearing of vegetation for construction of pipeline and reservoir. <b>Impact:</b> Disturbance of wooded ravines, cliffs and afforested plantation areas.	<b>Without</b>	1	1	2	3	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		Wooded ravines, cliffs and afforested plantation areas do occur within the proposed project development area, although the proposed infrastructure physically avoids these. <b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Workers must be limited to areas under construction within the 10 m construction servitude on either side or 5 m on either side within areas of high sensitivity as outlined in the EMPr.</li> <li>Access to the undeveloped areas, especially the relict Sandstone Sourveld on the edge of the plateau, Scarp Forest, and, rocky cliff and wooded valleys, must be strictly regulated.</li> <li>The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</li> </ul>						
Construction	<b>Aspect:</b>	<b>Without</b>	1	3	1	3	-8	Medium

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	Clearing of riparian vegetation for construction of pipeline and reservoir. <b>Impact:</b> Loss / degradation of non-perennial riparian zones.	<b>With</b>	1	1	1	-4	Low	
		<p>Non perennial riparian zones have been identified in the proposed project development area.</p> <p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion.</li> <li>▪ Construction contractors must be fully briefed on the areas which are of higher sensitivity along the pipeline route and in the vicinity of the reservoir.</li> <li>▪ Preventative measures to keep the area in the state it was found, must be sought.</li> <li>▪ The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</li> </ul>						
Construction	<b>Aspect:</b> Vegetation site clearing. <b>Impact:</b> Clearing and loss of natural vegetation.	<b>Without</b>	1	1	2	3	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<p>While the pipeline route will form part of the existing (informal) road servitude, there is potential that some areas may have existing vegetation.</p> <p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ Vegetation clearance must be restricted to the actual pipeline trench (1.5–2 m) within the pipeline servitude (10 m on either side, or, 5 m on either side within areas of high sensitivity, as outlined in the EMPr).</li> <li>▪ All alien vegetation in the pipeline servitude and densifiers (that create a fire hazard), shall be cleared and treated with herbicides. <ul style="list-style-type: none"> <li>○ The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent.</li> <li>○ The ECO must approve the use of herbicides.</li> </ul> </li> <li>▪ Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion. This is especially relevant adjacent to the Nhlankakazi borehole adjacent to the valley bottom wetland.</li> </ul>						
Construction	<b>Aspect:</b> Clearing of vegetation for construction of pipeline and reservoir. <b>Impact:</b> Habitat loss – particularly for red listed species.	<b>Without</b>	1	1	2	3	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<p>No Red Data listed ('Red List') species were identified within the project development area. There are however a number of so-called Orange List (i.e. species of provincial importance) present within the proposed reticulation alignment – it is thus required that the alignment be directly surveyed by a qualified specialist and relevant plants demarcated, or if relocation / removal is required, obtain approval from the provincial authority prior to relocation / removal thereof.</p> <p>It is noted that the dominant impact will be due to the increased human density, heavy construction machinery and vehicles will most likely directly and indirectly result in the short to long term alteration of the faunal composition on the site</p>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		and surrounding areas, particularly in the area the reservoir is being established. Loss of habitat for foraging, reproduction and shelter will most severely impact on the smaller sedentary species (insects, arachnids, reptiles, amphibians and mammals). Larger more agile birds and mammals will try and locate suitable habitat away from the development. <b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Contract employees must be educated about the value of wild animals and the importance of their conservation.</li> <li>Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harm remaining faunal species.</li> <li>No animals must not be intentionally killed or destroyed and poaching and hunting must not be permitted on the site.</li> </ul>						
Construction	<b>Aspect:</b> Construction of pipeline and reservoir. Development of fill embankments and site clearing. <b>Impact:</b> Degradation and loss of soil.	<b>Without</b>	1	1	2	3	-7	Medium
		<b>With</b>	1	1	1	2	-5	Low
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Top soil stripping must be restricted to the pipeline trench (1.5–2 m) and appropriately stored for later use in back-filling.</li> <li>Sub-soil and topsoil (the top ± 30–50 cm of the soil) should be stored separately.</li> <li>Soil stockpiles are to be protected from possible erosion, e.g. through covering of the stockpiles with tarpaulin, and limiting the height and angle of the stockpile.</li> <li>Soil stockpiles must not exceed 1 m in height.</li> <li>Soil stockpiling areas must be sufficiently situated away from the drainage areas towards the lower lying non-perennial drainage lines.</li> <li>Any erosion channels developed during the construction period or during the vegetation establishment period should be backfilled and compacted, and the areas restored to a proper condition.</li> <li>The Contractor should ensure that cleared areas are effectively stabilised to prevent and control erosion.</li> <li>Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent further soil erosion.</li> <li>Re-seeding shall be done on disturbed areas especially adjacent to any natural bushveld habitat, riverine or wetland crossing.</li> <li>In accordance with the Conservation of Agricultural Resources Act, Act No. 43 of 1983, slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced.</li> <li>Contour banks shall be spaced according to the original or surrounding topography / slope. The type of soil shall also be taken into consideration.</li> <li>Any erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted, and the areas restored to a proper condition.</li> <li>The Contractor shall ensure that cleared areas are effectively stabilised to prevent and control erosion.</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Operational	<b>Aspect:</b> Maintenance and repairs of pipelines.  <b>Impact:</b> Disturbance of rehabilitation.	Without	1	1	2	3	-7	Medium
		With	1	1	1	1	-4	Low
		<ul style="list-style-type: none"> <li>Implementation of an operational EMPr to ensure the maintenance and repairs are undertaken in a manner that is least intrusive and rehabilitated immediately upon completion of works.</li> </ul>						
Cumulative	<b>Aspect:</b> Maintenance of the servitude (e.g. clearing of alien vegetation).  <b>Impact:</b> Improvement in the health status of vegetation and natural habitats.	Without	1	1	3	3	-8	Medium
		With	2	3	3	4	+12	Very high
		<b>Mitigation measures:</b> Implementation of an operational EMPr to ensure the proposed protection and enhancement of existing vegetation and natural habitats.						

