8 IMPACT ASSESSMENT

The Impact Assessment will highlight and describe the impact to the environment following the above mentioned methodology and will assess the following components.

- Air;
- Aquatic Ecology;
- Avi-fauna;
- Geology;
- Groundwater;
- Heritage;
- Noise;
- Risk;
- Social;
- Soils and Agricultural Potential;
- Terrestrial Ecology;
- Topography;
- Traffic;
- Visual; and
- Wetlands and Surface Water.

The impact assessment was undertaken for the construction, operational and decommissioning phases of the project. The impact from the three corridor alternatives were assessed separately, however, where the impact was not significantly different, only one impact assessment was undertaken. The railway line will constitute a single railway line with a single overhead line and an access road. According to the design team the impact footprint for such a railway line would be approximately 50 m depending on the cut/fill required, however a 500m corridor was assessed for each alternative. Additionally to the impact of the railway, substation and associated infrastructure within the corridor the impact of the 88kV / 132 kV power line alternatives were also assessed.

8.1 Construction Phase

The construction phase will commence with the entire servitude being fenced off. Thereafter the access road will be constructed followed by the construction of bulk earthworks with all concrete structures.

The 88kV / 132 kV power line will be constructed within a 36 metre wide servitude. The power line masts will be erected and the power line cables will be strung between masts, which are wooden / steel structures erected in concrete below the mast. The two substations will be constructed within the approved corridor. The railway track will be constructed on top of formation level followed by the OHTE.

The major impacts during construction occur as a result of the following construction activities associated with the site clearance, transportation of equipment and materials, erection of masts, construction of substations, bulk earthworks, laying of access roads and railway track include, amongst others, heavy vehicle movement, excavation of the power line footings and any wastes generated.

8.1.1 Air Quality Impact

Initial Impact (Status Quo)

The initial impact on the present air quality status is considered MODERATE. The Kusile Power Station construction activities as well as other mining related activities in the area have MODERATELY contributed to the current state of the air quality. The impacts identified will persist over the short-term and are **presently occurring** in the *study area*. This is applicable to all the identified alternatives.

TABLE 8-1: INITIAL IMPACT ON AIR QUALITY.

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on air quality	Moderate	Local	Short Term	Is occurring	**Moderate**
	3	3	2	5	**2.67**

Additional Impact

During construction activities, the main activity of concern in terms of air quality is fugitive emissions from vehicle activity and earthworks. The roads that are proposed to be used during construction will only be used during the construction phase with the roads crossing through the farmlands being rehabilitated after this phase is completed. The predicted PM10 ground level concentrations due to vehicle entrainment on unpaved and paved road surfaces as well as earthworks as a result of proposed construction activities were well within the proposed daily and annual PM10 SA standards of 75 µg/m³ and 40 µg/m³ respectively.

The additional impact on air quality during the construction phase will be a LOW negative impact over the *study area* that will occur in the short-term. The impact is **very likely** to occur.

TABLE 8-2: ADDITIONAL IMPACT ON AIR QUALITY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on air quality	Low	Study Area	Short Term	Very Likely	**Low**
	2	2	2	4	**1.6**

Cumulative Impact

The construction cumulative impacts of the railway line in combination with the activities already present on site (including the construction of the Kusile Power Station) will be a MODERATE negative impact over the *study area* that will remain for the short term. This impact **is very likely** to occur.

TABLE 8-3: CUMULATIVE IMPACT ON AIR QUALITY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Cumulative impact on air quality	Moderate	Local	Medium Term	Very Likely	**Moderate**
	3	3	3	4	**2.4**

Mitigation Measures

Three types of measures may be taken to reduce emissions from unpaved roads, namely:

- Traffic control measures aimed at reducing the entrainment of material by restricting traffic volumes and reducing vehicle speeds, and
- Measures aimed at binding the surface material or enhancing moisture retention, such as wet suppression and chemical stabilization (EPA, 1987; Cowhert et al., 1988; APCD, 1995).

The control efficiencies achievable through paving unpaved roads may be estimated by comparing emission factors for unpaved and paved roads, in the particle size range of interest. Control efficiencies of 70% to 90% may be achieved through effective application of chemical surfactants or through the surfacing of roadways. It should, however, be noted that the paving of roads will only be effective if the dust loading on the road is controlled. Control programs aimed at reducing the particulate loading may consist of either preventative or mitigative measures, or a combination of both. Preventative measures impede the deposition of materials onto the travel surface, whereas mitigative measures remove that which has been deposited.

The control efficiency obtained by speed reduction can be calculated by varying the vehicle speed input parameter in the predictive emission factor equation given for unpaved roads. An evaluation of control efficiencies resulting from reductions in traffic volumes can be

calculated due to the linear relationship between traffic volume, given in terms of vehicle kilometres travelled, and fugitive dust emitted.

Permanent improvements in travel surfaces, such as the paving of a road, results in continuous control efficiencies. The control efficiencies obtained by wet suppression and the use of chemical stabilizers are, however, cyclic rather than continuous by nature as indicated previously.

Watering represents a commonly used, relatively inexpensive option, but provides only temporary dust control although the use of water in itself has an environmental impact to the area from where the water is sourced. Although the chemical treatment of exposed surfaces is more expensive, it provides for longer dust suppression. The use of chemicals may, however, have adverse effects on the receiving biophysical environment if not carefully selected and properly applied (Cowherd et al., 1988; EPA, 1996).

The efficiency afforded by the application of water or chemicals decays over time, requiring periodic reapplication to maintain the desired average efficiency (Cowherd et al., 1988).

Residual Impacts

If the above mitigation measures are implemented and adhered to then the residual impact on the air quality associated with the construction of the railway line will have a LOW negative impact in the short term.

TABLE 8-4: RESIDUAL IMPACT ON AIR QUALITY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on air quality	Low	Study area	Short term	Could happen	Low
	2	2	2	3	1.2

8.1.2 Geology

Initial Impact (Status Quo)

Impacts that could occur to geology are limited to the physical removal of geological strata, resulting in permanent damage to those strata. There are no present indications that any existing impacts to geology have occurred and therefore there is no initial impact rating.

Additional Impact

Alternative 1

Four areas of potential environmental impact have been identified along the length of this alternative 1, which is the shortest of the three corridors. It will require a high bridge or embankment at a stream crossing, and two long cuttings of up to six and 13 metres deep respectively. It has been assumed that the material required to construct the fill will be obtained by balancing the earthworks requirements, i.e. the volume of material obtained from

the cuttings will be sufficient to fulfil the fill requirements, and no borrow pits will be used. Should this assumption not be accurate, the spatial impact of haul roads and borrow pits as will be the temporal scale will be increased by one order. Each area has been labelled A to D in Figure 8-1, and are discussed separately below (distances within this section are measured with the initial starting position at the Kusile Power Station and the end point at the existing Pretoria – Witbank railway):

Section A: In order to meet the technical requirements for the design of the vertical alignment of the railway line, it is proposed that the route will be placed in a cut from chainage 3.1km to chainage 5.9km (total length 2800m) with a maximum depth of six metres. This section of the corridor is underlain by rocks of the Dwyka formation, which have an almost horizontal attitude, and therefore it is not anticipated that significant slope instability will occur. It is however known that these rocks slake (mechanically break down) upon exposure, and ravelling of exposed cut faces is a geotechnical characteristic of these formations that must be addressed in the design of the cutting.

Section B: The proposed corridor crossed an un-named tributary to the Klipfonteinspruit at approximately chainage 7 km. The stream is situated in a deep, narrow valley and in order to accommodate the technical requirements of the proposed railway line, this crossing must be supported on a bridge or a high fill. The maximum height of the crossing will be 30m, and it is therefore considered that an earth embankment will not be a viable solution, and this assessment is based on the assumption that a bridge will be constructed.

Section C: In order to accommodate that maximum permitted gradient of 1% of the proposed railway line, a section from approximately chainage 7.4km to chainage 9.0km (total length 1.6km) will be placed in a fill situation, which at its highest will be approximately 13m.

Section D: From approximately chainage 9.0km to 11.0km the proposed alignment will be constructed in a cutting that will be up to 13m deep and approximately 2km long. The entire length of the cutting will be within the shale of the Silverton formation. As discussed previously in this report (see section 7.2.4) the shales are susceptible to slope failure due to the very smooth bedding planes. The rock on the site dip at an angle of some 20º to 30º towards the southwest, which implies that the rock will dip into the proposed cutting which may induce potential slope failure in the eastern face. Significant precautionary measures will be required to stabilise the cuttings, which may include having to reduce the slope angles, construction of temporary support measures. A further complicating factor is the crossing of the proposed cutting with a small un-named stream at approximately chainage 10.2 km. It will be required that the stream is canalised around the cutting or directed into an aqueduct over the railway cutting. Both options will have a significant

impact, and furthermore, as indicated in section 7.2.4 above, surface water seepage along the shale bedding planes is known to be a major factor in inducing slope instability in the Silverton formation, and must be considered during the design of the proposed cutting.

FIGURE 8-1: GEOTECHNICAL IMPACTS PER SECTION FOR ALTERNATIVE 1.

TABLE 8-5: ADDITIONAL IMPACT ON GEOTECH – ALTERNATIVE 1.

Impact Type	Significance	Spatial	Temporal	Probability	Rating
A 2.8km long cutting	High	Study Area	Permanent	Very Likely	**Moderate**
	4	2	5	4	**2.9**
B bridge at km 7	Moderate	Study Area	Long Term	Very Likely	**Moderate**
	3	2	4	4	**2.4**
C 1.6km long fill	Moderate	Study Area	Medium Term	Very Likely	**Moderate**
	3	2	3	4	**2.1**
D 2km long cutting	High	Study Area	Permanent	Very Likely	**Moderate**
	4	2	5	4	**2.9**

Alternative 2

Six areas of potential environmental impact have been identified along the length of this corridor, which is the longest of the three alternatives. Each area has been labelled A to F in Figure 8-2 and are discussed separately below:

Section A: At approximate chainage 6.4km, the proposed corridor crosses a small unnamed tributary to the Klipfonteinspruit. At this position a small wetland has formed, and it is apparent that area is underlain by transported alluvial soils and deeply weathered residual soils derived from shale of the Silverton formation. To a limited extent this portion of the alignment is also underlain by intruded diabase sill. These lithologies will decompose to form potentially highly expansive clay which are also likely to be compressible. The presence of these adverse geotechnical conditions will have to be overcome to accommodate the proposed railway line. These solutions may include the excavation and removal of some of the poor soils that may be replaced with more competent soil and rock. A pioneered fill, using rocks and boulders may also be considered. Both of these solutions will have an impact on the environment.

