**Roodepoort Strengthening Project**

**BASIC ASSESSMENT REPORT ENVIRONMENTAL FINDINGS**

***DRAFT***



Project ref: 372

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October 2012

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EXECUTIVE SUMMARY

Fourth Element Consulting (Pty) Limited were commissioned by Eskom SOC Limited to undertake an Environmental Assessment of the proposed Roodepoort Strengthening Project. It was established that a Basic Assessment Report is the appropriate level of assessment for this project. A total of six route corridor options and five substation site options have been considered as part of this Basic Assessment Report and the results and recommendations presented above.

In addition to an extensive public consultation exercise, a number of specialist studies were undertaken in order identify potential environmental impacts arising from the implementation of the proposed infrastructure. Based on the information gathered by specialists and received from Interested and Affected Parties (I&AP’s) that responded during the public consultation process, a sensitivity map was prepared to indicate the main social and environmental features present within the study area and the likely impact of transmission line infrastructure on them. GIS based analysis allowed a comparison of the route corridors and substations and this analysis was then compared with the recommendations made by individual specialists.

All of the route corridor alternatives pass through complex and varied environmental conditions with features including the Cradle of Humankind World Heritage Site at the western extent of the study area, nature reserves and residential areas on the eastern extent and Lanseria Airport in the centre. Despite these challenging conditions, the final evaluation of routes eliminated the ‘no-go’ option based on conformance with Eskom’s own performance objectives and national, regional and local priorities for the provision new transmission infrastructure.

Our findings suggest that, although it is likely that the undergrounding option using Malibongwe Drive (Option 5a) will be preferred by the public and may result in a lower overall impact at a corridor level, this option is not considered feasible or reasonable based on the available knowledge. Furthermore, when examined at a servitude level it is less clear that such an option would result in significantly lower environmental impacts (it would need to run along the western side of Malibongwe Drive which is more sensitive than the eastern edge) than overhead lines, the impact of which can often be mitigated through placement and design considerations.. Given the cost of taking forward this option (up to 20 x the cost of an overhead line) it is our view that there is too much uncertainty regarding feasibility and insufficient environmental benefit to justify the cost of such a proposal thereby passing the test of reasonableness.

Thus, taking into account all of the factors identified through extensive study, **Route Corridor Option 1 and Substation Option A** are recommended. Though there are a number of potentially unavoidable impacts resulting from the selection of this route, these are generally limited to visual impact. The route is able to follow existing infrastructure for the majority of its length and furthermore can be sited in the most part in such a way that it only passes through atreas of low to medium sensitivity. The mitigation measures outlined in specialist reports and the Environmental Management Plan appended to this document will need to be implemented as part of the proposed development.

1. introduction

Eskom SOC Limited proposes to construct new infrastructure in the form of transmission lines in the Roodepoort area of Johnannesburg. The proponent (Eskom) has commissioned Fourth Element Consulting (Pty) limited to undertake the necessary environmental assessment work in conjunction with the proposals which comprise new transmission lines connecting the existing Apollo-Pluto transmission lines with a new Demeter substation in the Roodepoort area.. In broad terms, the new infrastructure is required in order to provide sufficient capacity for the anticipated growth in this area as well as to upgrade the current supply to existing residential and industrial uses in the area.

It was established under advisement from the Department of Environmental Affairs that this project should be subject to the basic Assessment report process as outlined in the National Environmental management Act (Environmental Impact Assessment Regulations) 2010. Six alternative routes and five substation options have been considered as part of the BAR process and the purpose of this report is to outline the findings of the studies conducted on those routes and to make recommendations as to which route should be taken forward as the preferred option. This supplementary report forms part of the Basic Assessment (BAR) for the Roodepoort Strengthening Project and should be read in conjunction with the BAR Report itself and specialist reports addressing specific environmental issues.

1. Details of BAR Practitioner

Fourth Element Consulting (Pty) Limited, previously known as PBA International (South Africa) Consulting Engineers (Pty) Limited has been engaged with the assessment of environmental effects associated with the provision of new infrastructure in South Africa since its inception in 1997. The company and its staff have prepared numerous Environmental Impact Assessment Reports and Basic Assessment Reports for Eskom transmission and distribution schemes during this time.

As independent practitioners, we ensure that all of the schemes and projects for which we provide Environmental Assessment services are assessed based on robust scientific evidence and a sound understanding of the significant impacts likely to arise from the construction, operation and decommissioning of such schemes. During our time of operation we have specialised in the environmental assessment of linear infrastructure and have worked on some of the largest transmission line projects in South Africa including the Delta-Epsilon project which included the assessment of over 3000km of power line infrastructure.

Tsepo Lepono, the Director of Ecology (and previously the Director of Environment) had led the project since it’s inception with support from our in house team comprising of both junior and senior Environmental practitioners. The latter stages of the project have been overseen by Nick Hilton, the recently appointed Director of Environment who will be taking over from Mr Lepono following the submission of the BAR report. Both Mr Hilton and Mr Lepono are members of the International Association of Impact Assessors. Mr Lepono has over 10 years experience in the field of natural Sciences and Mr Hilton has over 15 years experience working on the Environmental Assessment and Strategic Environmental Assessment of infrastructure projects. Please refer to attached CV in Appendix G

1. Project description and rationale
   1. General Description

The proposed Roodepoort Strengthening Project is expected to involve the construction of two new 400Kv power lines to connect the existing Apollo-Pluto 400Kv line with a proposed new substation in the Roodepoort area. Two lines are required to complete the circuit in and out of the Apollo-Pluto line. The proposed lines will be between 14 and 20 kilometres in length (depending on the final route selected) with a servitude of 110m. The transmission lines will be supported by single circuit Cross Rope type towers and self-supporting towers will be used where a bend in the line is encountered. The maximum tower height expected will be 32m for cross rope structures. Cross-rope tower types have been used as this is widely perceived to result in the least visual impact however examples of alternative tower types can be found at Appendix X.

Figure 3.1.1 - Diagram of Cross Rope Tower Type to be Used for the Roodepoort Scheme



Figure 3.1.2- Cross Rope Tower Type in the Landscape

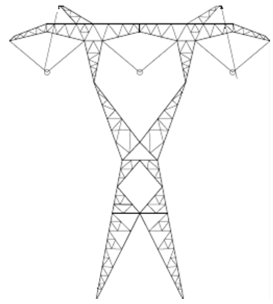


Figure 3.1.3- Self Supporting tower type to be used as necessary on bends.

The proposed Demeter substation will require a total footprint of 25m2, though the substation itself will be significantly smaller with the remainder of the site providing a buffer zone. Example plans and diagrams of the proposed substation are included at Appendix X. In broad terms the substation will consist of the following features: 3 x 315 MVA; 400kv/88kv Demeter Substations, one telecommunications tower, one oil dam and one access road to the substation anticipated to be no longer than 500m in length).

****

Figure 3.1.4- **Example of a Main Transmission Substation: Spitskop MTS**

(Courtesy of Eskom)

The servitude for the transmission lines and the areas for the substation will be acquired by Eskom and will result in certain restrictions for existing landowners though it is likely that in some cases existing activities will not be required to cease altogether. The servitude of the lines will be cleared and Eskom will maintain this area in perpetuity to ensure suitable access and that vegetation does not interfere with the operation of the line itself. There will be no public access to the substation site.

In terms of the activities and timescales associated with the proposed scheme, the following table (Table 1) provides an overview which is further developed in the EMPr: and at Appendix G to the main BAR.

Table 1: Project Rollout

| **Phase** | **Timescale** | **Activity** |
| --- | --- | --- |
| Pre-construction phase | Unknown- landowner dependent | Acquisition of land. |
| Construction phase | 12 to 18 months | Development of the access roads. |
| Transportation and traffic associated with the movements of labour, machinery and construction materials. |
| Vegetation clearing in transmission line servitudes. |
| Vegetation clearing in substation site. |
| Earthwork and excavation. |
| Management of wastes and of contaminated products. |
| Operational phase | Assumed operation lifespan is 50 years | The presence of facilities (transmission line, servitude, substation, access roads). |
| Operation of facilities (transmission line, servitude, substation and access roads). |
| Maintenance activities (transmission lines, servitude, substation and access roads) and associated management of wastes and dangerous materials. |
| Decommissioning phase | 12 months | Demolition of infrastructure. |
| The management of wastes and dangerous materials. |
| 5-10 years | Rehabilitation of impacted areas. |

* 1. Motivation for the Proposed Development

The proposed development is required to support existing growth and development in the Roodepoort area, particularly in the context of planned development in and around Cosmo City. It is further required to ensure reliability of supply for existing residences and businesses in the area.