## Heritage

**Table 11: Heritage impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> Site clearing.  <b>Impact:</b> Disturbance of sites of archaeological, historical and cultural significance.	Without	1	4	1	2	-8	Medium
		With	1	1	1	2	-5	Low
		<p>There were no sites or objects of archaeological, historical and/or cultural significance identified, however, if during construction any possible finds are made, the construction operations must be stopped and a qualified archaeologist be contacted for an assessment of the find.</p> <p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>Grave/ heritage areas are to be marked as 'No-Go' Areas and a 20 m buffer to the graves is to be established.</li> <li>All graves must be accorded the highest level of protection and may not be disturbed without both family consent and a permit from Amafa.</li> <li>Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on the site.</li> <li>Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or paleontological artefacts, as set out in the National Heritage Resources Act (Act No. 25 of 1999), Section 51(1).</li> <li>It is advisable that an information section on cultural/heritage resources be included in the Environmental Induction training and a chance-find procedure be developed. All contractors involved in surface earthmoving activities must be</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
		<p>trained on these procedures.</p> <ul style="list-style-type: none"> <li>▪ These sections must include basic information on: <ul style="list-style-type: none"> <li>○ Heritage;</li> <li>○ Graves;</li> <li>○ Archaeological finds; and</li> <li>○ Historical Structures.</li> <li>○ The archaeologist needs to document (record / photograph) and evaluate the finds on-site, and make recommendations towards possible mitigation measures.</li> </ul> </li> </ul>					