Section B: The proposed alignment entails crossing the Klipfonteinspruit at two positions, of which this is the first, at approximately chainage 7.5km. The stream is a perennial river that flows across shale and diamictite of the

Dwyka formation. The stream channel and adjacent floodplain will be underlain by transported alluvial soils and sedimentary rocks that are expected to be weathered to a significant depth. The river will have to be traversed by means of a small bridge or possibly culverts that will have to be suitably founded on bedrock. Furthermore the abutments on either side of the feature will also require appropriate foundations, and approach fills must be constructed.

Section C: This position represents the second crossing of the Klipfonteinspruit at approximately chainage 12km. The anticipated geotechnical conditions at this position are similar to those presented above.

Section D: At approximately chainage 13km, the proposed alignment crosses a small un-named tributary to the Wilgerivier. The underlying rock formations belong to the Dwyka formation, and the anticipated geotechnical conditions will be similar to those indicated for the stream crossings at B and C above.

Section E: In order to accommodate that maximum permitted gradient of 1% on the railway line, a section from approximately chainage 13.2km to chainage 15km (total length 1.6km) will be placed in a fill situation, which at its highest will be approximately 13m.

Section F: From approximately chainage 15km to 17km the proposed alignment will be constructed in a cutting that will be up to 13m deep and approximately 2km long. The entire length of the cutting will be within the shale of the Silverton formation. The shales are susceptible to slope failure due to the very smooth bedding planes. The rock on the site dip at an angle of some 20º to 30º towards the southwest, which implies that the rock will dip into the propose cutting which may induce potential slope failure in the eastern face. Significant precautionary measures will be required to stabilise the cuttings. A further complicating factor is the crossing of the proposed cutting with a small un-named stream at approximately chainage 16.2 km. It will be required that the stream is canalised around the cutting or directed into an aqueduct over the railway cutting. Both options will have a significant impact, and furthermore surface water seepage along the shale bedding planes is known to be a major factor in inducing slope instability in the Silverton formation, and must be considered during the design of the proposed cutting.

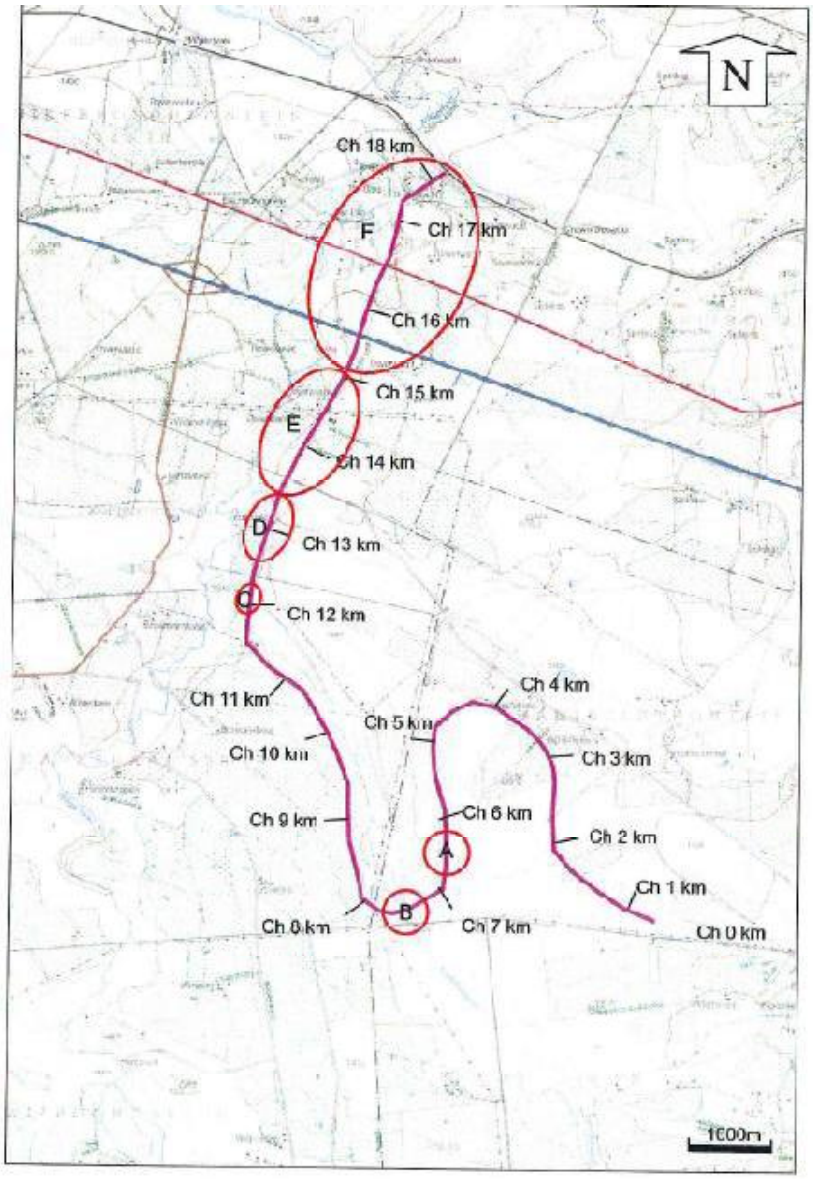

FIGURE 8-2: GEOTECHNICAL IMPACTS PER SECTION FOR ALTERNATIVE 2.

TABLE 8-6: ADDITIONAL IMPACT ON GEOTECH – ALTERNATIVE 2.

Impact Type	Significance	Spatial	Temporal	Probability	Rating
A wetland crossing	MODERATE	Study Area	Medium term	Could happen	**Low**
	3	2	3	3	**1.59**
B 1st Klipfonteinspruit crossing	HIGH	Study Area	Medium term	Could happen	**Low**
	4	2	3	3	**1.8**
C 2nd Klipfonteinspruit crossing	HIGH	Study Area	Medium term	Could happen	**Low**
	4	2	3	3	**1.8**
D stream crossing	HIGH	Study Area	Medium term	Could happen	**Low**
	4	2	3	3	**1.8**

E 1.6km long fill	MODERATE	Study Area	Medium term	Very likely	**Moderate**
	3	2	3	4	**2.1**
F 2km long cutting	HIGH	Study Area	Long term	Very likely	**Moderate**
	4	2	5	4	**2.9**

Alternative 3

Two areas of potential environmental impact have been identified along the length of this corridor, both of which are identified in the previously considered alternative corridors, namely a deep cutting of approximately 2km long and a 700m long bridge. The affected sections have been labelled A and B in Figure 8-3 and are discussed separately below:

Section A: The proposed alignment crossed an un-named tributary to the Klipfonteinspruit at approximately chainage 7 km. The stream is situated in a deep, narrow valley and in order to accommodate the technical requirements of the proposed railway line, this crossing must be supported on a bridge or a high fill. The maximum height of the crossing will be 30m, and it is therefore considered that an earth embankment will not be a viable solution, and this assessment is based on the assumption that a bridge will be constructed.

Section B: From approximately chainage 9.4km to 11.4km the proposed alignment will be constructed in a cutting that will be up to 13m deep and approximately 2km long.

The entire length of the cutting will be within the shale of the Silverton formation. As discussed previously in this report the shales are susceptible to slope failure due to the very smooth bedding planes. The rock on the site dip at an angle of some 20º to 30º towards the southwest, which implies that the rock will dip into the propose cutting which may induce potential slope failure in the eastern face. Significant precautionary measures will be required to stabilise the cuttings.

A further complicating factor is the crossing of the proposed cutting with a small un-named stream at approximately chainage 10.2 km. It will be required that the stream is canalised around the cutting or directed into an aqueduct over the railway cutting. Both options will have a significant impact, and furthermore, surface water seepage along the shale bedding planes is known to be a major factor in inducing slope instability in the Silverton formation, and must be considered during the design of the proposed cutting.