The study area is currently fed by Lulamisa grid system which is understood to be under pressure as a result of demand growth. The new substation and transmission line are needed to strengthen the network in the Load Centre including Cosmo City and the surrounding area. The strengthening project is considered to be vital infrastructure in the context of priority growth plans in this area that include township projects and extensions, industrial expansion and employment growth as well as increased demand from existing occupiers and landowners.

The economic assessment (see BAR appendix X) report provides greater detail on the economic composition of the area however as noted in this report ‘*High economic growth, especially between the period between 2004 and 2008 coupled with a roll-out plan by government to supply electricity to all households within the country, has seen demand for electricity in South Africa increase substantially. As a result of increased demand, Eskom initiated the development of new coal power stations as the primary source for additional power supply. Consequently, the necessary ancillary infrastructure associated with this type of a development includes new sub-stations and power lines to distribute the increased power supply. The continued growth and development is evident in the urban areas of South Africa, where the majority of job opportunities are located. This has led to the expansion of urban areas up to the existing urban edge and even beyond, which is especially evident in the study area between Mogale City, Johannesburg and Lanseria where residential and commercial expansion took place*’.

As noted above, growth in the area is expected to continue in the coming years with a number of high density residential developments proposed across the Mogale City area as well as within the project area itself. These residential developments are supported by retail development nodes and employment development which will also increase the demand for electricity within the planning horizon. The economic assessment shows the proposed development zoning in the area at Maps 2.6 and 2.7.

[further information requested from Henry- rationale/business case/demand forecast]

* 1. Alternatives Considered

In accordance with the requirements of the National Environmental management Act, a number of alternative routes and substation sites have been considered as well as a ‘no-go option’. Figure X shows the route and substation options considered.

In terms of the ‘no-go option’, in this case the proposed development is considered to be vital infrastructure both in the national interest as well as at a local and regional level. Delivering priority infrastructure such as the proposed scheme delivers on Eskom’s agreed operational objectives of ensuring reliability of supply and providing for future demand growth. It also makes an essential contribution to wider governmental objectives associated with the provision of housing and basic utilities to a wider cross section of society. For this reason the ‘no-go option’ is not considered viable in these circumstances. For this reason six route corridor options and five substation options have been considered; these are described below.

* + 1. Route Corridor Options
       1. Route Corridor Option 1

Route alternative 1 is approximately 1km long connecting from the existing 400kV Apollo-Pluto heads southerly on farm Rietfontein 532 JQ (Diepsloop Nature Reserve) following the existing Klevebank/Lomond 88kV distribution line, crossing the N14 highway and the R144 main road then the Jukskei River. The proposed line then turns west following the existing 88kV distribution line on the northern boundary of the Chartwell Agricultural Holdings, then turns south following the Klein-Jukskei River and the existing 88kV distribution line. It then heads south-west still following the existing distribution line, it eventually runs over the northern boundaries of both portion 22 and 23 of Nietgedacht 535 JQ to join the R144 main road. It follows this road southerly up to R512 (Malibongwe Drive) into the proposed substation A at the Lion Park. This route can terminate at either substation D or A however for assessment purposes the longer of the two options (terminating at substation A) has been used to ensure the assessment of a ‘worst case scenario’.

* + - 1. Route Corridor Option 2

Route alternative 2 is approximately 20km long connecting from the existing 400kV Apollo-Pluto line. It runs south on the eastern boundary of the farm Rietfontein 532 JQ following the existing 400kV transmission line then it crosses the N14 highway following a westerly turn to join the R144. It then turns south crossing the Jukskei River following the existing Klevebank/Lomond 88kV distribution line. The proposed line then turns west following the existing 88kV distribution line on the northern boundary of the Chartwell Agricultural Holdings, then makes a southerly turn following the Klein-Jukskei River and the exising 88kV distribution line., It then heads south-west still following the existing distribution line past the easterly boundary of Millgate and western boundary of Farmall agricultural holdings. The proposed line can terminate at the proposed substation D, A or continue following the existing distribution line southerly on western boundary of Cosmo City into the proposed substation B. For assessment purposes, the longest route terminating at substation B has been used.

* + - 1. Route Corridor Option 3

Route alternative 3 line is approximately 15km long connecting from the existing 400kV Apollo-Pluto on the southern side of the farm Tweefontein 523 JQ running south-westerly in the middle of farm Zwartkop 525JQ crossing the Crocodile River then a 88kv distribution line (Crocodile/Lanseria). It then joins a main road (Beyers Naude Drive) running in a southerly direction for approx 2.5 km. The proposed line then turn west towards the eastern boundary of the farm Driefontein 179 IQ, follows the boundary for 1km before turning in a south-easterly direction back onto Beyer Naude Drive for 1.2km then making a easterly turn into the proposed substation C.

* + - 1. Route Corridor Option 4

Route alternative 4 is approximately 17km long connecting from the existing 400kV Apollo-Pluto on the western area of the farm Rietfontein 532 JQ heading in a south-easterly direction crossing an existing 88kV distribution line (Lanseria/Tee). At the southern boundary of the Reitfontein farm the line then turns south west, crossing the N14 and running to the east of R144. The line then crosses over to the west of R114 (to avoid Thabo Mbeki Informal Settlement) running parallel to the N14 for approximately 7km. This alternative coul;d use either substation option D or C however for assessment purposes the longer of the two has been used, thus connecting with substation option C.

* + - 1. Route Corridor Option 5

Proposed route 5 is approximately 15km in length; it will connect to the Apollo – Pluto 400KV lines on the farm Lindley 528JQ.  The lines will run underground though the farms Lindley 528JQ, Bultfontein 533 JQ. At 6th Road the lines will emerge on the farm Bultfontein 533LQ. The lines will then loop in/out at substation E on the farm Bultfontein 533JQ. Alternatively the overhead lines can proceed south-westerly through Nooitgedaght 524 IQ to substation C on Rietfontein 189 IQ portion 49 and 305 and portion 3 & remainder of Whitestone 188 IQ connecting with substation option C which has been used for assessment purposes.

* + - 1. Route Corridor Option 6

Route alternative 6 power lines is approx 15km long, it will connect to the Apollo – Pluto 400kV lines on Lindley 528JQ following an existing main road (Beyers Naude Drive) in a southerly direction crossing an existing 88kV distribution line and the N14 highway, 2km after the highway it eventually turns east into substation C on Rietfontein 189 IQ portion 49 and 305 and portion 3 & remainder of Whitestone 188 IQ. This ropute would terminate at substation option C.

* + 1. Substation Options
       1. Substation Option A

Substation A is located on Portion 2 of the farm Nietgedacht 535 JQ and Portion 4 & RE 36 of Zandspruit 191 IQ. The proposed substation site is currently part of the existing Lion Park, approximately 1.8 km east of the N14 adjacent to two main roads namely Malibongwe Dr and the R114. It positioned between smallholdings at Nooitgedacht to the west, Cosmo City to the south, Farmall agricultural holding on the east and Millgate and Chartwell to the North. It is approximately 2.8 km west of the nearest water course, the Klein-JukskeiRivier. It is expected that the access road to the substation would be off either Malibongwe Drive or the R114.

* + - 1. Substation Option B

Substation B is located on Portions 42, 56, 67, 105 and 121 of the farm Zandspruit 191 IQ. The proposed substation is near Zandspruit informal settlement in Mogale City and is approximately 1.5 km east of Beyers Naude Drive and 1km south of the Dalkeith 88/11kV distribution substation. The proposed substation is positioned south of Cosmo City, north of Zandspruit, 3.5km west of Northgate. Access to the substation would need to be from marina Street.