### Socio-economic and Health

**Table 12: Socio-economic and health impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<p><b>Aspect:</b> Construction activities.</p> <p><b>Impact:</b> Expected to provide at least 60 jobs, with the majority of unskilled labour to be sourced from the local communities.</p>	<b>Without</b>	2	2	1	2	+7	Medium
		<b>With</b>	2	2	2	4	+10	High
	<p><b>Aspect:</b> Construction activities.</p> <p><b>Impact:</b> Job creation during the construction phase could result in the influx of people to the area.</p>	<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ All labour (skilled and unskilled) and Contractors should be sourced locally where possible.</li> <li>▪ A labour and recruitment policy will be developed, displayed and implemented by the contractor.</li> <li>▪ Recruitment at the construction site will not be allowed.</li> <li>▪ Where possible, labour intensive practices (as opposed to mechanised) should be practiced.</li> <li>▪ The principles of equality, BEE, gender equality and non-discrimination will be implemented.</li> </ul>						
		<b>Without</b>	2	2	2	2	-8	Medium
		<b>With</b>	2	1	1	1	-5	Low
		<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ Ensure transparent employment process and regular communication via formal communication platforms (for example, Municipal Public Notice Board). In this way the public is kept informed of the work scenario.</li> <li>▪ The office that is handling all recruitment matters (off-site) must undertake the necessary monitoring and communication on site, to potential work-seekers.</li> <li>▪ On site construction camps should not be considered.</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<b>Aspect:</b> Construction activities. <b>Impact:</b> Increased noise and dust leading to increased safety risk and inconvenience to nearby residents	<b>Without</b>	2	2	2	2	-8	Medium
		<b>With</b>	2	1	1	1	-5	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>The contractor will adhere to local authority by-laws relating to noise control.</li> <li>Construction activities will for the most part occur during regular working hours, i.e. Monday to Friday (8am – 5pm).</li> <li>Mechanical equipment with lower sound power levels will be selected to ensure that the permissible occupation noise is not exceeded.</li> <li>Equipment will be fitted with silencers as far as possible to reduce noise.</li> <li>All equipment will be adequately maintained and kept in good working order to reduce noise.</li> <li>A grievance procedure will be established, allowing complaints to be received, recorded and responded to appropriately.</li> <li>The construction area will be cordoned off, thus not causing added safety issues to pedestrian traffic.</li> <li>All employees, contractors and sub-contractors must comply with the Municipality's Health and Safety Policy.</li> <li>Appropriate health and safety signage must be displayed on site.</li> <li>The contractor must water down the dirt roads if in use by the contractors, thus decreasing the dust factor.</li> </ul>							
	<b>Aspect:</b> Construction activities. <b>Impact:</b> Increase in informal and formal procurement of goods and services leading to increased local economic activity.	<b>Without</b>	1	1	1	1	+4	Low
		<b>With</b>	1	1	1	1	+4	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Small-scale vending ventures are likely to experience an increase in the trade of small everyday goods.</li> <li>This is not a sustained activity as it will probably only service the construction workers for the period they are on site.</li> </ul>							
	<b>Aspect:</b> Construction activities. <b>Impact:</b> Compromised Contractor health and safety.	<b>Without</b>	1	2	3	2	-8	Medium
		<b>With</b>	1	2	1	1	-5	Low
	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Moving vehicles, suspended loads, loading and unloading of materials all pose risks. The receptor is limited to the construction workforce.</li> <li>The construction site must be fenced off to prohibit unauthorised access and site access must be strictly controlled.</li> <li>All employees, contractors and sub- contractors to wear appropriate PPE.</li> <li>Open excavations must be clearly marked.</li> </ul>							

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		<ul style="list-style-type: none"> <li>All employees, contractors and sub-contractors must comply with the Municipality's Health and Safety Policy.</li> <li>Appropriate health and safety signage must be displayed on site.</li> </ul>						
Cumulative	<b>Aspect:</b> Community safety and well-being.  <b>Impact:</b> Improvement in access to potable water supply will reduce the number of incidents and improve well-being.	<b>Without</b>	2	3	3	2	-10	High
		<b>With</b>	2	3	3	4	+12	Very high
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Maintenance on the infrastructure must be ongoing.</li> </ul>						