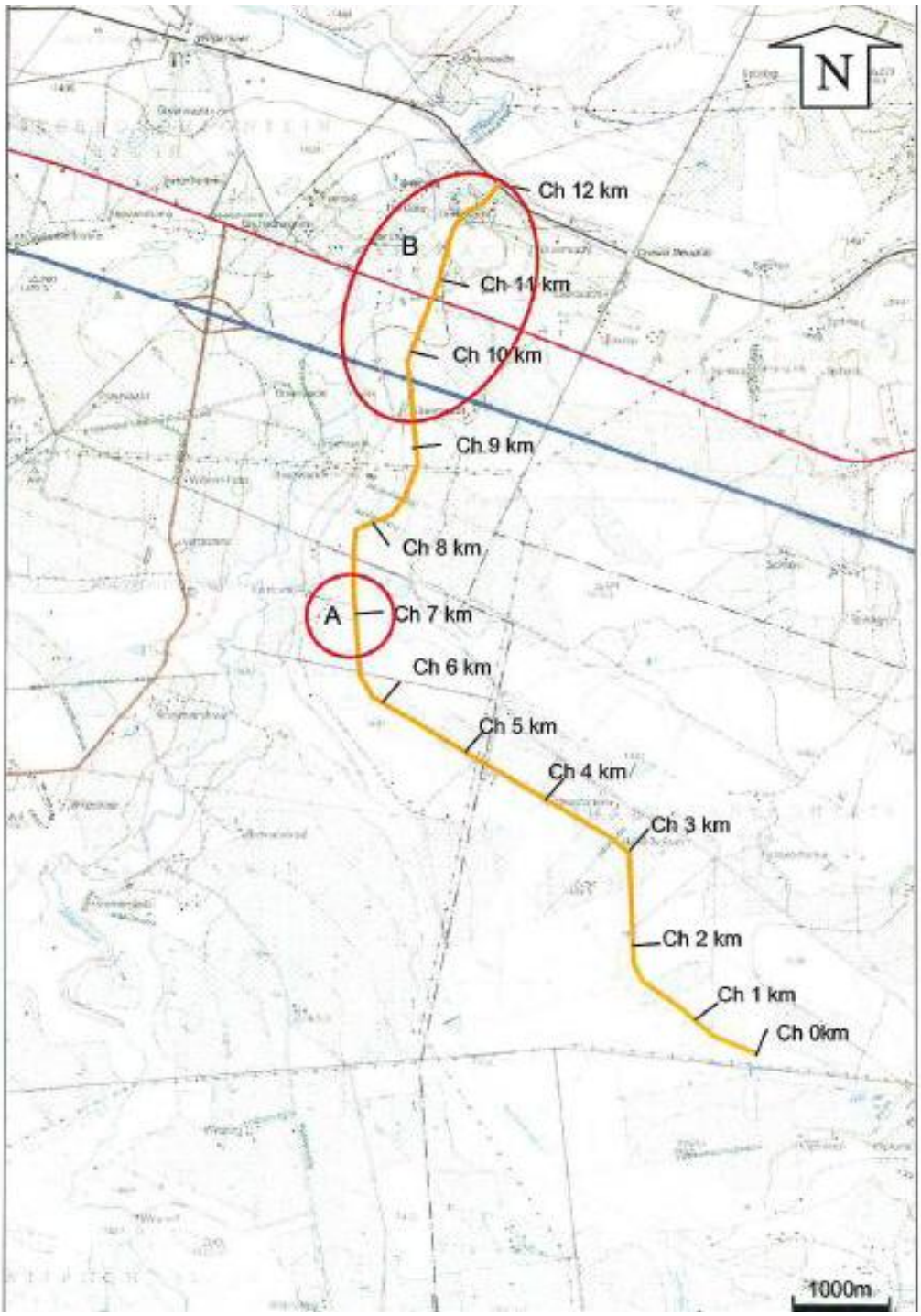

FIGURE 8-3: GEOTECHNICAL IMPACTS PER SECTION FOR ALTERNATIVE 3.

TABLE 8-7: ADDITIONAL IMPACT ON GEOTECH – ALTERNATIVE 3.

Impact Type	Significance	Spatial	Temporal	Probability	Rating
A bridge at km 7	Moderate	Study Area	Long Term	Very Likely	**Moderate**
	3	2	4	4	**2.4**
B 2km long cutting	High	Study Area	Long Term	Very Likely	**Moderate**
	4	2	5	4	**2.9**

Cumulative Impact

The construction cumulative impacts of the railway line in combination with the activities already present on site (including the construction of the Kusile Power Station) will be a MODERATE negative impact *locally* that will be permanent. This impact **is very likely** to occur.

TABLE 8-8: CUMULATIVE IMPACT ON GEOLOGY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Cumulative impact on geology	Moderate	Local	Permanent	Very Likely	**Moderate**
	3	3	5	4	**2.9**

Mitigation Measures

The following mitigation are required during construction:

- Significant precautionary measures are required to stabilise the cuttings, which may include having to reduce the slope angles and construction of temporary support measures. This must be done in order to minimise instability and soil erosion during construction.
- Where the underlying geology is of the Dwyka formation precautions must be put in place to prevent the rocks from slaking (mechanically breaking down) upon exposure, and ravelling of exposed cut faces is a geotechnical characteristic of these formations that must be addressed in the design of the cutting.
- No blasting is undertaken on site without a suitable blast design, compiled in line with relevant SANS codes and approved by an appropriately qualified professional;

Residual Impact

Although mitigation measures will not reduce the significance of impact to geology they will ensure that the impacts are contained. Mitigation measures will ensure that the likelihood of secondary impacts occurring is significantly reduced. The residual impact to geology at the completion of the construction phase will be the same as for the additional impact assessment.

8.1.3 Topography

The main impact to topography will result from the cut/fill operations during the construction phase. In order to maintain the railway line at a uniform angle, the line will be constructed by either cutting or filling the underlying substrate.

Initial Impact (Status Quo)

Currently the topography of the study area is relatively undisturbed with isolated areas of impact. Current impacts include the construction site of the Kusile Power Station, where major terracing and fill operations are underway.

FIGURE 8-4: CURRENT CONSTRUCTION ACTIVITIES ON SITE

TABLE 8-9: INITIAL IMPACT ON TOPOGRAPGY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on topography	Low	Isolated sites	Permanent	Is occurring	**Moderate**
	2	1	5	4	**2.1**

Additional Impact

The additional impact will be the impact of the railway line on topography excluding any mitigation measures. During the construction phase this will involve the clearing of rock for cut operations, filling of areas and the erecting of the railway line including the placing of the ballast on the terrain. This impact is rated as **Moderate**. The three alternatives suggested have similar impacts to topography, especially in the northern sections of the railway line, but in the southern section Alternative 2 has a couple more stream crossings. These inevitable require more cut and fill operations adjacent to the streams in order to elevate the railway line over the water. On this basis, Alternative 1 or 3 should rather be considered.

TABLE 8-10: ADDITIONAL IMPACT ON TOPOGRAPHY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on topography	High	Proposed site	Long Term	Very likely	**Moderate**
	4	1	4	4	**2.4**

Cumulative Impact

The construction cumulative impact of the railway line in combination with the activities already present on site will be a MODERATE negative impact over the *study area* that will remain for the long term. This impact *will definitely* occur. This results in a rating of **Moderate**.

TABLE 8-11: CUMULATIVE IMPACT ON TOPOGRAPHY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Cumulative impact on topography	Moderate	Study area	Long Term	Will definitely occur	**Moderate**
	3	2	4	5	**3**

Mitigation Measures

The following mitigation measures are proposed to mitigate the impact on topography.

- Use blasting as a last resource, preferably never to clear rock for the railway line;
- Ensure that all structures, whether cut or fill, are erosion resistant and built to the relevant SABS codes;
- Limit the cut and fill operations to the preferred alternative alignment servitude; and
- Ensure that adequate storm water control measures are in place to prevent erosion.

Residual Impact

The mitigation measures proposed above will not reduce the impact rating to topography, but in implementing these measures it will ensure that the impact remains a moderate impact.

TABLE 8-12: RESIDUAL IMPACT ON TOPOGRAPHY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on topography	Moderate	Study area	Long Term	Has occurred	**Moderate**
	3	2	4	5	**3**

8.1.4 Soils and Agricultural Potential Impact

Initial Impact (Status Quo)

As mentioned above, the site is presently being developed into the Kusile Power Station. The section of soils that will be crossed by the power line and rail alternatives are presently not impacted by the construction of the power station, but in the near future the construction of the power plant will extend westward. Other existing impacts are the existing power line pylon footings and cultivation of soils for mainly maize and fodder. The soils underneath the Kusile Power Station site will become sterile and cannot be used for the land capability that the soils possess. This impact is rated as a HIGH negative impact that occurs on *isolated sites* and will remain for the long term. The impact *has already occurred* and is therefore rated as a **Moderate impact.**

TABLE 8-13: INITIAL IMPACT ON SOILS AND AGRICULTURAL POTENTIAL (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on soils and agricultural potential	High	Isolated Sites	Long Term	Has occurred	**Moderate**
	4	1	4	5	**3**

Additional Impact

The additional impacts to soils and agricultural potential during construction of the railway line include the clearing of vegetation in the railway servitude, compaction and levelling of the soil, covering of the soil by the ballast stones and the construction of the power line and the access road adjacent to the railway line. The clearing of the soil could potentially result in erosion as the vegetation is removed, exposing the soil to the elements. Furthermore the construction vehicles have the potential to compact the soil by their movements or pollute the soil by spilling hydrocarbons. Both of these impacts significantly reduce the agricultural potential of soils. The placing of the ballast on the soil creates a long term impact that renders the underlying soil sterile and useless in terms of agriculture. Furthermore the establishment of a linear impact like a railway line will divide the farmland and in several places, farms are divided in half, and neither half can operate as an economic unit, therefore rendering a larger area not suitable to agriculture (in this specific cases – grazing land for livestock).

The impacts described above are similar for all the alternatives, but due to the fact that Alternative 2 is significantly longer in length (8 km) than the other two alternatives, and has a bigger impact footprint, it is recommended that the impact be minimised by selecting one of the shorter routes, alternatives 1 or 3.

The additional impact to soils and agricultural potential during the construction phase is a HIGH negative impact occurring in the *study area* and acting in the long term. This impact *will occur* and as such is rated as a **High** impact.

TABLE 8-14: ADDITIONAL IMPACT ON SOILS AND AGRICULTURAL POTENTIAL (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on soils and agricultural potential	High	Study area	Long Term	Will occur	**High**
	4	2	4	5	**3.33**

Cumulative Impact

The cumulative impact during the construction phase remains as assessed above as the impact stretches over the study site. Therefore the impact remains a **High** impact.

Mitigation Measures

- Ensure that all machinery on site is in a good working order;
- Limit all activities to the proposed railway line servitude;
- Ensure that adequate storm water control measures are in place to prevent erosion;
- Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling area in the hard park;

- Oil-contaminated soils are to be removed to a contained storage area and bio-remediated or disposed of at a licensed facility;
- If soils are excavated for the cut operations, ensure that the soil is utilised elsewhere within the project for rehabilitation/road building/fill purposes; and
- Ensure that soil is stockpiled in such a way as to prevent erosion from storm water.

Residual Impact

The residual impact with the successful implementation of the mitigation measures mentioned above will be slightly less significant as the probability reduces slightly. Therefore the rating reduces to **Moderate.** This is relevant for both the construction and operational phases.

TABLE 8-15: RESIDUAL IMPACT ON SOILS AND AGRICULTURAL POTENTIAL (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on soils and agricultural potential	High	Study area	Long Term	Very Likely	**Moderate**
	4	2	4	4	**2.7**

8.1.5 Surface Water and Wetlands Impact

Initial Impact (Status Quo)

The initial impacts on surface water and wetlands are mostly located around the Kusile Power Station and potentially downstream of the construction activities. A number of dams have been constructed in the water courses, but this appears not to have affected the downstream aquatic environment. The Kusile Construction site is currently undegoing major construction works with the potential to contaminate the surface water through hydrocarbon and dust pollution. In addition the study area is criss-crossed with roads and associated bridges over the rivers and streams. The construction at the Kusile Power Station is creating large amounts of dust and this is entering the aquatic system through runoff. The streams to the west of the power station construction site have notibly increased in turbidity over the recent months. This is rated as a **Moderate** impact.