* + - 1. Substation option C

Substation C is located on Portion 49 and 305 of the farm Rietfontein 189 IQ and on Portion R and 3 of farm Whitestones 188 IQ. The proposed substation is situated 1.8km south of the N14 and it is approximately 1km east of an existing main road (Beyers Naude Drive), adjacent to a planned Demeter 88kV substation in Mogale City Local Municipality The proposed substation is located approximately 3km west of Cosmo City and 4km west of Muldersdrif se loop river. Access to the substation would be via Beyers Naude Drive.

* + - 1. Substation option D

Substation D is located on Portions 22, 68 and 69 of Farm Nietgedacht 535JQ. The proposed substation is surrounded by a number of main roads including next to Cedar/6th road with the N14 to the north and R114 on its south. It in the centre of two distribution substation; approx 1.5 west the planned Ithuba 88kv and 3.5km east of the Charwell 88/11kv substations. The nearest water courses lies approx 2.5km north (Jukskei River) and 1.5 km east (Klein-Jukskeirivier) of the proposed substation. The access road would come off either Cedar Road or the R114.

* + - 1. Substation Option E

Substation E is located on Portion 58, 59 and the remainder of the Farm Bulfontein 533 JQ. The proposed substation next to the planned Ithuba 88kv distribution substation, about 5km north of the Load Centre (Cosmo City and surroundings) and approx 3km south of the Lanseria Airport. It is also situated less than 1km east of the R512 (Malibogwe dr) adjacent to an existing main road (6th/Cedar rd) from which the access road would be constructed.

1. Methodology
   1. Establishing the appropriate level of assessment

Fourth Element was appointed by Eskom Holdings SoC Limited (Eskom) in February 2011 to undertake the Environmental Assessment for 2 x 400kV power lines, approximately 20km, from existing Apollo-Pluto 400kV power line to a proposed substation called Demeter Substation.

Examination of the 2010 Environmental Impact Assessment Regulations and subsequent discussion with the Department of Environmental Affairs resulted in it being established that a Basic Assessment Report (BAR) would be the appropriate level of assessment in these circumstances. Eskom was advised to consider undertaking as full EIA due to the complexities of the project however it was decided regulation 544 listing 10 (i) and 23 (i) apply:

* + 10 ( i ) *“The construction of facilities or infrastructure for the transmission and distribution of electricity – (ii) Inside urban areas or industrial complexes with a capacity 275 kilovolts or more”*. The environment through which the proposed development passes is considered to be largely an urban environment with significant existing infrastructure as well as industrial complexes. The proposed route corridors do pass through more rural environments at times however given the development plans in the area it was deemed more appropriate to view the application site as an urban area. Furthermore the application relates the construction of a 400/88 MTS substation and 400kV transmission power line which is directly related to the strengthening of the urban power supply network for Johannesburg and more specifically Mogale City.
  + 23 ( i ) “*The transformation of undeveloped, vacant or derelict land to – ( i ) residential, retail, commercial, recreational, industrial or institutional use, inside an urban area and where the total area to be transformed is bigger than 5 hectare or more but less than 20 hectares; and Except where such transformation takes place for linear activities”.* This project is a linear activity requiring approximately 13 000 hectares.

In order to ensure that a robust process was undertaken, it was decided that a number of specialist studies be undertaken to ensure that all impacts of the proposed development are considered in detail. The means of establishing the appropriate specialist studies is provided below. In the first instance however, a site selection report was presented by Eskom to Fourth Element. This report proposed 4 substation sites and 4 power line corridors for which the basic assessment should be performed (Appendix G). Additionally, One day site reconnaissance was undertaken by Eskom and Fourth Element on 11 March 2011.

The following documents were signed and submitted to the DEA on 31 May 2011 as required:

* + Application to undertake a listed activity
  + EAP Declaration
  + Specialists declaration form

An acknowledgement letter was received from the DEA 07 June 2011 confirming receipt of above documents and accepting the project.

* 1. Defining the Scope of the assessment process
     1. Specialist Studies

The requirements for specialist studies usually follow a scoping study that is used to identify the main environmental issues within the study area. The scoping phase does not form part of the BAR process (Basic Assessment Report process), and given that the BAR process was approved by the Department of Environment (DEA) for this study, the rationale for the specialist studies selected was based on an evaluation of the receiving environment and previous experience on Transmission power line studies. The studies selected included:

Biodiversity Power lines my pass safely over many habitat types with limited impact, but there is risk of permanent damage arising from the construction and maintenance of the lines. Hence it is important to identify sensitive environments, and areas of particular conservation importance.

Avifauna A specialised area of biodiversity examined as birds have particular interactions with power line infrastructure and there are certain species of birds that are particularly power line sensitive. Bird collisions with power lines also needs specific consideration both from a conservation and operational perspective.

Heritage Though transmission infrastructure may safely pass over sites of archaeological and cultural (e.g. graves) significance, these need to be identified where possible. Additionally, there may be locations of heritage significance that will be negatively affected by the presence of transmission infrastructure (e.g. heritage landscapes), and these too need to be identified.

Social Interactions between transmission infrastructure and local society can be varied, and not always negative. Some understanding of local communities and potential impacts needs to be considered by a specialist.

Economic Similar to social impacts, economic impacts can also be varied and negative impacts on land use, productivity and land value need to be considered against the benefits of improving the supply of electricity to the area.

Visual Transmission infrastructure is out of character with most landscapes and negative impacts occur in most locations. These impacts feed into many of the other specialist studies, but are particularly important in planning power line routes.

These issues are relatively standard for power line studies, and early inspections of the area did not identify any additional issues that would necessitate further studies. In recent years the DEA has also requested wetland and aquatic habitat studies to be included and these were therefore carried out as part of this EIA.

* + 1. The unique nature of power line EIAs

The specialist studies are essentially used to help identify which of the route options and substation locations would offer the lowest negative impact. For this reason, site inspections are not carried in detail, and in many cases only ‘spot inspections’ may be done along a route. The information collected through desk based research and spot inspections is further supported by information received during the public consultation exercise. The intended result is an overall assessment of environmental significance and risk of impact of each route and substation location. All “No-Go” areas, if any, must be identified during the BAR process. On this basis, the least impact options are determined and presented for public comment before submission to the Dept. of Environment for a decision.

This approach is balanced by the servitude negotiation process and the specialist “walk-through” surveys undertaken on the selected route. The latter may be done at the same time as the servitude negotiation, or just after. During servitude negotiation, the landowner will discuss with the Eskom negotiator the exact alignment of the power line (within the study corridor) and may even discuss the location of the towers. During the “walk-through” surveys, a number of specialists will walk the route and identify site specific aspects that need to be avoided by the power line towers, and servitude access roads and the construction crews. This process can also affect the location of the towers along the alignment of the power line, but usually only limited lateral movement can be done.

The “walk-through” surveys provide the detailed site environmental information necessary for the detailed design and management of the transmission infrastructure. It is part of a process that has developed specifically for power line EIAs over many years. It is due to the very specific nature of the type of development that is a power line, and in particular that it is an overhead development and contact with the ground occurs every 300m or so, and that many land uses may continue in the power line servitude. This approach has therefore been followed in this study.

* + 1. Identifying additional studies during the BAR process.

Additional specialist investigations may also be identified during the consultation process, and in this study the potential impacts of EMFs (Electric and Magnetic Fields) on human and animal health, and particularly breeding centres, was raised by a number of stakeholders. Numerous studies on the potential for human health effects arising from EMF’s associated with power lines have been undertaken and this information has been reviewed and presented as an appendix to this BAR. Nonetheless it should be acknowledged that primary research on this subject requires epidemiological expertise and was not included as a specialist study for the following reasons:

* This topic has been studied over many years with little consensus on a clear link between the strength of power line EMFs and ill health in animals and humans, and the duration of exposure.
* That there is, however, potential for health impacts, and therefore the precautionary principle shall apply.
* That Eskom has in the recent past commissioned a professional assessment of the risks, and this was subject to an independent review (this report is available for all interested parties).
* That Eskom follows the precautionary approach and adheres to the ICNIRP[[1]](#footnote-1) guidelines which set limits of field strength and duration of exposure.