## Geohydrology

Table 13: Geohydrology impacts

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
Construction	<b>Aspect:</b> <ul style="list-style-type: none"> <li>Water supply and quality</li> <li>Improper storage of fuels, chemical, etc.</li> <li>Construction equipment, vehicles, workshop and wash bay areas</li> <li>Inadequate ablutions.</li> </ul> <b>Impact:</b> Groundwater scarcity and reduction in groundwater quality. Groundwater contamination as a result of: <ul style="list-style-type: none"> <li>Spillage of fuels, lubricants and other</li> </ul>	<b>Without</b>	1	1	3	3	-8	Medium
		<b>With</b>	1	2	1	2	-6	Low
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>Potentially hazardous substances must be stored on an impervious surface in a designated bunded area, able to contain 110% of the total volume of materials stored at any given time.</li> <li>Material safety data sheets (MSDSs) are to be clearly displayed for all hazardous materials.</li> <li>The integrity of the impervious surface and bunded area must be inspected regularly and any maintenance work conducted must be recorded in a maintenance report.</li> <li>Employees should be provided with absorbent spill kits and disposal containers to handle spillages.</li> <li>Train employees and contractors on the correct handling of spillages and precautionary measures that need to be implemented to minimise potential spillages.</li> <li>All mobile plant and equipment must be regularly maintained to ensure their integrity and reliability. No repairs may be undertaken beyond the contractor laydown area.</li> <li>Immediate reporting and rectification of any incident that might lead to pollution. Implementation of best practice methods to prevent potential incidents from occurring e.g. an Environmental Management System (EMS) reporting and monitoring system.</li> </ul>						



Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<p>chemicals.</p> <ul style="list-style-type: none"> <li>Construction equipment, vehicles, workshop and wash bay areas will be a likely source of pollution as a non-point source.</li> <li>Lack of provision of ablutions that may lead to the creation of informal ablutions.</li> </ul>	<ul style="list-style-type: none"> <li>An Emergency Preparedness and Response Plan will be developed and implemented should an incident occur.</li> <li>Access to storage areas on-site must be restricted to authorised employees only.</li> <li>Contractors will be held liable for any environmental damages caused by spillages.</li> <li>The construction workforce must have adequate sanitation facilities.</li> <li>The sanitation facilities should be on-site before the extended workforce is employed to ensure that no unauthorised sanitation practices are implemented on-site.</li> <li>Potential construction practices that might lead to groundwater contamination should be conducted on areas with impervious surfaces to avoid infiltration of contaminated substances into the groundwater aquifer.</li> <li>All contaminated stormwater should be treated before being discharged into the surrounding natural environment.</li> </ul>						
<b>Operational</b>	<p><b>Aspect:</b> Water supply and quality.</p> <p><b>Impact:</b> Groundwater scarcity and reduction in groundwater quality.</p>	<b>Without</b>	2	1	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>24-hour timer to ensure that the borehole is pumped as per the recommended pumping cycle.</li> <li>Water meter to check the pump discharge rates and volumes abstracted from the aquifer.</li> <li>Conduit must be installed next to the pump riser to allow measuring of static and dynamic water levels.</li> <li>Overload and dry run protection must be installed to prevent the pump burning out.</li> <li>High quality lighting and electrical surge protection must be provided.</li> <li>Pressure switch to stop pump once the tanks or reservoirs are full.</li> <li>The completed pump installation must be protected by a lockable concrete manhole and well head must be graded to ensure surface run-off cannot enter and contaminate the borehole.</li> <li>Boreholes must be equipped with real time monitoring equipment to check the water table and abstraction rates in real time, results of which must be analysed by a qualified geohydrologist on a regular basis.</li> <li>Recommended that ground water is chlorinated to ensure it remains free of <i>E. coli</i> and Total Coliforms.</li> <li>Water quality samples must be taken from the boreholes at least once a year and submitted to an accredited laboratory for analysis as per the SANS 241:2011.</li> </ul>						
<b>Cumulative</b>	<p><b>Aspect:</b> Construction routes through</p>	<b>Without</b>	2	1	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)
	wetland systems. <b>Impact:</b> Compacting of soils may lead to changes in subsurface water flow.	<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>▪ Construction routes, through wetland systems should have adequate drainage to avoid the damming of water and the hindering of natural sub-surface water flow.</li> <li>▪ As far as possible the existing road network should be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. <ul style="list-style-type: none"> <li>○ Should temporary roads or access routes be necessary and unavoidable, proper planning must take place and the site sensitivity plan must be taken into consideration.</li> <li>○ If additional roads are required, then wherever feasible such roads should be constructed a distance from the more sensitive riparian areas and not directly adjacent thereto.</li> <li>○ If crossings are required they should cross the systems at right angles, as far as possible to minimise impacts in the receiving environment.</li> </ul> </li> </ul> <p>The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</p>					