Table 8-16: Initial impact on Surface Water and Wetlands (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on surface water and wetlands	Low	Isolated Sites	Long Term	Is happening	**Moderate**
	2	2	4	4	**2.2**

Additional Impact

The additional impact of the railway line will be most evident at the river and wetland crossings along the route. Alternatives 1 and 3 cross over 2 streams and 1 wetland area, while Alternative 2 crossed over 4 streams (Klipfonteinspruit twice) and 2 wetland areas. The river and stream crossings will be done by building bridges over the larger features and culverts over the drainage lines. The footings of these structures will be placed within the buffer zones of the surface water features and this impact cannot be avoided. The construction vehicles have a potential to enter the rivers or wetlands and cause damage to the integrity of the systems by destroying vegetation, polluting the water system, increasing turbidity in the water system and the chasing the natural fauna away. This is rated as a **High** impact.

TABLE 8-17: ADDITIONAL IMPACT ON SURFACE WATER AND WETLANDS (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on surface water and wetlands	Very High	Isolated sites	Long Term	Will happen	**High**
	5	1	4	5	**3.3**

Cumulative Impact

The cumulative impact of the proposed railway line along with the existing impacts in the area will cumulatively remain a **High** impact as rated in the table above (Table 8-17)..

Mitigation Measures

- Demarcated areas where waste can be safely contained and stored on a temporary basis during the construction phase should be provided at the hard park;
- When adequate volumes (not more than 1 month) have accumulated all waste is to be removed from site and disposed of at a licensed facility;
- Waste is not to be buried on site;
- Hydro-carbons should be stored in a bunded storage area;
- All hazardous materials *inter alia* paints, turpentine and thinners must be stored appropriately to prevent these contaminants from entering the environment;
- Spill-sorb or similar type product must be used to absorb hydrocarbon spills in the event that such spills should occur;
- Care must be taken to ensure that in removing vegetation adequate erosion control measures are implemented;
- No construction vehicles or activities will be allowed to work within 50 m of any of the streams or wetlands on site, unless this cannot be avoided, then it should only occur under supervision of the ECO;

- Demarcate the "No-Go" areas with tape and ensure that the demarcation remains in place for the duration of the construction works; and
- Use existing river crossings where possible.

Residual Impact

The residual impact if the above mitigation measures are implemented, especially the adherence to the buffer zones could reduce the impact significance and also the probability of the impact. If successfully implemented the impact could be reduced to a **Moderate** impact during the construction phase.

Table 8-18: Residual impact on Surface Water and Wetlands (Alternative 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on surface water and wetlands	High	Isolated sites	Long Term	Very Likely	**Moderate**
	5	1	4	4	**2.6**

8.1.6 Groundwater Impact

Initial Impact (Status Quo)

Currently the groundwater of the study area is relatively undisturbed with isolated areas of impact. Current aspects include the construction site of the Kusile Power Station, where major terracing and fill operations are underway. Other potential aspects include mining operations upstream of the study area.

TABLE 8-19: INITIAL IMPACT ON GROUNDWATER (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on groundwater	Moderate	Isolated sites	Long Term	Is occurring	**Moderate**
	4	1	4	5	**2.4**

Additional Impact

The additional impact will be the impact of the railway line on groundwater excluding any mitigation measures. During the construction phase two possible causes for groundwater contamination exist, namely: (1) spillage or leakage of hydrocarbons from heavy vehicles and / or generators on site and (2) contamination from pit latrines infiltration (although these will not be utilised). This impact is rated as **Moderate**.

TABLE 8-20: ADDITIONAL IMPACT ON GROUNDWATER (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on groundwater	Moderate	Isolated sites	Long Term	Very likely	**Moderate**
	3	1	4	4	**2.3**

Cumulative Impact

The construction cumulative impact of the railway line in combination with the activities already present on site will be a MODERATE negative impact over the *study area* that will remain for the long term. This impact *will definitely* occur. This results in a rating of **Moderate**.

TABLE 8-21: CUMULATIVE IMPACT ON GROUNDWATER (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Cumulative impact on groundwater	Moderate	Study area	Medium Term	Very likely	**Moderate**
	3	2	3	4	**2.1**

Mitigation Measures

The following mitigation measures are proposed to mitigate the impact on groundwater.

- Where generators are used they should be placed in a bunded area to capture all potential spillages;
- No pit latrines should be allowed;
- Groundwater monitoring in the railway study area should be included in the existing monitoring protocol for the construction of the Kusile Power Station during construction.

Residual Impact

The mitigation measures proposed above should reduce the impact rating of groundwater to a **low** impact.

TABLE 8-22: RESIDUAL IMPACT ON GROUNDWATER (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on groundwater	Low	Isolated sites	Medium Term	Could happen	**Low**
	2	1	2	3	**1.0**

8.1.7 Terrestrial Ecology Impact

Initial Impact (Status Quo)

The initial impact on the terrestrial ecology of the proposed project is mainly in the form of the agricultural establishment over an extended period of time. The natural grasslands have been transformed into croplands where the soils allow and the remainder of the habitat is used for the grazing of livestock. In addition several alien invasive plants have also established themselves in the area, especially *Acacia mearnsii* (Black Wattle) and poplar. The natural grasslands have also been fragmented through the establishment of farms, fences and roads in the area. There are patches of grassland that is still in relatively good condition and that support small faunal species, but no large fauna remain in the area. From personal

communications with the farmers in the area larger mammals that used to frequent the area included leopard and warthog. The eastern highveld grassland habitat which this area falls under has been severely impacted upon by coal mining, sand quarrying and industries such as steel smelters and power stations. This is rated as a **High** impact.

TABLE 8-23: INITIAL IMPACT ON TERRESTRIAL ECOLOGY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on terrestrial ecology	High	Local Area	Long Term	Has Occurred	**High**
	4	3	4	5	**3.7**

Additional Impact

The additional impact of the construction of the railway line will further fragment an already disturbed system. Some habitat will be lost, especially considering the servitude that will be used for the railway line and the associated access road.

The wetland and riparian systems is the least impacted in the area and should be preserved as far as possible. The three alternatives all cross over streams but Alternative 2 cross over more than the other two alternatives and also impact the habitat for a longer length. Therefore either Alternative 1 or 3 is recommended.

TABLE 8-24: ADDITIONAL IMPACT ON TERRESTRIAL ECOLOGY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on terrestrial ecology	High	Study area	Long Term	Very Likely	**Moderate**
	4	2	4	4	**2.7**

Cumulative Impact

The cumulative impact of both the historical impacts and the proposed development remain as assessed for the initial impact assessment.

Mitigation Measures

- All construction areas should be demarcated prior to construction to ensure that the footprint of the impacts are limited (including areas where vehicles may traverse);
- The sensitive vegetation should be avoided and construction limited to 50 m from the edge of the wetlands and streams;
- Alternative 1 should be considered as the preferred alternative;
- All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is complete;
- Adhere to the Eskom vegetation management guideline;

- Remove sensitive plants by means of the Search-and-Rescue exercise as undertaken for the Kusile Power Station;

  Place rescued plants in the Kusile nursery prior to re-establishment in a natural area; and

- Install power lines according to the Eskom bird collision prevention guideline.

Residual Impact

With the successful implementation of the above mitigation measures the impact to the terrestrial ecology can be mitigated to a **moderate** impact.

TABLE 8-25: RESIDUAL IMPACT ON TERRESTRIAL ECOLOGY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on terrestrial ecology	Moderate	Local Area	Long Term	Very Likely	**Moderate**
	3	3	4	4	**2.7**

8.1.8 Avi-fauna Impact

Initial Impact (Status Quo)

The initial impact on avi-fauna in the area is mainly due to the large presence of existing power lines and additionally the change in habitat as a result of mining operations in the area and the construction site for the Kusile Power Station. The natural grasslands have been transformed into croplands where the soils allow and the remainder of the habitat is used for the grazing of livestock. The natural grasslands have also been fragmented through the establishment of farms, fences and roads in the area. The eastern highveld grassland habitat which this area falls under has been severely impacted upon by coal mining, sand quarrying and industries such as steel smelters and power stations. This is rated as a **High** impact.

TABLE 8-26: INITIAL IMPACT ON AVI-FAUNA (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on avi-fauna	High	Local Area	Long Term	Has Occurred	**High**
	4	3	4	5	**3.7**

Additional Impact

The additional impact of the construction of the railway line and power lines will further fragment an already disturbed system. Some habitat will be lost, especially considering the servitude that will be used for the railway line and the associated access road. The largest impact will result from the overhead traction equipment and the power lines.

The three alternatives all cross over streams but Alternative 2 crosses over more than the other two alternatives and also impact the habitat for a longer length. Therefore either Alternative 1 or 3 is recommended.

TABLE 8-27: ADDITIONAL IMPACT ON AVI-FAUNA (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on avi-fauna	High	Study area	Long Term	Very Likely	**Moderate**
	4	2	4	4	**2.7**

Cumulative Impact

The cumulative impact of both the historical impacts and the proposed development remain as assessed for the initial impact assessment.

Mitigation Measures

- The phase conductor should be insulated for a distance of one metre on either side of the insulator for all three phases to prevent any risk of phase-earth electrocution for species such as African Grass-owl, Marsh Owl, Barn Owl, Spotted Eagle-Owl and Black-shouldered Kite.
- Alternative 1 should be considered as the preferred alternative;
- Investigate the option of establishing a nature area on Eskom property to act as an impact offset. The area to the north of Kusile Power Station has been purchased by Eskom and will provide the ideal area for such an offset area;
- Install power lines according to the Eskom bird collision prevention guideline.

Residual Impact

With the successful implementation of the above mitigation measures the impact to avi-fauna can be mitigated to a **moderate** impact.

TABLE 8-28: RESIDUAL IMPACT ON AVI-FAUNA (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on avi-fauna	Moderate	Local Area	Long Term	Very Likely	**Moderate**
	3	3	4	4	**2.7**

8.1.9 Aquatic Ecology Impact

Initial Impact (Status Quo)

Based on the findings from the specialist, the initial impacts on present ecological status, would probably be considered **MODERATE**, with low diversity and high sediment loads present locally. The impacts identified will persist over the medium-term and are presently occurring at the sampled sites. The table below indicates the impact rating class as **moderate impact**.

TABLE 8-29: INITIAL IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on aquatic ecology	Moderate	Local	Medium Term	Presently Occurring	**Moderate**
	3	3	3	5	**3**

Additional Impact

The additional impacts of the proposed railway alternatives on the aquatic ecosystem during the construction phase include, degradation of biotic integrity due to modification of water quality; degradation of aquatic ecosystems due to increased sedimentation; and change to natural flow regime due to the construction of bridges.