To date, there has not been a specialist epidemiological study undertaken on a specific transmission power line EIA in South Africa, and certainly the timeframes of a BAR do not normally allow for extensive research studies. Instead, this BAR will seek to ensure that the precautionary approach is followed and that the risk of long-term exposure to electric and magnetic fields above the ICNIRP guidelines are avoided. This is not meant to diminish the significance of this issue, and there a number of stakeholders in the study who have emphasised their very serious concern about this issue. The authorities will need to take a balanced view on the matter on the basis of the information presented with this BAR.

* 1. Consulting Stakeholders

A deed’s search was undertaken as an initial step in identifying I&APs in the study area. To date, 543 farm have been identified. The project is then advertised through print media and site notices were posted at strategic places within the study area. Invitation was sent out to encourage I&APs to register. A database with approximately 800 has been developed. Stakeholders groups including National and Local Government, NGOs, Ratepayer’s Association, Business Community and Interested and Affected Landowners have registered.

Concerns and issues raised during the project were recorded in the Comment and Response Report (CRR). This document addresses comments and issues raised by I&APs during public consultation process.

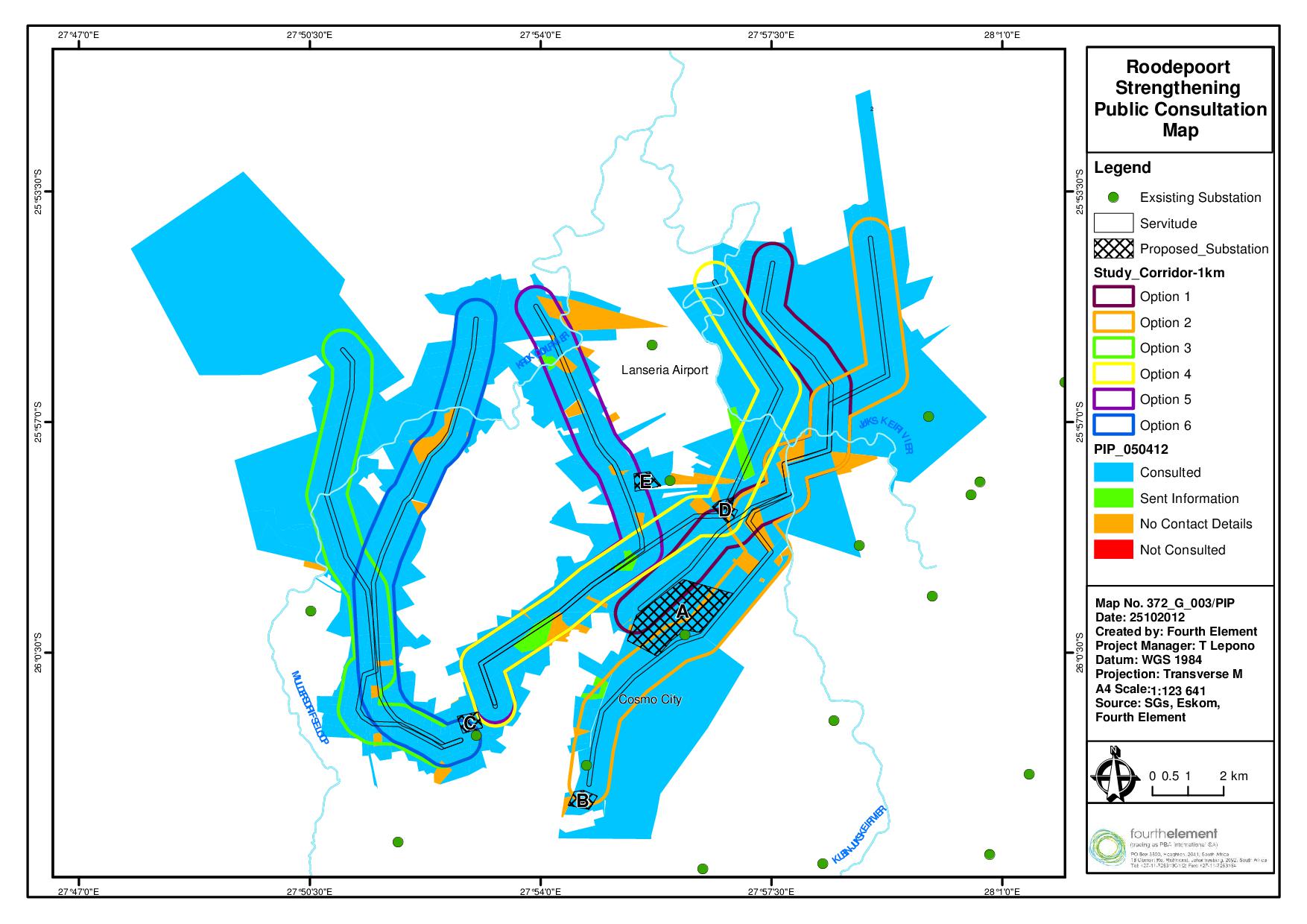


Figure 1: public Consultation Map

Public consultation figure above shows that approximately 90% of the directly affected landowners have been consulted. About 9% of the landowners did not have contact details, and were therefore not consulted.

* + 1. Authority Consultation

At the outset of the project, a meeting was held with Mogale City and Eskom on 01 April 2011 in order to assist with the definition of route and substation options. The following points were discussed:

* + Substation sites A and B were both taken off; substations sites C and D remain
  + Eskom proposed other substation sites around substation D but are all put together as one large substation D
  + An additional Substation site E was also proposed by Eskom was added.
  + Substations were renamed as A(old D), B(the new E) and C remains
  + 3 possible options were discussed with option 1 going to substation A, option 2 going into substation B and option 3 into substation 3.

The following additional meetings with Municipalities and Ward Councillors were held:

* + Consultation with Community Leaders and Councillors – Zandspruit and Cosmo City 24 June 2011
  + Consultation with Community Leaders and Councillors – Muldersdrift and Lanseria 29 June 2011
  + Meeting with Mogale City – 01 April 2011
  + Meeting with City of Johannesburg – 13 May 2011
  + Meeting with City of Tshwane – 26 July 2011
    1. Public Participation process

A comments and response document is appended to the main BAR report and the key issues arising from the Public Participation Process are outlined below. In summary terms however, the following activities were undertaken:

* + - 1. Adverts
* Invitation to register as I&APs on 31 August 2011
* Circulate BID to registered I&APs on 16 September 2011
* Circulate BID, with new sites to registered I&APs on 15 March 2012
* Project was advertised on newspaper on 13 October 2011 on the Star, Beeld and Sowetan
* Additional routes and sites were advertised on 09 March 2012 on the Star, Beeld and Sowetan
* New BIDs, Comment forms, invitation letters to participate and registration forms have been sent to Landowners on New Routes were circulated to registered I&APs on 19 March 2012.
  + - 1. Meetings
* **Focus Group Meetings** – involving landowners who are directly affected by the power line (1km area) and substation.
  + Zwartkops – 03 August 2011 affected by 3 and 6 and substation C. Route 6 was not yet part of the study during this meeting.
  + Rietfontein - 04 August 2011 affected by Route 3 and substation C
  + Driefontein and Rietfontein Landowners – 04 August 2011 affected by all six routes Chartwell North – 08 June 2011 land owners directly affected by routes 1 and 2 as well as substations A and B.
  + North Champagne - 08 June 2011 affected by routes 1 and 2 and substation A and B.
  + and substation sites, although at the time of this meeting, route 4,5 and 6 and substation E were not yet part of the study.
  + Nooitgedacht - 12 April 2012 all six routes and substations.
* **Key Stakeholder Workshop** – Government Departments, Utilities, NGO’s, Tourism Operators, Developers, Rate Payers Associations, CoHKWHS (Cradle) and SAHRA. Meetings was held at Ekudeni on 01 November 2011
  + A Short presentation was done by Lynette Groenewald (Urban Dynamics) on the development at Lion Park and surrounding areas. The City of Johannesburg and Cosmopolitan Properties have approved RoA’s and the development lay out plan is complete. Construction is plan for the beginning of 2012. All the space is needed to accommodate informal settlements into formal housing developments.
  + Mr Anton Lotter (Croc City) gave presentation on the tourist and agricultural impact that the lines will have in the area. It was pointed out that Croc City is the first tourist attraction on the way to Cradle of Humankind.
* **Public Meetings** – Registered Interested and Affected Parties
  + Hebron College 18 October 2011 – Eastern Section of the study area
  + Ekudeni 19 October 2011 – Western Section of the study area
* **One-on-One Meetings –** Meetings affected landowners to explain the project. More than 80% of the landowners were met, in person. Project was explained and comment form dropped. Some of the land is owned by foreigners and could not be reached. Information was sent where contact details were available.
  1. Preparing the Basic Assessment Report

This study has gone beyond the usual expectations of a basic assessment report with an extensive public consultation exercise being carried out as indicated above and specialist studies supplementing desk based research with site visits to confirm and identify environmental features present within the study area.