### ***Wetland and Riverine Habitat***

**Table 14: Wetland and riverine habitat impacts**

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
<b>Construction</b>	<b>Aspect:</b> Construction activities within watercourses.  <b>Impact:</b> Site clearing, the removal of vegetation, and associated disturbances to soils, leading to increased run-off and erosion with consequent sedimentation of riparian/wetland habitat.	<b>Without</b>	2	2	2	3	-9	<b>Medium</b>
		<b>With</b>	1	1	1	1	-4	<b>Low</b>
		Watercourses do occur within the proposed project development area, although the proposed infrastructure is aligned along existing roads where disturbance has already occurred. <b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>▪ All construction footprint areas must remain as small as possible and should as far as possible not encroach into surrounding more sensitive areas. It must be ensured that the riparian and drainage line systems, and their associated buffer zones are off-limits to construction vehicles and personnel for the majority of activities. For work within these areas, all work plans must be approved by the ECO with the area modified within the 32m buffer and/or the watercourse is limited as far as feasible.</li> <li>▪ The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas.</li> <li>▪ The working servitude must not exceed 10 m on either side, for non-sensitive areas, as outlined in the EMPr.</li> <li>▪ The working servitude shall be limited to 5 m on either side for areas of high sensitivity, as outlined in the EMPr.</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		<ul style="list-style-type: none"> <li>▪ Any areas where bank failure is observed, due to the pipeline infrastructure, it should be immediately repaired.</li> <li>▪ As far as possible the existing road network must be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment.               <ul style="list-style-type: none"> <li>○ Should temporary roads or access routes be necessary and unavoidable, proper planning must take place and the site sensitivity plan must be taken into consideration.</li> <li>○ If additional roads are required, then wherever feasible such roads should be constructed a distance from the more sensitive riparian areas and not directly adjacent thereto. Additional access roads with work plans and schedule for their proposed use must be approved by the Engineer and Environmental Control Officer, prior to their construction and use.</li> <li>○ If crossings are required they should cross the systems at right angles, as far as possible to minimise impacts in the receiving environment.</li> </ul> </li> <li>▪ All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel.</li> <li>▪ The duration of impacts on the riverine and perennial drainage line systems should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised.</li> <li>▪ Appropriate sanitary facilities must be provided for the life of the construction and all waste removed to an appropriate waste facility.</li> <li>▪ No informal fires should be permitted in within the study area.</li> <li>▪ Ensure that an adequate number of rubbish bins are provided so as to prevent litter and ensure the proper disposal of waste generated during construction activities.</li> <li>▪ Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed.</li> <li>▪ The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</li> </ul>						
Construction	<b>Aspect:</b> Construction activities within watercourses.  <b>Impact:</b> Movement of construction vehicles within the drainage line systems.	<b>Without</b>	2	1	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<p>Watercourses do occur within the proposed project development area, although the proposed infrastructure is aligned along existing roads where disturbance has already occurred.</p> <p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel.</li> <li>▪ All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.</li> <li>▪ All spills, should they occur, must be immediately cleaned up and treated accordingly.</li> <li>▪ The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		medium to high sensitivity areas within the project site.						
Construction	<b>Aspect:</b> Construction activities within watercourses.  <b>Impact:</b> Proliferation of alien vegetation in disturbed areas.	<b>Without</b>	2	4	3	3	-12	High
		<b>With</b>	1	2	2	2	-7	Medium
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>▪ Proliferation of alien and invasive species is expected within any disturbed areas particularly as there is a high degree of alien and invasive species within the study area at present. These species should be eradicated and controlled to prevent further spread beyond the study area.</li> <li>▪ Alien vegetation along the proposed pipeline should be removed and care taken to ensure no more alien plant growth occurs within the newly disturbed areas.</li> <li>▪ Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled.</li> <li>▪ Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;</li> <li>▪ Footprint areas should be kept as small as possible when removing alien plant species; and</li> <li>▪ No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.</li> <li>▪ The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</li> </ul>						
Construction	<b>Aspect:</b> Construction activities within watercourses.  <b>Impact:</b> Earth-works within riparian/wetland habitats and in the vicinity of these areas leading to increased run-off and erosion and altered run-off patterns.	<b>Without</b>	2	1	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<b>Mitigation measures:</b> <ul style="list-style-type: none"> <li>▪ To prevent the further erosion of soils, management measures may include berms, soil traps, hessian curtains and storm water diversion away from areas particularly susceptible to erosion.</li> <li>▪ Install erosion berms during construction to prevent gully formation.               <ul style="list-style-type: none"> <li>○ Berms every 50 m should be installed where any disturbed soils have a slope of less than 2%,</li> <li>○ Every 25 m where the track slopes between 2% and 10%,</li> <li>○ Every 20 m where the track slopes between 10% and 15%, and</li> <li>○ Every 10 m where the track slope is greater than 15%.</li> </ul> </li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		<ul style="list-style-type: none"> <li>Sheet run-off from access roads should be slowed down by the strategic placement of berms and sandbags.</li> <li>As far as possible, all construction activities should occur in the low flow season, during the drier winter months.</li> <li>All soils compacted as a result of construction activities falling outside of footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive vegetation control within these areas.</li> <li>Alien and invasive vegetation control should take place throughout all construction and rehabilitation phases to prevent loss of floral diversity.</li> <li>Monitor all areas for erosion and incision, particularly any riparian/wetland crossings. Any areas where erosion is occurring excessively quickly should be rehabilitated as quickly as possible.</li> <li>The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</li> </ul>						
Construction	Aspect: Construction activities within	Without	1	2	2	2	-7	Medium
		With	1	1	1	1	-4	Low