Access to site often includes secondary impacts, which include sedimentation, increased run-off and dust. Temporary dirt roads are required to get machinery to site, especially during the construction phase, this increased activity if not managed will have a negative impact with regard to the above mentioned.

Alternative 1

The proposed rail, Alternative 1, passes over two water crossings (sites RKUS4 and RKUS5). The additional impact on the aquatic ecosystem during the construction phase will probably include these impacts as well as access to the site. Due to the tributaries flowing into the Wilge River, impacts are considered to be **MODERATE** and occur on a Regional scale. The additional impacts will occur in the short-term. The impact rating of rail alternative 1 is moderate.

TABLE 8-30: ADDITIONAL IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 1).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on aquatic ecology	Moderate	Regional	Short Term	Will Occur	**Moderate**
	3	4	2	5	**3.00**

Alternative 2

Alternative 2 passes over all five water crossings assessed. The additional impact on the aquatic ecosystem during the construction phase will probably include the above mentioned impacts as well as access to the site. Due to the tributaries flowing into the Wilge River and the fact that this proposed rail alternative crosses so many watercourses, impacts are considered to be **HIGH** and occur on a Regional scale. The additional impacts will occur in the short-term. As indicated in Table 8-31 below, the impact rating of rail alternative 2 is high.

TABLE 8-31: ADDITIONAL IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 2).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on aquatic ecology	High	Regional	Short Term	Will Occur	**High**
	4	4	2	5	**3.33**

Alternative 3

The proposed rail, Alternative 3, passes over two water crossings (sites RKUS4 and RKUS5). These crossing points are relatively similar to that of Alternative 1. The additional impact on the aquatic ecosystem during the construction phase will probably include the above mentioned impacts as well as access to the site. Due to the tributaries flowing into the Wilge River, impacts are considered to be **MODERATE** and occur on a Regional scale. The additional impacts will occur in the short-term. As indicated in Table 8-32 below, the impact rating of rail alternative 3 is moderate.

TABLE 8-32: ADDITIONAL IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on aquatic ecology	Moderate	Regional	Short Term	Will Occur	**Moderate**
	3	4	2	5	**3.00**

Cumulative Impact

The cumulative impacts of constructing the proposed railway line, with either alternative, increases the initial impact (moderate), up to within a high impact class. This is due to the fact that the rivers are currently already impacted upon by the Kusile Power Station construction site and farming practices within the area.

TABLE 8-33: CUMULATIVE IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Cumulative impact on aquatic ecology	High	Regional	Medium Term	Will Occur	**High**
	4	4	2	5	**3.33**

Mitigation Measures

The following mitigation measures should be implemented in order to minimise the adverse environmental degradation:

Mitigation measures to avoid minimise or reduce degradation of biotic integrity due to modification of water quality.

- Monitoring of streams should be conducted and quality should be maintained to comply with the Department of Water Affairs (DWA) standards / guidelines; and
- Avoid any spillage or pollution entering the system during construction phase.

Mitigation measures to avoid minimise or reduce degradation of aquatic ecosystems due to increased sedimentation.

- Maintain surveillance of construction activities;

- Limit speed and traffic on dirt roads adjacent to sites (to minimise soil erosion);
- Construction should take place at the right time (winter) of the year to reduce runoff into streams; and
- Sediment traps should be put into place and should be maintained.

Mitigation measures to avoid minimise or reduce environmental degradation due to the change to natural flow regime.

- Infrastructure and design should take into account the natural flow of the current system and base flow; and
- Access roads and construction should where possible avoid the streams and adjacent riparian zones and take into consideration base flow (i.e. compaction and diversion).

Residual Impact

Alternative 1

If the above mitigation measures are implemented and adhered to then the residual impact on the aquatic ecosystems associated with river crossings will possibly have a **LOW** negative impact in the short term, which will occur during construction. Thus the construction of rail alternative 1 will have a LOW impact on the associated aquatic ecosystems (water crossings).

TABLE 8-34: RESIDUAL IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 1).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on aquatic ecology	Low	Study Site	Short-Term	Will occur	**Low**
	2	2	2	5	**2.00**

Alternative 2

If the mitigation measures are implemented and adhered to then the residual impact on the aquatic ecosystems associated with river crossings will possibly have a MODERATE negative impact in the short term, which will occur during the construction phase. Thus the construction of rail alternative 2 will have a MODERATE impact on the associated aquatic ecosystems (water crossings).

TABLE 8-35: RESIDUAL IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 2).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on aquatic ecology	Moderate	Study Site	Short-Term	Will Occur	**Moderate**
	3	2	2	5	**2.33**

Alternative 3

If the mitigation measures are implemented and adhered to and rail alternative 3 is constructed, then the residual impact on the aquatic ecosystems associated with river crossings will possibly have a LOW negative impact in the short term, which will occur during the construction phase. Thus the construction of rail alternative 3 will have a LOW impact on the associated aquatic ecosystems (water crossings).

TABLE 8-36: RESIDUAL IMPACT ON AQUATIC ECOLOGY (ALTERNATIVE 3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on aquatic ecology	Low	Study Site	Short-Term	Will Occur	**Low**
	2	2	2	5	**2.00**

8.1.10 Cultural and Archaeological Impact

Initial Impact (Status Quo)

Impacts that could occur to historically significant structures are limited to the physical removal of graves and historical buildings, vandalism or renovations to these structures resulting in permanent damage. There are no present indications that any existing impacts to any historical structures has taken place and therefore there is no initial impact rating.

Additional Impact

Alternative 1 and 2 traverse a similar number a graves and historically significant structures and therefore are the least preferred alternatives. Although alternative 3 traverses the least number of historically significant structures and graves the sensitive structures must be avoided at all times.

Alternative 1 and 2

Based on the findings from the specialist, the additional impacts on historical structures and graves, would probably be considered **LOW**. The impacts identified if not mitigated would be permanent occurring at isolated sites.

TABLE 8-37: ADDITIONAL IMPACT ON CULTURAL AND ARCHAEOLOGICAL SITES (ALTERNATIVE 1 AND 2).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on cultural and archaeological sites	High	Isolated sites	Permanent	Unlikely	**Low**
	4	1	5	2	**1.33**

Alternative 3

Based on the findings from the specialist, the additional impacts on historical structures and graves, would probably be considered **LOW**. The impacts identified if not mitigated would be

permanent occurring at isolated sites. Although the impact is grouped in the same class impact as alternative 1 and 3 it is to a lesser degree sensitive due to fewer historical significant structures being present within this corridor.

TABLE 8-38: ADDITIONAL IMPACT ON CULTURAL AND ARCHAEOLOGICAL SITES (ALTERNATIVE 3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on cultural and archaeological sites	Moderate	Isolated sites	Permanent	Unlikely	**Low**
	3	1	5	2	**1.2**

Cumulative Impact

The cumulative impact of both the historical impacts and the proposed development remain as assessed for the additional impact assessment.

Mitigation Measures

Should any of the historical structures or graveyards be affected by the proposed new railway line and / or associated infrastructure the following mitigation measures must be applied, namely:

Historical houses and dolerite structures

Historical houses may not be demolished, renovated, or altered as a result of the project without prior investigation by a historical architect in good standing with the South African Heritage Resources Agency (SAHRA). The historical architect has to acquire a permit from the SAHRA prior to any of these structures been affected or altered as a result of the project.

The dolerite structures must be investigated by an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) prior to its demolishment, should demolishment be the only option. The archaeologist has to obtain a permit from the SAHRA and must document these structures before they may be affected.

Graveyards and graves

The following measures must be taken, namely:

- Graveyards can be demarcated with brick walls or with fences when they are retained in-situ within 30m from the railway line or associated infrastructure.
- Graveyards can also be exhumed and relocated whenever they are located in the railway line corridors. The exhumation of human remains and the relocation of graveyards are regulated by various laws, regulations and administrative procedures. This task is undertaken by forensic archaeologists or by reputed undertakers who are acquainted with all the administrative procedures and relevant legislation that have to be adhered to whenever human remains are exhumed and relocated. This process also includes social

consultation with a 60 days statutory notice period for graves older than sixty years. Permission for the exhumation and relocation of human remains have to be obtained from the descendants of the deceased (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local police.

Residual Impact

If the above mitigation measures are implemented and adhered to then the residual impact on the cultural and archaeological sites will possibly have a **VERY LOW** negative impact.

TABLE 8-39: RESIDUAL IMPACT ON CULTURAL AND ARCHAEOLOGICAL SITES (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on cultural and archaeological sites	Low	Isolated sites	Permanent	Practically impossible	**Very Low**
	1	1	5	1	**0.46**

8.1.11 Traffic Impact

Initial Impact (Status Quo)

A traffic specialist underwent a traffic count exercise on the N4 east of the Wilgerivier interchange and at the intersection of the R104 and the D2236 as part of the Traffic Impact Assessment. The observations indicated the following:

- The N4 National Road, typically carries peak hour traffic that is of the order of less than 20 % of the theoretical capacity of the road;
- The R104 also carries relatively low peak hour volumes of traffic with peak hour traffic typically of the order of 110 vehicles per hour which is less than 10% of theoretical capacity;
- Whilst no detailed traffic counts were conducted on the various gravel access roads in the study area the site inspection conducted on 8/09/2009 showed that traffic on these roads is insignificant in terms of volume.

TABLE 8-40: INITIAL IMPACT ON TRAFFIC (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on traffic	Moderate	Local	Short Term	Is occurring	**Moderate**
	2	3	2	5	**2.33**

Additional Impact

Based on the findings from the specialist, the additional impacts on traffic, would probably be considered **LOW**. The impacts identified would definitely occur in the study area in the short term. Although Alternative 1 – 3 would have a similar impact, Alternative 2 would have a

larger impact due to it being the longest alternative and consequently the construction period would be longer. Therefore alternative 2 is the least preferred alternative.

TABLE 8-41: ADDITIONAL IMPACT ON TRAFFIC (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on traffic	Moderate	Study area	Short Term	Will happen	**Low**
	2	2	2	5	**2**

Cumulative Impact

The cumulative impact of both the historical impacts and the proposed development remain as assessed for the initial impact assessment.