The analytical methodology for route selection is described in detail in section 8 below however in broad terms the following was undertaken:

* Following initial public consultation additional routes identified for assessment.
* Terms of reference for specialist studies and BAR were established.
* Deeds searches carried out to identify affected landowners/occupiers.
* Desktop studies were undertaken by specialists to identify key environmental features.
* Site inspections were undertaken to confirm and ameliorate desktop information.
* The ongoing consultation process identifies additional areas of environmental/social value which are provided to specialists to include within their assessments.
* Consultation information and specialist studies are used to update ‘deeds based’ land use maps.
* Sensitivity mapping and impact assessment undertaken by all specialists.
* Integration of specialist studies carried out using GIS.
* Evaluation of route and substation options carried out using GIS based methodologies.
* Statistical analysis to select preferred route option undertaken.
* Preferred route option established.
* Preferred route option modified using expert judgment to avoid specific features.
* BAR report prepared.

A key factor to note in this process is that initially, the BAR was expected to evaluate three route corridor options and three substation options. As a result of the public consultation process undertaken in 2011 a further three route options were identified and an additional two substation sites were also included in the overall evaluation. Within these options, the opportunity exists to terminate the route at a number of points. For the purpose of establishing a worst case scenario , the longest routes were assessed by specialists (for example route corridor 2 terminating at substation B). The GIS based analysis allows us to refine this methodology to consider shorter routes terminating at alternative substations (for example route corridor 2 terminating at substation A) for this reason a total of 8 route corridor alternatives is shown within the analysis at section 8 of this report.

1. Legislative Context

In summary terms the overarching legislative framework guiding the assessment of Environmental Impacts arising from proposed development projects such as that which is the subject of this report is the national Environmental Management Act. Under this legislation the proponents of projects are required to engage the services of an independent Environmental practitioner to carry out the necessary assessment of potential impacts and make recommendations as to the preferred option or alternative within the context of the development proposed.

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| |  |  |  | | --- | --- | --- | | **Title of legislation, policy or guideline:** | **Administering authority:** | **Date:** | | National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) | Provincial & National | 27 November 1998 | | National Environmental management Act, Environmental Impact Assessment Regulations (as amended) 2010 (including listing notices) | Provincial and National | 18th June 2010 (corrected 10th December 2010) | | National Water Act 36 of 1998 | Provincial & National | 1998 | | National Environmental Management: Air Quality Act 39 of 2004 | Local | February 2005 | | National Environmental Management: Biodiversity Act 10 of 2004 | Provincial & National | June 2004 | | National Environmental Management: Waste Act 59 of 2008 | Provincial & National | April 2009 | | National Heritage Resources Act 25 of 1999 | Provincial & National | April 1999 | | CARA (Conservation Agricultural Resources Act) Act 43 of 1983. | Provincial & National | 1983 | |  |  |

1. KEY ISSUES RAISED DURING THE PUBLIC PARTICIPATION PROCESS

The issues identified below are the recurring issues raised by Interested and Affected parties (I&AP’s) during the public participation process. This is not intended to be a comprehensive list and further reference should be made to the comments and response report contained at Appendix E.

* 1. Route Alternatives

As described above, during the first phase of public consultation three routes were introduced to the public as the alternatives or options being considered for the proposed scheme. These routes are described above as Route Corridor Options 1, 2 and 3. At this stage there was also only three substation options (A,B and C) on the table. A number of consultees suggested alternative routes which were subsequently included in this BAR report. These additional routes included the use of a longer stretch of the N14 Highway (Option 4), the use of Malibongwe Drive (Option 5 and 5a) on the Western side of Lanseria Airport, and the use of Beyers Naude Drive to join the Apollo-Pluto Line just North of the R540. It is a requirement of NEMA for the BAR to consider all feasible and reasonable alternatives and as such, all of the above routes have been comprehensively assessed.

* 1. Visual Impact

Visual Impact is one of the key environmental aspects which often causes concern for residents and other stakeholders in the vicinity of proposed new power line infrastructure. It was raised by numerous I&AP’s (see comments and response report) and for this reason has been one of the detailed considerations of this BAR. In the case of critical infrastructure such as transmission lines and associated substations that once the need for infrastructure is demonstrated to be in the public interest, as is the case with the Roodepoort project there will undoubtedly be impacts that cannot be fully mitigated. As environmental practitioners it is incumbent on us to select the route that results in the least overall impact, taking into account a variety of factors including those included in the specialist reports. In the case of visual impact some of the impacts can be mitigated through measures such as tower type selection and route and tower location that takes account of natural screening and visual absorption capacity. A full visual impact assessment can be found at Appendix X to the main BAR. In summary terms the visual impact assessment recommended Route Option 1 and the use of substation A.

* 1. Undergrounding

The option of undergrounding the proposed lines was suggested by a number of consultees and indeed, should the route pass along Malibongwe Drive such an alternative would be necessary due to the flight paths of aircraft and the limitations on structure heights required by the Civil Aviation Authority. As noted above, it is a requirement for the environmental assessment practitioner to consider all feasible and reasonable alternatives. This is a key factor in the consideration of the undergrounding option(s) and is further discussed in section 8 below. In summary terms, whilst there are environmental advantages that lean the Environmental practitioner towards a recommendation to underground the line along Malibongwe Drive, terminating at substation E, there are too many unknowns for this to be a practicable option. This issue is further discussed below however in the context of reasonableness and feasibility many of the issues associated with undergrounding in this unique environment remain unknown.

In the first instance, a 400Kv line such as that under consideration has never been undergrounded in South Africa and the constraints and additional costs associated with doing so are considerable, thus raising questions as to ‘reasonableness’. Indications suggest that the cost of implementation could be as high as 20 x the cost of an overhead line. Furthermore, the suitability of such technologies within the environment being considered are also unknown and are likely to be limited by issues such as ground conditions. In these circumstances the precise methodology to be employed will vary considerably and are likely to result in significant environmental degredation over and above the obvious advantages in the context of visual impact. All of these factors must be weighed against each other in making a final recommendation.

* 1. Risks to Humans and Animals Relating to Electro-Magnetic Fields

The issue of Electro Magnetic Fields arising from power lines and the health effects thereof is an emotive issue and was raised by significant numbers of I&AP’s. This subject has been extensively researched by the medical community in recent years and whilst it has not been possible (nor appropriate) to engage in primary research relating to the subject, a literature review and consultation with Eskom has been carried out. A separate paper outlining the findings of this literature review is included at Appendix X to this BAR.

In summary terms, despite the extensive research that has been carried out on EMF’s the link between EMF’s and human health effects remains inconclusive. Eskom take a risk based approach based on guidelines supported by the World Health Organisation (WHO) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Typical EMF profiles from single and double circuit lines are included at Appendix X. In broad terms it is noted that should any risk to human health be present, it is most likely to manifest itself in cases of long term exposure. Short term or occasional exposure is less likely (indeed there is no evidence to suggest such issues) to result in health effects to either humans or animals. Eskom’s current policy supports the use of precautionary measures and does not allow the construction or operation of any building for the use of humans or animals within the servitude, as these would result in long-term exposure to the EMFs. However, most land use activities may continue, including most forms of cultivation and animal grazing.

* 1. Issues Relating to Purchase of Servitude

A number of I&AP’s have offered their land for use as servitude or for the substation and will be happy to negotiate with Eskom regarding the sale of such land. Others are less willing to cooperate with the process of servitude acquisition. Where I&AP’s have formally responded to the consultation process, comments have been recorded in the comments and response document. It should however be noted that the process of servitude and substation site acquisition does not form part of this BAR. It is understood that Eskom will purchase the necessary land at market value and any ongoing use of the land by current owners (for grazing purposes for example) will be part of the negotiations undertaken by Eskom.