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
	<p>watercourses.</p> <p><b>Impact:</b> Construction of roads through riparian and drainage line crossings, altering stream and base flow patterns and water velocities.</p>	<p>Watercourses do occur within the proposed project development area, although the proposed infrastructure is aligned along existing roads where disturbance has already occurred.</p> <p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ All construction footprint areas should remain as small as possible and should as far as possible not encroach into surrounding more sensitive areas.</li> <li>▪ It must be ensured that the riparian and drainage line systems and that their associated buffer zones are off-limits to construction vehicles and personnel.</li> <li>▪ The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas.</li> <li>▪ The working servitude must not exceed 10 m on either side, for non-sensitive areas, as outlined in the EMPr.</li> <li>▪ The working servitude shall be limited to 5 m on either side for areas of high sensitivity, as outlined in the EMPr.</li> <li>▪ Any areas where bank failure is observed, due to the pipeline infrastructure, must be immediately repaired.</li> <li>▪ As far as possible the existing road network must be utilised, minimising the need to develop new access routes resulting in an increased impact on the local environment. <ul style="list-style-type: none"> <li>○ Should temporary roads or access routes be necessary and unavoidable, proper planning must take place and the site sensitivity plan must be taken into consideration.</li> <li>○ If additional roads are required, then wherever feasible such roads must be constructed a distance from the more sensitive riparian areas and not directly adjacent thereto. Additional access roads must be approved by the Engineer and Environmental Control Officer, prior to their construction and use.</li> <li>○ If crossings are required they should cross the systems at right angles, as far as possible to minimise impacts in the receiving environment.</li> </ul> </li> <li>▪ All areas of increased ecological sensitivity must be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel.</li> <li>▪ The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</li> </ul>						
Construction	<p><b>Aspect:</b> Construction activities within watercourses.</p> <p><b>Impact:</b> Dumping of waste, including waste material spills and refuse deposits into the riparian/wetland areas.</p>	<b>Without</b>	2	1	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<p>Watercourses do occur within the proposed project development area, although the proposed infrastructure is aligned along existing roads where disturbance has already occurred.</p> <p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>▪ Appropriate sanitary facilities must be provided for the life of the construction and all waste removed to an appropriate waste facility. The ratio of labourers to toilets must be maintained at 1:15.</li> <li>▪ Ensure that an adequate number of rubbish bins are provided so as to prevent litter and ensure the proper disposal of</li> </ul>						