TABLE 8-42: CUMULATIVE IMPACT ON TRAFFIC (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Cumulative impact on traffic	Moderate	Local	Short Term	Will happen	**Moderate**
	2	2	2	5	**2.33**

Mitigation Measures

- To minimise traffic impacts all trips for delivery of materials should utilise the N4 either from the east or west. These trips to and from the N4 should use the R545 to the Kusile Power Station construction site;
- The shoulder sight distance is the distance that the driver of a vehicle, that is stationary at the stop line of a minor road, can see along the major road to be able to cross the major road before an approaching vehicle reaches the intersection. It is therefore a function of the speed of vehicles travelling on the major road, the width of the major road and the type of vehicles that are trying to cross. The shoulder sight distance along the R104 where the rail crossing will be located is more than adequate for this class of road and will not be an issue even if construction traffic gains access to and from the site at this point. Therefore it is recommended that this road be used for access to the site;
- Notwithstanding the above, with the increase in heavy vehicle volumes that could be associated with future construction activities, it is recommended that W107 and W108 intersection warning signs with IN 11.569 supplementary warning plates be erected on the R104 approaching the existing intersection with the D2236, and at the potential point of access to the site, indicating the presence of heavy vehicles at the intersections.
- Dust is obviously not an issue on the R104 which has a tarred surface. It could however be an issue on the service road within the railway reserve. After the construction is finished this road will carry sporadic very low volumes of traffic and thus traffic-generated dust will not be an issue. This will however be a more significant issue with construction traffic using it. Similarly, apart from exceptional circumstances, construction traffic should not be permitted to use any of the other gravel access roads in the study area.

- Gravel Access Roads: For the very low daily volumes of basically farm-related traffic that currently uses the gravel access roads in the area road safety should not be an issue related to road surface conditions. This will however become a completely different issue if heavy construction traffic is permitted to use them.
- Road R104 between Bronkhorstspruit and the Balmoral is a tarred road which, from visual inspection, appears generally to be in good condition for the volumes of traffic that use it. However with heavy construction traffic over a period of two years, if this road pavement is not monitored, surface distress and edge deterioration could develop and accelerate and potentially become road safety hazards. This road should be resurfaced back to its original condition once construction is completed;
- A detailed construction-related traffic management plan will need to be addressed prior to the start of any construction work both in terms of road safety and road pavement maintenance. Construction traffic should not in normal circumstances be permitted to use any portion of the existing gravel access roads, the proposed service road within the future rail reserve would be more appropriate as a site access road.
- All road design work must be carried out by suitably qualified personnel, compliant with relevant standards and be approved by the appropriate road authority.
- All other construction vehicles, e.g. tippers, dump trucks, compactors, water bowsers, etc. will as far as possible be confined to site and will not travel on public roads;
- The normal working day will be 07:30 to 17:30, Mondays to Saturdays, with work on Sundays only in exceptional circumstances.

Residual Impact

If the above mitigation measures are implemented and adhered to then the residual impact on traffic will possibly have a **LOW** negative impact in the study area in the short-term.

TABLE 8-43: RESIDUAL IMPACT ON TRAFFIC (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on traffic	Low	Study area	Short Term	Very Likely	**Low**
	1	2	2	4	**1.33**

8.1.12 Social Impact

The following section discusses the various change processes and related expected impacts that could be expected as a result of the proposed construction of the railway line and associated infrastructure. The change processes which were assessed include the following:

- **Demographic processes:** changes in the number and composition of the community;
- **Economic processes**: changes in a way in which people make a living and the economic activities in the community;

- **Institutional and empowerment processes**: changes in the role, efficiency and operation of local structures and the community's ability to get involved and influence decision making process;
- **Socio–cultural processes**: changes in a way in which humans behave, interact or relate to each other and their environment and the belief and the value systems which guide these interactions.

A change process can be regarded as a change that takes place within the receiving environment as a result of a direct or indirect intervention. A potential impact follows as a result of a change process However; a change process can only result in an impact once it is experienced as such by an individual or community on a physical and / or cognitive level. This section will further discuss the following:

- The change process without the project;
- The expected change process with the project;
- Circumstances that will lead to the change processes;
- Assess the potential impacts as a result of the project before mitigation;
- Determine significance of the impact before mitigation;
- Proposed mitigation and enhancement measures; and
- Discuss both cumulative and residual impacts if any.

Initial Impact (Status Quo)

Demographic Impacts

Due to the construction of the Kusile Power Station locally there has been an influx of construction workers and job seekers. This has resulted in a MODERATE negative perceived impact on the local community in the short term.

TABLE 8-44: INITIAL DEMOGRAPHIC IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Influx of construction workers (Negative)	MODERATE	Local	Short term	It is occurring	**Moderate**
	3	3	2	5	**2.66**
Influx of job seekers (Negative)	LOW	Study area	Incidental	It is occurring	**Low**
	2	2	1	5	**1.66**

Economic Impacts

Similarly as a result of the construction of the Kusile Power Station direct and indirect formal and informal employment opportunities were created to local individuals. This has resulted in both **negative** and **positive impacts**.

TABLE 8-45: INITIAL ECONOMIC IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Direct Formal Employment Opportunities **(Positive)**	Moderate	Local	Short Term	It is occurring	**Moderate**
	3	3	2	5	**2.66**
Indirect Formal And /Or Informal Employment Opportunities **(Positive)**	Low	Study Area	Incidental	It is occurring	**Low**
	2	2	1	5	**1.66**
Compensation For Servitude **(Positive)**	Moderate	Study Area	Permanent	It is occurring	**Moderate**
	3	2	5	5	**2**
Social Pathologies Arising From Population Influx **(Negative)**	Moderate	Local	Short Term	Is has happened	**Moderate**
	3	3	2	5	**2.66**

Institutional and Empowerment Impacts

Additionally to the aforementioned initial impacts as a result of the Kusile Power Station construction site a negative attitude in some cases has been formed against the project. This has resulted in a MODERATE negative perceived impact towards Eskom in the short term.

TABLE 8-46: INITIAL INSTITUTIONAL AND EMPOWERMENT IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Attitude formation against project **(Negative)**	Moderate	Local	Short Term	Very Likely	**Moderate**
	3	3	2	4	**2.13**

Socio-Cultural Impacts

Safety and security is a large issue of concern as a result of the Kusile Power Station construction site. This has resulted in a MODERATE negative impact on the local community in the short term.

TABLE 8-47: INITIAL SOCIO-CULTURAL IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Safety And Security (Negative)	High	Local	Short Term	Very Likely	**Moderate**
	4	3	2	4	**2.4**

Additional Impact

Demographic Impacts

The construction of the proposed railway line and associated infrastructure could lead to a change in the number and composition of the population within the affected local area. This could in turn lead to economic, land use and socio – cultural impacts. The demographic change processes that can be expected as a result of the proposed railway line, and which have been assessed, comprise the following:

- Influx of construction workers; and
- Influx of job seekers.

These impacts are tabulated below.

TABLE 8-48: ADDITIONAL DEMOGRAPHIC IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Influx of construction workers (Negative)	MODERATE	Local	Short term	It's going to happen	**Moderate**
	3	3	2	5	**2.66**
Influx of job seekers (Negative)	LOW	Study area	Incidental	It's going to happen	**Low**
	2	2	1	5	**1.66**

Economic Impacts

The economic change processes that were assessed are as follows:

- Direct formal employment opportunities to local individuals; and
- Indirect formal and /or informal employment opportunities to local individuals.

These impacts are tabulated below.

TABLE 8-49: ADDITIONAL ECONOMIC IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Direct Formal Employment Opportunities **(Positive)**	Moderate	Local	Short Term	It's Going To Happen	**Moderate**
	3	3	2	5	**2.66**
Indirect Formal And /Or Informal Employment Opportunities **(Positive)**	Low	Study Area	Incidental	It's Going To Happen	**Low**
	2	2	1	5	**1.66**
Compensation For Servitude (Positive)	Moderate	Study Area	Permanent	It's Going To Happen	**Moderate**
	3	2	5	5	**2**
Social Pathologies Arising From Population Influx **(Negative)**	Moderate	Local	Short Term	Very Likely	**Moderate**
	3	3	2	4	**2.13**

Institutional and Empowerment Impacts

The institutional and empowerment change processes that can be expected as a result of the proposed Eskom project, and which were then assessed include the following:

- Attitude formation against the project;
- Negotiation processes; and
- Disaster management plan on site.

These impacts are tabulated below.

TABLE 8-50: ADDITIONAL INSTITUTIONAL AND EMPOWERMENT IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Negotiation process **(Positive)**	High	Local	Short Term	It's Going To Happen	**High**
	4	3	2	5	**3**
Disaster Management Plan on site **(Positive)**	Moderate	Study Area	Incidental	Could Happen	**High**
	3	2	1	3	**3.6**
Attitude formation against project **(Negative)**	Moderate	Local	Short Term	Very Likely	**Moderate**
	3	3	2	4	**2.13**

Socio-Cultural Impacts

The expected changes that can occur in relation to social health and safety aspects could be as a result of the presence of construction workers and job seekers during the construction period. The socio-cultural processes that can be expected are as follows:

- Integration with local community;
- Safety and security; and
- Noise pollution.

These impacts are tabulated below.

TABLE 8-51: ADDITIONAL SOCIO-CULTURAL IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Integration With Local Community (Negative)	Moderate	Local	Short Term	Very Likely	**Moderate**
	3	3	2	4	**2.13**
Safety And Security (Negative)	High	Local	Short Term	Very Likely	**Moderate**
	4	3	2	4	**2.4**
Noise Pollution (Negative)	Moderate	Local	Short Term	Very Likely	**Moderate**
	3	3	2	4	**2.13**
Pedestrian And Vehicle Access (Negative)	Moderate	Local	Permanent	It's Going To Happen	**High**
	3	3	5	5	**3.67**

Cumulative Impact

Demographic Impacts

Influx of construction workers to other projects taking place in the area, i.e. the Kusile Power Station and its associated activities could result. This influx could lead to significant increase on the demand of local services and/or resources.

Economic Impacts

The local economy will be boosted on a temporary basis, and the local communities may experience financial relief to some extent - during construction period.

Institutional and Empowerment Impacts

Attitudes towards construction activities could be influenced by other construction activities such as the Kusile Power Station and its associated activities.