* 1. Loss/Change to Business/Agricultural Functionality

I&AP’s who currently operate commercial activities on land which has been the subject of this application will require clarity as to the ongoing functionality of their land for its current use. The variety of land uses is considerable and has been indicated in general terms on the land use plan at Figure X. An Economic Impact Assessment has been carried out for the proposed scheme which takes account of potential extinguishment of commercial activities and the route selection takes this assessment into account.

Again, questions concerning the direct impact upon individual farms and commercial activities will be undertaken following the selection of the preferred option and following the precise definition of the servitude that is completed following a site walkover and in consultation with landowners. Eskom will undoubtedly wish to minimise the impact to landowners as any direct impacts to business functionality will need to be taken into account when agreeing compensation. It should be noted that it is normally the case that compensation is only paid to properties and businesses that are crossed by there servitude and as such directly affected by the proposed infrastructure.

1. Summary of Specialist Studies findings

This section provides a summary of the findings of each of the specialist studies undertaken for this project. This section should be read in conjunction with the specialist reports provided at Appendix X to the main BAR.

* 1. Heritage and Archaeology

Digby Wells Environmental (Digby Wells) was contracted by Fourth Element Consulting (Pty) Limited to prepare a Heritage Statement examining the proposed route options and substation sites for new transmission lines in the Roodepoort area of Gauteng. This Heritage Statement forms part of the Basic Assessment Report.

The Heritage Statement consisted of a background literature review, archival and database survey, aerial imagery and cartographic survey, consultation of relevant previous impact assessments from the area, and a site visit.

During the background research for the Heritage Statement, 22 heritage resources were identified within the project area. In addition, eight heritage resources were identified during the site survey. They consist of the following:

* Graveyards;
* Iron Age Stone walled sites;
* Stone Age sites; and
* Historical sites; and
* The Cradle of Humankind World Heritage Site).

Areas and sites of potential heritage value were identified during the site visit such as undisturbed fields, river banks, rocky outcrops and historical dwellings. A sensitivity map was produced depicting each route and substation option with identified heritage resources. Preliminary recommendations are stated to aid the planning process. These include:

* Option 1 and Option 2 are of low to medium sensitivity are considered as the preferred routes;
* Option 4 and Option 5 are of medium heritage sensitivity are should only be considered as options after consideration of Option 1 and Option 2; and
* Option 3 and Option 6 are of high sensitivity and should not be considered as options for the proposed power lines due to the close proximity to the Cradle of Humankind World Heritage Site.
* Substation options A – D are of low – to medium sensitivity with Option A, B, and D being the preferred options.
  1. Visual Impact Assessment

The Eskom Transmission Division is proposing to construct two new 400 kV transmission power lines and a Demeter 400/88 kV MTS substation that will connect to the existing Apollo – Pluto 400 kV transmission power line in the vicinity of Cosmo City and the greater Johannesburg region in the Gauteng Province, South Africa. The need for the proposed project, also known as the Roodepoort Strengthening Project, has arisen from the increasing demand for electricity in the area, especially to serve new residential, industrial and tourism developments.

This Visual Impact Assessment examines six alternative transmission power line corridors and complementary sub-station sites, one of each of which will be recommended by the Environmental Assessment Practitioner (EAP) as the preferred option. The scoping report and initial specialist studies concentrated on three alternative corridors (Corridor 1, Corridor 2 and Corridor 3) and substation sites (Site A, Site B and Site C). However, as a result of information gained from the public participation process and feedback during the scoping stage it was decided to include three additional alternatives (Corridor 4, Corridor 5 and Corridor 6).

All six corridor and substation sites will be evaluated in one integrated and comprehensive report. The proposed project area that has been assessed includes a 1 km buffer corridor around transmission power line alternatives (1) Corridor 1; (2) Corridor 2; (3) Corridor 3; (4) Corridor 4; (5) Corridor 5 and (6) Corridor 6, as well as the entire footprint of the alternative substation sites, (1) Site A, (2) Site B, (3) Site C, (4) Site D and (5) Site E. The area is characterised by residential areas, small holdings, cultivated land, chicken farms and various nature reserves. A site visit was carried out, literature was reviewed and photographs were analysed in order to assess and define the visual elements of landscape character and land use, visual resource and scenic quality, sense of place, visual sensitivity and sensitive receptors, potential project visual exposure, Visual Absorption Capacity (VAC) and the potential visibility of the infrastructure (defined by slope, vegetation, buildings and landscape character).

Each of the six proposed corridors was defined by the landscape character (based on aerial photography and the site visits). Each of these corridor sections were rated according to the sensitivity of the particular visual aspects (landscape character, sense of place, visual resource and potential visibility). A total sensitivity score was given for each section. Each of the entire corridor options was given a score based on the sensitivity of each of their corridor sections. In addition, the potential impacts associated with each of the project activities and risk sources that were identified were then assessed based on their severity, geographical scale, duration and probability.

From the table below, it can be seen that Corridor 1 has the lowest overall visual sensitivity since it traverses mostly built-up and residential landscapes, while Corridor 3 is likely to have the highest since it traverses the largest areas of natural looking landscapes in the Cradle of Humankind. Corridor 3 should therefore be considered the ‘no-go’ option within the context of the study and the visual and cultural landscape. Substation site D is likely to have the highest overall visual sensitivity due to the surrounding landscape (which consists of a fair number of smallholdings with grassy areas in between them) while substation site A is likely to have the lowest as it is positioned close to industrial activities.

|  |  |  |
| --- | --- | --- |
|  |  | **Total Visual Sensitivity** |
| **Corridor Options** | Corridor Option 1 | 2.5 |
| Corridor Option 2 | 2.7 |
| Corridor Option 3 | 3.2 |
| Corridor Option 4 | 2.8 |
| Corridor Option 5 | 2.6 |
| Corridor Option 6 | 3.0 |
| **Substation Options** | Substation Option A | 1.8 |
| Substation Option B | 2.4 |
| Substation Option C | 2.5 |
| Substation Option D | 2.7 |
| Substation Option E | 2.5 |

Mitigation measures that include the use of less visually intrusive transmission power line tower designs (already employed by Eskom) and the careful positioning of infrastructure within the natural and man-made landscape should be employed in order to decrease the visual impacts associated with the proposed infrastructure of the Roodepoort Strengthening Project.

* 1. Flora and fauna Assessment

Digby Wells Environmental was appointed by Fourth Element Consulting (Pty) Limited to complete the terrestrial ecological assessment for the six transmission line route options, proposed by Eskom, to ensure the supply of electricity to the west of Johannesburg. This was accomplished by means of a flora and fauna survey conducted on each of the six route options, desktop research and an examination of the potential impacts associated with the implementation of the proposed infrastructure.

The study area is located to the west of Johannesburg in the Gauteng Province of South Africa. Each route option was evaluated through applying accepted study methodologies to a one (1) kilometre (km) wide corridor, which made up the study area of each of the six options.

Potential risks are threats to Red Data, rare or protected species of vegetation and potential risks to avifauna species (discussed in a specific Avifauna report). During the field assessment, various aspects of the natural environment were recorded. These aspects include a vegetation component, which was conducted by following the Braun-blanquet sampling technique which gave rise to the various vegetation communities. Within these communities the protected, endemic, exotic, alien invasive and culturally significant species were identified. The aspects concentrated on during the fauna assessment included the following:

* Mammals;
* Birds (see specific Avifauna report);
* Reptiles; and
* Amphibians.

The aim of this survey was to undertake an ecological assessment, whereby the ecological state of the area is investigated by means of the methodologies set forth for the relevant components, namely flora and fauna.

The objectives were to establish the sensitivity of the habitats/vegetation types present, followed by determining the significance of the impacts of the construction and operation of the proposed new transmission lines on the flora and fauna present within identified habitat types. Within the habitat types all species encountered have been compared to the latest South African national, provincial and international Red Data list in order to identify species of concern early in the project.

Recommendations have been made for mitigating the actions that may either enhance potential benefits or minimise harmful effects. In order to meet this objective, the aforementioned flora and fauna surveys were conducted.