Phase	Potential Aspect and/or Impact	Mitigation	Extent (E)	Duration (D)	Intensity (I)	Probability (P)	Significance (E+D+I+P)	
		<p>waste generated during construction activities.</p> <ul style="list-style-type: none"> <li>Implement effective waste management in order to prevent construction related waste from entering the drainage line and riparian environments.</li> <li>The EMPr will advise on special (and on-going) monitoring activities that will target areas that have been identified as medium to high sensitivity areas within the project site.</li> </ul>						
Operational	<p><b>Aspect:</b> Maintenance activities within watercourses.</p> <p><b>Impact:</b> Disturbance to the riparian/wetland areas.</p>	<b>Without</b>	2	1	2	2	-7	Medium
		<b>With</b>	1	1	1	1	-4	Low
		<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>An Operational EMPr must be compiled and adhered to.</li> </ul>						
Cumulative	<p>Improvement in the health of wetlands as a result of rehabilitation of the wetland and buffer zones.</p>	<b>Without</b>	2	1	1	2	-6	Low
		<b>With</b>	2	3	3	4	+12	Very high
		<p><b>Mitigation measures:</b></p> <ul style="list-style-type: none"> <li>The wetland rehabilitation recommendations contained within the <i>Wetland Ecological Assessment for the Proposed Emergency Nondabula Water Reticulation Project, Ilembe Municipality, KwaZulu-Natal</i> as prepared by Scientific Aquatic Services (June 2015), must be strictly adhered to and included as an appendix to the EMPr.</li> <li>The public must be educated on the importance of wetland preservation.</li> </ul>						

**SUMMARY OF IMPACTS AND AVERAGE POINTS ALLOCATED TO EACH SITE ALTERNATIVE DURING THE CONSTRUCTION PHASE**

IMPACTS	Site Alternative 1 – Without Mitigation	Site Alternative 1 – With Mitigation
<b>Direct Impacts</b>		
Soils and Agriculture	-8	-4
Geology and Topography	-8	-5
Air Quality	-9	-6
Noise	-8	-5
Visual	-8	-6
Traffic	-8	-5
Stormwater	-9	-5
Biodiversity	-7	-4
Heritage	-8	-5
Socio-Economic	-1	+5
Geohydrology	-8	-6
Wetland and Riverine Habitat	-8	-5
<b>Average Total</b>	<b>-7.5</b>	<b>-4.3</b>



IMPACTS	Site Alternative 1 – Without Mitigation	Site Alternative 1 – With Mitigation
<b>Cumulative Impacts</b>		
Biodiversity	-8	+12
Socio-Economic	-10	+12
Geohydrology	-7	-4
Wetland and Riverine Habitat	-6	+12
<b>Average Total</b>	<b>-7.8</b>	<b>+8</b>

**SUMMARY OF IMPACTS AND AVERAGE POINTS ALLOCATED TO EACH SITE ALTERNATIVE DURING THE OPERATIONAL PHASE**

IMPACTS	Site Alternative 1 – Without Mitigation	Site Alternative 1 – With Mitigation
<b>Direct Impacts</b>		
Biodiversity	-7	-4
Geohydrology	-7	-4
Wetland and Riverine Habitat	-7	-4
<b>Average Total</b>	<b>-7</b>	<b>-4</b>