Socio-Cultural Impacts

The impacts could be permanent duration due to the nature of HIV/AIDS and other STIs that are incurable. The spatial scale is local but infected persons from the community as well as construction team who are mobile and could infect more people in other parts of the country. In terms of noise pollution, other construction activities taking place in the area could add to the noise levels.

Mitigation Measures

Demographic Impacts

- Raise awareness amongst construction workers about local traditions and practices;

- Inform local businesses about the expected influx of construction workers so that they could plan for extra demand; and
- Ensure that the local community communicates their expectations of construction workers' behaviour with the construction sub-contractor, and formalize a written agreement between the community and the sub-contractor.
- Ensure that employment procedures / policy is communicated to local stakeholders, especially local fire control committee / initiative, local farmers / land owners as well as the Emalahleni and Kungwini local councillors;
- Have clear rules and regulations for access to the construction site to control loitering;
- Consult with local South African Police Services (SAPS) to establish standard operating procedures for the control and removal of loiterers at the construction site; and
- Construction workers should be clearly identifiable by wearing proper construction uniforms displaying the logo of the construction company. Construction workers must also be provided with identification tags.

Institutional and Empowerment Impacts

- Factual and transparent information should be supplied to the community from the beginning of the project;
- Employment opportunities should also be offered to the local community; and

- ***Socio-Cultural Impacts***

- Launch aggressive culturally appropriate STI and HIV/AIDS awareness campaigns;
- Distribute condoms by placing them at centrally located points;
- Control access to the construction site to prevent sex workers;
- Employ local women to decrease their financial vulnerability.

Residual Impact

Demographic Impacts

It is expected that construction workers who do not leave the area once the construction phase has been completed will continue to impact on the number and composition of the local community, thereby possibly affecting social well-being. Long term demographic changes are possible, for example when unplanned pregnancies occur as a result of relationships between construction workers and community members. Spread of HIV / AIDS and other sexually

transmitted infections leaving behind a vulnerable community in terms of illnesses and lack of access to medical care.

Economic Impacts

Training of local individuals will provide them with the necessary skills to find employment on other construction projects. Also unemployed individuals are motivated and empowered to find and maintain employment. Income received by local individuals will have a positive impact on their families as money will now be available to increase their livelihood, even if it will be for a short period.

Institutional and Empowerment Impacts

If a community becomes opposed to the construction activity, this might have negative impacts on other and future construction activities in the area / region.

Socio-Cultural Impacts

A reduction in human resources as a result of death from HIV and AIDS related illnesses could in turn lead to reduced life expectancy, increase in health care expenditure; and an increase in health care cost. In as far as safety and security is concerned, loiters could continue to engage in criminal activities even after the completion of the project.

8.1.13 Noise Impact

Initial Impact (Status Quo)

The area is natural grassland with some arable farming and pig farms. The primary noise sources in the area are natural birdlife and farm stock as well as sparse and unpredictable local traffic on the dirt roads and overflying. The noise climate in the study area along the R104 corridor is dominated by traffic noise up to 300m from the road

TABLE 8-52: INITIAL IMPACT ON NOISE (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Initial impact on noise	Low	Study area	Short Term	Unlikely	**Very Low**
	1	2	2	2	**0.66**

Additional Impact

The ambient noise levels in the study area currently fall significantly below the recommended noise levels for suburban residential areas. The major noise impacts associated with the construction phase of the proposed railway are noise during the construction due to heavy vehicles and the impact during construction as a result of cut and fill operations in the short term.

This impact was not deemed to be problematic and it is in the specialist's professional opinion that the railway project should not have a significant detrimental noise impact. The noise impact is a factor of distance from the receptor. The further the receptor (dwellings) is form

the source of the noise the lower the noise impact is. The preferred alternative from a noise impact perspective is Alternative 3, followed by Alternative 1 and the least preferable alternative is alternative 2.

Alternative 1 and 3

Alternative 1 and 3 are not as long as alternative 2 but Alternative 1 is in closer proximity to more dwellings then alternative 3.

TABLE 8-53: ADDITIONAL IMPACT ON NOISE (ALTERNATIVE 1 AND 3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on noise	Moderate	Study area	Short Term	Very Likely	**Low**
	3	2	2	4	**1.86**

Alternative 2

Alternative 2 is the longest alternative and therefore more stakeholders are affected by construction related activities. Additionally this railway affects the Topigs farm which is highly sensitive to noise

TABLE 8-54: ADDITIONAL IMPACT ON NOISE (ALTERNATIVE 2).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on noise	Moderate	Local	Short Term	Very Likely	**Moderate**
	3	3	2	4	**2.13**

Cumulative Impact

The cumulative impact of both the historical impacts and the proposed development remain as assessed for the additional impact assessment.

Mitigation Measures

- All noise generating activities should be undertaken during the day between 7h00 and 17h00 including the transportation of structures / equipment to site with the aid of heavy duty vehicles.
- All heavy duty vehicles should be fitted with exhaust silencers;
- All diesel powered earth moving and construction equipment must be of high quality and well maintained
- Regular scheduled maintenance must include the checking and replacement, if necessary, of intake and exhaust silencers
- Any change in the noise characteristics of a particular equipment piece should serve as an indicator of potential mechanical failure and immediately be investigated.

Residual Impact

If the above mitigation measures are implemented and adhered to then the residual impact of noise will possibly have a **LOW** negative impact in the study area in the short-term.

TABLE 8-55: RESIDUAL IMPACT ON NOISE (ALTERNATIVE 1 AND 3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on noise	Low	Incidental	Short Term	Very Likely	**Low**
	2	1	2	4	**1.33**

TABLE 8-56: RESIDUAL IMPACT ON NOISE (ALTERNATIVE 2).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on noise	Low	Study Area	Short Term	Very Likely	**Low**
	2	2	2	4	**1.6**

8.1.14 Visual Impact

The visual simulations prepared (see Section 7.2.4 and **Appendix M**) illustrate the extent to which the railway will be visible from key observation points (static and dynamic views) during construction and operation. The vertical form/dimensions of the buildings/structures would be hidden by their location among existing buildings and within a well vegetated area. The visual contrast is increased by the "shape" and scale of the buildings/structures, which generally will not be viewed along the skyline.

Static Views

The proposed railway would potentially be visible from the surrounding farmland and the high-lying areas to the north of Bronkhorstspruit. The potential number of viewers from this area should be low as the farmlands are quite sparsely populated but the views would vary greatly depending on site specific conditions like the orientation of the homes as well as the location of other buildings, fences, vegetation and localized landforms. All these elements have the potential to block views from the buildings to the proposed railway.

Dynamic Views

The railway and power lines will be visible to a moderate number of viewers, mainly those travelling along the N4 highway and some travellers along the R 104. Views from the N4 extend approximately 8 km and represent a view period of approximately 36 seconds travelling at 120 km/h. The level of visibility would be low due to the view distance of more than 5 km and the resulting atmospheric effects that reduce the contrast between the power lines and the surrounding landscape. The effects are similar for the R 545. Please refer to Table 8-57 for a summary of the dynamic impacts. This assessment is similar for both route alternatives.

The proposed railway would also be visible from several farm roads which are located around the proposed site. The viewing distance varies between 1 and 11 km for these roads and if the

viewing distance is less than 2 km, the potential visual impact would be considered as moderate.

TABLE 8-57: DYNAMIC IMPACT TABLE

Road Name	Speed limit (km/h)	Length of Road (km)	Approximate Period of View (min)	View Distance
N 4	**120**	**8**	**4**	**0 – 8 km**
R 104	**100**	**7**	**4.2**	**0 – 7 km**

Impact

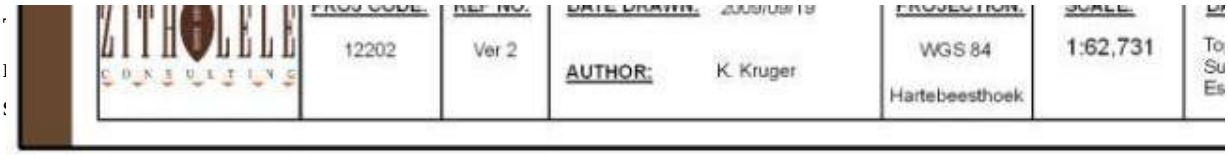

Figure 6-32.

TABLE 8-58: VISUAL IMPACT MATRIX

Potential Observation Point	Category of Potential Receptor	Context of View	Approximate View Distance	Period of View	Visibility Rating
Surrounding Farmland	Static	Level	0 – 11 km	Long Term	Medium
Bronkhorstspruit highlands	Static	Level Above	> 5 km	Long Term	Medium
Gravel Roads	Dynamic	Above & below	0 – 11 km	Medium	Low
Tar Roads	Dynamic	Level - Above	5 – 11 km	Short	Low

The visual impact of the railway line in a landscape characterised by power lines, roads and farmlands will have an impact, but not as high as in an unimpacted area. All three alternatives have very similar visual impacts and none of the alternatives can be suggested as a preferred alternative on visual grounds.

8.2 Operational Phase

The main impacts during the operational phase are bird collisions with the moving train and power lines, windblown sorbent off rail wagons, and noise from the train operations.

8.2.1 Air

Initial Impact (Status Quo)

The initial impact remains as assessed in Section 10.1.2, a Moderate impact.

Additional Impact

During the operation phase the main activities that will impact on air quality are twofold (1) fugitive dust from maintenance vehicles travelling on dirt roads and from the railway due to the transportation of sorbent and (2) windblown sorbent from the rail wagons (this conservative approach was assessed should the wagons not be covered during transportation, however it is proposed that the wagons will be covered).

As the various moisture contents of the sorbent material (i.e. 8%, 6% and 4%) provided similar impacts, the prediction ground level concentration for sorbent at 8% moisture content was illustrated only. The predicted PM10 ground level concentrations due to wind-blown sorbent material from the moving rail wagons were well within the proposed daily and annual PM10 SA standards of 75 µg/m³ and 40 µg/m³ respectively. Refer to Table 8-59 below.

The additional impact on air quality during the operational phase will be a LOW negative impact over the *study area* that will occur in the long-term.

TABLE 8-59: ADDITIONAL IMPACT ON AIR QUALITY (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on air quality	Moderate	Study Area	Long Term	Very Likely	**Low**
	3	2	2	4	**1.86**

Cumulative Impact

The cumulative impact remains as assessed in Section 10.1.2, a Moderate impact.