The abovementioned habitat components were discussed in terms of the vegetation units/habitat types in which they were found. These vegetation units/habitat types were differentiated because of the anthropogenic pressure exerted on them in conjunction with natural factors. Grassland was the dominant vegetation type of the areas surveyed, this was however utilised or altered to such an extent that the species composition has changed. During field work 107 plant species were encountered, of these 34 species were of medicinal use or edible. A total of 25 exotic alien invasive or weed species were found. Two protected plant species were encountered.

Fifteen (15) mammal species were encountered during field work. This low number was expected, as the animal numbers are a reflection of the available habitat and the level of threats present. The presence of both these factors was evident as far as relatively low animal numbers where concerned.

Amphibian species recorded totalled two species and no reptile species were recorded during the survey.

Areas consisting of rocky ridges were encountered during field work, rocky ridges and wetlands are designated as sensitive landscapes according to the Gauteng Department of Agriculture and Rural Development (previously known as the Gauteng Department of Agriculture, Conservation and Environment).

The quality and quantity of the habitat available within each of the options and sub stations determined the sensitivity of each option and therefore the preferred option consists of the least amount of good quality habitat. The good habitat designation is seen as the one with the highest probability of containing protected plant species. Taking this into consideration, Option 1 or 2 followed by Option 4 should be the preferred options for transmission line construction accompanied by sub-station B. The quality of the available habitat types present within each of the transmission line options and substations were evaluated through the potential of these habitat types to contain protected plant species. It was determined that Option 3 possesses the most suitable habitat, followed by Option 6. The sensitivity map which follows on the vegetation types delineated can be seen in Appendix B, Plan 2 G.

* 1. Avifauna Assessment

The Eskom Transmission Division (ETD) is proposing to construct two new 400 kV transmission lines and a Demeter 400/88 kV MTS substation that will connect to the existing Apollo – Pluto 400 kV transmission line in the vicinity of Cosmo City and the greater Johannesburg region in the Gauteng Province, South Africa. The proposed project area that was assessed includes a 1 km buffer zone around transmission line alternatives Option 1; Option 2; Option 3, Option 4 and Option 6. Option 1, Option 2 and Option 4 stretches over the Diepsloot and Cosmo City area. Option 3 and Option 6 occurs within Muldersdrift and the Cradle of Humankind.

The six options have more or less the same significance rating, apart from option 5 which has a low significance rating due its construction method. Option 3 and 6 was slightly higher due to the fact that it stretches over more natural areas. Option 1, 2, 4 and 5 overlap in certain areas and cover much of the same habitat types. Option 1 however, runs through the Diepsloot Reserve, whereas Option 2 runs on the boundary of the reserve and Option 4 starts in the Diepsloot reserve and then follows the N14 highway, the areas that it traverse are considerably more impacted on by human activity than Option 1. As far as impacts on birds are concerned option 5 has the lowest impact on birds and is therefore the preferred option, followed by Option 2.

Major risks to avifauna are collision during flight and electrisation when perching on transmission line infrastructure, which is the reason option five scored so low in significance. The White-bellied Korhaan (Eupodotis senegalensis) (Vulnerable) (found on Option 3) may be affected by the power line whereas the Black-winged Pratincole (Near Threatened) (Option 1 and Option 2), although protected, will most likely not be affected. Furthermore although protected raptors, secretary birds and vultures were not found during the survey, they are very likely to occur within the project area. Vultures including the White-backed and Cape Vulture are both species that may frequent Option 1, 2, 4 and 5 due to the presence of the Rhino and Lion Park in the vicinity of the routes, and have previously been recorded in this region. For this reason it may also be affected by the power line. Further recommendations include:

* To avoid sensitive areas by remaining close to road reserves already impacted areas with a low ecological integrity, such as industrial/residential areas;
* All disturbances to natural areas must be limited and activities must remain in demarcated areas;
* Before and during construction an ecological audit is recommended to establish the presence of nests and breeding pairs;
* It is recommended that the earth wire on the power line is marked with Bird Flight Diverters, alternating black and white, ten metres apart, on each earth wire. In sensitive areas the spacing should be reduced to five metres;
* The standard bird perch should be fitted to the top of the poles in order to minimise the chance that birds, especially vultures, will attempt to perch on the insulators; and To conduct construction and maintenance activities during the non-breeding seasons of birds present.
  1. Wetlands Assessment

The study area comprises two main rivers, Crocodile River in the west and Juskei River towards the east. Numerous drainage lines are crossed by the proposed development routes. The proposed development has a potential to impact on the two perennial rivers and wetlands within the study area, and are deemed areas of concern related to development activities (needs specific EMPr’s and WULA’s if constructed on). None of the wetlands in the study area are classed as Freshwater Ecological Priority Area’s (FEPA’s) by SANBI/CSIR’s National Freshwater Ecosystem Priority Areas Map.

The natural wetlands in the study have critically been modified. They comprise of numerous seeps associated with perennial rivers as well as hillslope seepage wetlands. The rivers in the proposed development area are in a poor ecological condition. Impacts to the water resources are largely due to intense land-use (agriculture and urban development which includes both formal and informal settlements). From a goods and services point of view, all the wetlands are regarded as important refugia for biota. The natural wetland systems were found to provide numerous good ecological and human use services compared to only water supply from the artificial wetlands (farm and industrial dams).

Development around wetlands should be avoided. A wetland delineation study should be undertaken on the preferred route to identify these important ecosystems. Delineation map should be developed and implemented with no impact to any wetlands or rivers along the proposed development route (50m development setback to all delineated water resources) and must adhere an approved constructed EMPr when constructing within wetlands and rivers (with the approval from DWA).

Five of the six proposed development routes cross wetlands and rivers, save for the underground route. The impact assessment recommends that the power line route 5 (underground route) with associated Substation E as preferred options. Route 1 is the second most preferred route, followed by routes 4 and 6 provided no development construction within any wetland areas (rivers and wetlands) found along any of these routes. This implies the compliance to at least a 50m setback for all identified aquatic features within this delineation assessment. The motivation for not supporting the power line routes 2 and 3 is due to large coverage of wetlands, most of which are in Category C (Moderately modified, but with some loss of natural habitats) as determined by Wetland Habitat Integrity Assessment.

The wetland buffer zone and development setback should be established in the identified mapped area, where no construction vehicles should dredge and/or work within 50m of wetland edges for all identified water features. If possible, the undertaking of construction should take place during the dry season when development activities are near the rivers and associated wetlands.

* 1. Socio-Economic Assessment

Eskom Transmission Division (Eskom) is proposing to construct two new 400kV transmission lines and a Demeter 400/88kV MTS substation that will connect with the existing Apollo-Pluto 400kV transmission line in the vicinity of Cosmo City and the greater Johannesburg region in the Gauteng Province of South Africa. The need for the proposed project, known as the Roodepoort Strengthening Project (RSP), has arisen from the increasing demand for electricity in the north-western areas of Johannesburg and the north-eastern areas of the Mogale City municipal area.

Eskom is proposing six potential transmission line route options (Route Options 1 to 6) and five substation site options (Site Options A to E) as described in Section 1.5. The proposed RSP is bounded by the existing Apollo-Pluto 400kV transmission line to the north; the City of Tshwane Municipality to the east and the Cradle of Humankind to the west. The project will traverse parts of the City of Johannesburg Metropolitan Municipality and Mogale City Local Municipality, while bordering on the City of Tshwane Metropolitan Municipality.

While the total surface area of the preferred substation site will be acquired for the project, Eskom will enter into a contract with the affected property owners along the transmission line servitude. Affected property owners will receive financial compensation for the (potential) loss of livelihood resulting from the servitudes on their land. Contracts will include certain restrictions on activities within the acquired servitude.

During the construction of the transmission lines and associated substation, one or more temporary construction camps will be established along the transmission line route. The location of the construction camp(s) will take into consideration the findings of the social and environmental studies. Construction of the lines will take approximately 20 months, while the construction teams will travel to and from the construction camp on a daily basis during this period. Construction of the new Demeter Substation will last approximately 18 months. It is anticipated that a construction camp will be established at the substation site.

The size of the construction workforce will increase during the construction process from approximately 50 workers during land clearing to up to 150 workers during the peak of construction. Construction activities may take place simultaneously along different sections of the route.