Mitigation Measures

Effective mitigation measures for the rail transportation of sorbent material would be to cover the wagons. This will eliminate the impacts of windblown sorbent material depending on the sorbent particle size. Additionally the mitigation measures presented in Section 10.1.2 must also be implemented.

8.2.2 Geology

The impact assessment during the operational phase is negligible.

8.2.3 Topography

The impact assessment during the operational phase is negligible.

8.2.4 Soils and Agricultural Potential

During the operational phase the impacts described in the construction phase will remain, but the construction vehicles will be replaced with the potential for spillage from the train. Therefore the impact is rated the same as in Table 8-14 above.

8.2.5 Surface Water and Wetlands

Initial Impact (Status Quo)

The initial impact remains as assessed in Section 10.1.5, a Moderate impact.

Additional Impact

During the operational phase the structures constructed will remain within the buffer zones of the surface water features. These structures will initially alter the banks of the rivers and streams and could alter the flow during storm flow events. Therefore the impacts assessed during the construction phase will persist in terms of the structures on site but the vehicles will not be present. This impact is rated as a **Moderate** impact as shown in the table below.

TABLE 8-60: ADDITIONAL IMPACT ON SURFACE WATER AND WETLANDS (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on surface water and wetlands	High	Isolated sites	Long Term	Will happen	**Moderate**
	4	1	4	5	**3**

Cumulative Impact

The cumulative impact during the operation phase will be MODERATE at *isolated sites* in the long term.

TABLE 8-61: CUMULATIVE IMPACT ON SURFACE WATER AND WETLANDS (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Cumulative impact on surface water and wetlands	High	Isolated sites	Long Term	Will happen	**Moderate**
	4	1	4	5	**3**

Mitigation Measures

The mitigation measures remain as assessed and recommended in Section 10.1.5.

Residual Impact

The residual impact during the operation phase will be MODERATE at *isolated sites* in the long term and will be **very likely** to occur.

TABLE 8-62: RESIDUAL IMPACT ON SURFACE WATER AND WETLANDS (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on surface water and wetlands	High	Isolated sites	Long Term	Very Likely	**Moderate**
	4	1	4	4	**2.4**

8.2.6 Ground water

The impact assessment does not change from that of the construction phase, refer to Section 10.1.6 above. However an additional impact to groundwater during the operational phase could result from the spillage of sorbent from the railway wagons. This impact is rated as **Moderate**.

8.2.7 Terrestrial Ecology

The impact assessment does not change from that of the construction phase, refer to Section 10.1.7 above.

8.2.8 Avi-fauna

Initial Impact (Status Quo)

The initial impact remains as assessed in Section 10.1.8, a High impact.

Additional Impact

During the operational phase the greatest impact on avi-fauna include the collisions of birds with the moving train and power lines. The additional impact during the operation phase will be HIGH, *locally* in the in the long term.

TABLE 8-63: ADDITIONAL IMPACT ON AVI-FAUNA (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on avi-fauna	High	Local	Long Term	It's going to happen	**High**
	4	3	4	5	**3.67**

Cumulative Impact

The cumulative impact will be the same as the additional impact.

Mitigation Measures

The mitigation measures remain as assessed in Section 10.1.8.

Residual Impacts

If the above mitigation measures are implemented and adhered to then the residual impact on avi-fauna will possibly have a **LOW** negative impact in the study area in the long term.

TABLE 8-64: RESIDUAL IMPACT ON AVI-FAUNA (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on avi-fauna	Moderate	Local	Long Term	Could happen	**Low**
	2	3	4	3	**1.8**

8.2.9 Aquatic Ecology

The impact assessment does not change from that of the construction phase, refer to Section 10.1.9 above.

8.2.10 Cultural and Archaeological

The impact assessment does not change from that of the construction phase, refer to Section 10.1.10 above.

8.2.11 Traffic

Initial Impact (Status Quo)

The initial impact remains as assessed in Section 10.11, a Low impact.

Additional Impact

The additional impact on traffic during the operation phase will be VERY LOW at isolated sites in the long term.

TABLE 8-65: ADDITIONAL IMPACT ON TRAFFIC (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Additional impact on traffic	Low	Isolates sites	Long Term	Unlikely	**Very Low**
	1	1	3	2	**0.67**

Cumulative Impact

The cumulative impact will remain as assessed in the construction phase, Section 10.1.11.

Mitigation Measures

The mitigation measures will remain as assessed in the construction phase, Section 10.1.11.

Residual Impact

If the above mitigation measures are implemented and adhered to then the residual impact the traffic impact will possibly be negligible.

8.2.12 Social

Initial Impact (Status Quo)

The initial impact remains as assessed in Section 10.1.12, a Moderate impact.

Additional Impact

Demographic Impacts

The additional impact during on demographics during the operational phase will be a VERY LOW negative impact over the *proposed route*.

TABLE 8-66: ADDITIONAL DEMOGRAPHIC IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Influx of maintenance workers (Negative)	Very Low	Proposed Route	Incidental	Very Likely	Very Low
	1	1	1	4	**0.8**

Economic Impacts

The economic change processes that were assessed are as follows:

- Direct formal employment opportunities to local individuals; and

These impacts are tabulated below.

TABLE 8-67: ADDITIONAL ECONOMIC IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Direct formal employment opportunities to local individuals **(Positive)**	Moderate	Local	Medium Term	It's Going To Happen	**Moderate**
	3	3	2	5	**2.66**

Institutional and Empowerment Impacts

The institutional and empowerment change processes that can be expected as a result of the proposed Eskom project, and which were then assessed include:

- Disaster management plan on site.

These impacts are tabulated below.

TABLE 8-68: ADDITIONAL INSTITUTIONAL AND EMPOWERMENT IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Disaster Management Plan **(Positive)**	Low	Local	Incidental	Could Happen	**Low**
	2	3	1	3	**1.2**

Socio-Cultural Impacts

The expected changes that can occur in relation to social health and safety aspects could be as a result of the presence of construction workers and job seekers during the construction period. The socio-cultural processes that can be expected are as follows:

- Movement of maintenance workers;

- Safety and security; and
- Noise pollution.

These impacts are tabulated below.

TABLE 8-69: ADDITIONAL SOCIO-CULTURAL IMPACT (ALTERNATIVE 1-3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Movement of maintenance workers **(Negative)**	Very Low	Local	Incidental	Could Happen	**Low**
	1	3	1	3	**1**
Safety and security **(Negative)**	Moderate	Local	Long Term	Very Likely	**Moderate**
	3	3	4	4	**2.66**
Noise pollution **(Negative)**	Moderate	Local	Long Term	Very Likely	**Moderate**
	3	3	4	4	**2.66**

Cumulative Impact

The cumulative impact remains as assessed in Section 10.1.12 above.

Mitigation Measures

The mitigation measures remain as assessed in Section 10.1.12 above and in addition the servitude fence (to optimise security) and corridor must be maintained.

Residual Impact

The residual impact remains as assessed in Section 10.1.12 above.

8.2.13 Noise

Initial Impact (Status Quo)

The initial impact remains as assessed in Section 10.1.12, a very low impact.

Additional Impact

The additional impact during the operational phase will be predominantly from the train moving during operation and the noise at the offloading facility during discharge. Additionally there will be an impact due to the noise attenuation in the cuttings or bridges (Doppler Effect).

Alternative 2 is the longest alternative and therefore more stakeholders are affected by construction related activities. Additionally this corridor affects the Topigs farm which is highly sensitive to noise

TABLE 8-70: ADDITIONAL IMPACT ON NOISE (ALTERNATIVE 1 AND 3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating

Additional impact on noise	Very High	Local	Long Term	It's going to happen	**High**
	5	3	3	5	**3.66**

Cumulative Impact

The cumulative impact remains as assessed for the additional impact.

Mitigation Measures

It is suggested that bottom discharge wagons are used in order to minimise the noise impact at the discharge area.

Residual Impact

TABLE 8-71: RESIDUAL IMPACT ON NOISE (ALTERNATIVE 1 AND 3).

Impact Type	Significance	Spatial	Temporal	Probability	Rating
Residual impact on noise	High	Study Area	Long Term	Very Likely	**Moderate**
	4	2	3	4	**2.4**

8.2.14 Visual

The impact assessment does not change from that of the construction phase, refer to Section 10.1.14 above.

8.2.15 Risk

A risk assessment was undertaken by *Mr Mike Oberholzer of Riscom (Pty) Ltd.* This risk assessment is valid for the transportation of **limestone and lime only**. The risk assessment would require a review if hazardous materials were transported on the railway line.

It was concluded that **neither lime nor limestone is flammable or toxic, there would be no acute health effects from an accidental release during transportation.**

8.3 Decommissioning Phase

8.3.1 Air

The impact assessment does not change from that of the construction phase, refer to Section 10.1.1 above.

8.3.2 Geology

The impact assessment does not change from that of the construction phase, refer to Section 10.1.2 above.

8.3.3 Topography

The impact assessment does not change from that of the construction phase, refer to Section 10.1.3 above.

8.3.4 Soils and Agricultural Potential

During the rehabilitation and closure phase the ballast will be removed along with the rest of the railway line infrastructure. With proper rehabilitation the soils could be re-established as an agricultural resource. The rehabilitation will be a major positive impact rated as a **High** positive impact as indicated in Table 8-14.

8.3.5 Surface Water and Wetlands

The impact assessment does not change from that of the construction phase, refer to Section 10.1.5 above.

8.3.6 Ground water

The impact assessment does not change from that of the construction phase, refer to Section 10.1.6 above.

8.3.7 Terrestrial Ecology

The impact assessment does not change from that of the construction phase, refer to Section 10.1.7 above.

8.3.8 Avi-fauna

The impact assessment does not change from that of the construction phase, refer to Section 10.1.8 above.

8.3.9 Aquatic Ecology

The impact assessment does not change from that of the construction phase, refer to Section 10.1.9 above.

8.3.10 Cultural and Archaeological

The impact assessment does not change from that of the construction phase, refer to Section 10.1.10 above.

8.3.11 Traffic

The impact assessment does not change from that of the construction phase, refer to Section 10.1.11 above.

8.3.12 Social

The impact assessment does not change from that of the construction phase, refer to Section 10.1.12 above.

8.3.13 Noise

The impact assessment does not change from that of the construction phase, refer to Section 10.1.13 above.

8.3.14 Visual

The impact assessment does not change from that of the construction phase, refer to Section 10.1.14 above.