**Study Approach**

Fourth Element consulted all registered stakeholders and landowners during the course of the study, and this exercise was not repeated for the SIA. The discussion in the SIA report of the issues and concerns raised by interested and affected parties is, therefore, largely based on the findings of this public participation process. Fieldwork for the SIA study included an orientation site visit to the broader project area, as well as subsequent site visits to the Zandspruit and Thabo Mbeki/Lion Park informal settlements respectively. A drive-by inspection was undertaken for all the project options. Digby Wells also attended a high level stakeholder workshop during which the various RSP options were debated.

Desktop research was undertaken to identify the socio-economic baseline conditions in the affected municipal areas. Particular emphasis was placed on discussions around the spatial development within the affected municipalities. Desktop work included an analysis of the relevant environmental and economic specialist studies undertaken for the proposed RSP.

Socio-economic impacts were identified by considering the various project components and activities that may affect the prevailing socio-economic baseline conditions and/or influence daily social processes. A corridor width of 1km was investigated for each project option with a focus on the proposed 110m servitude areas. The identified impacts were assessed using a standard social impact assessment approach and methodology, as described in Section 5. A comparison of the various route and site options respectively was undertaken in terms of the significance of the assessed impacts.

Section 4 describes the current socio-economic baseline conditions within the broader project area. The discussion focuses on baseline information in the affected municipalities. The information was taken from secondary sources such as reports, websites and census data. The baseline description provides an overview of the administrative structures, community profiles, population demographics, economic activities and employment profiles in the study area.

**Impact Assessment**.

The primary goal of the assessment was (a) to identify and assess the extent and significance of potential social impacts associated with the RSP according to defined assessment criteria; and (b) to develop measures to avoid, minimize, reduce or compensate for potential adverse effects.

The social impact rating methodology applied in this SIA is described in Section 5.2. It designed to provide a numerical rating of the various socio-economic impacts identified. The potential social impacts are grouped according to the aspect of the social environment that they may affect. Impacts are rated prior to mitigation and enhancement and again after consideration of the proposed mitigation or enhancement measures.

The report provides a descriptive overview of the most significant impacts associated with the RSP. The range and categories of social impacts along the line options are similar and these are discussed under the same heading. Similarly, impacts associated with facility construction and infrastructure placement at the proposed substation sites will be comparable between sites although the extent and/or significance of the impacts may vary.

A comparison of the transmission line route options and substation site options respectively was undertaken based on the assessed socio-economic impacts. The rating for the different options is based on the application of a numerical value of between -4 and +4. In instances where the results of the comparative analysis did not sufficiently distinguish between the various options, a number of guidelines were applied.

A sensitivity map was produced to illustrate the relative social sensitivity for the proposed project options. The sensitivity mapping is based on an analysis of each project option in terms of the concentration of negative social impacts at different sections of the various routes. While all project options reflect similar social impacts, sensitivity levels were further analysed in terms of the significance ratings of the social impacts.

The findings of the social impact assessment process are discussed in Table 1 below. The impacts were rated in terms of their overall significance as it is not practical to undertake separate assessments for each project option (11) at the level of a Basic Assessment Report. The significance impacts are rated pre- and post-mitigation based on the scale below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Significance**  **Negative Positive** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Probability** | **7** | -147 | -140 | -133 | -126 | -119 | -112 | -105 | -98 | -91 | -84 | -77 | -70 | -63 | -56 | -49 | -42 | -35 | -28 | -21 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 | 91 | 98 | 105 | 112 | 119 | 126 | 133 | 140 | 147 |
| **6** | -126 | -120 | -114 | -108 | -102 | -96 | -90 | -84 | -78 | -72 | -66 | -60 | -54 | -48 | -42 | -36 | -30 | -24 | -18 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 108 | 114 | 120 | 126 |
| **5** | -105 | -100 | -95 | -90 | -85 | -80 | -75 | -70 | -65 | -60 | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 |
| **4** | -84 | -80 | -76 | -72 | -68 | -64 | -60 | -56 | -52 | -48 | -44 | -40 | -36 | -32 | -28 | -24 | -20 | -16 | -12 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 |
| **3** | -63 | -60 | -57 | -54 | -51 | -48 | -45 | -42 | -39 | -36 | -33 | -30 | -27 | -24 | -21 | -18 | -15 | -12 | -9 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 | 63 |
| **2** | -42 | -40 | -38 | -36 | -34 | -32 | -30 | -28 | -26 | -24 | -22 | -20 | -18 | -16 | -14 | -12 | -10 | -8 | -6 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 |
| **1** | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9 | -8 | -7 | -6 | -5 | -4 | -3 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|  |  | **-21** | **-20** | **-19** | **-18** | **-17** | **-16** | **-15** | **-14** | **-13** | **-12** | **-11** | **-10** | **-9** | **-8** | **-7** | **-6** | **-5** | **-4** | **-3** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** |
|  |  | **Consequence** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Cumulative Impacts**

The RSP associated impacts are likely to increase the significance of existing impacts on the socio-economic environment resulting from overall economic/industrial and housing development in the broader project area. The project will involve land acquisition in urban areas that are characterised by current and planned housing developments. The proposed development could therefore put additional pressure on local government endeavours to close the housing backlog in these areas.

The development of the RSP is likely to facilitate and increase economic development in the broader project area. This will contribute towards changes in land use (e.g. from agricultural to residential and industrial), as well as increased rural to urban migration. The latter process could result in the establishment of new informal settlements. It is anticipated that the presence of the RSP, combined with the existing and anticipated economic growth and housing development will have a further negative effect on the tourism potential in the broader project area.

**Impact Management and Monitoring**

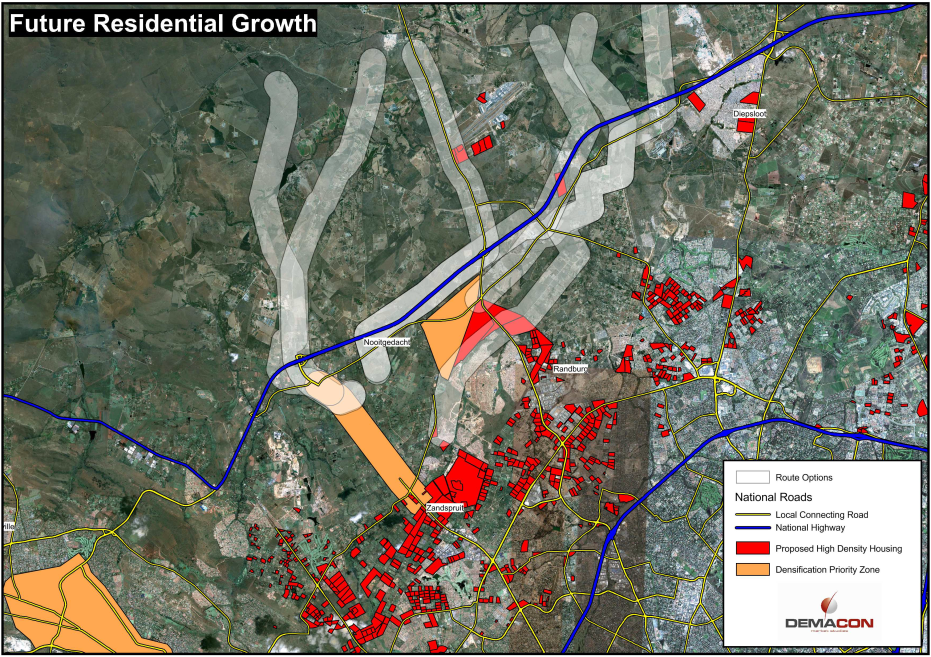
Section 8 of the report discusses the identified management measures to mitigate and compensate for negative impacts, and develop the potential benefits flowing from the RSP. Section 9 recommends that social monitoring should take place throughout the construction, operation and closure phases of the project. A project specific monitoring programme should be developed once the project design has been finalised.

**Recommendations**

The SIA report provides a comparison of the transmission line route options and substation site options respectively in relation to the identified impacts and sensitivity assessment. It is recommended that Transmission Line Route Option 5 and Substation Site Option B respectively are further investigated as the preferred options. It is probable that Route Option 5 may be considered unviable due to cost implications and engineering considerations. Consequently, it is recommended that Route Options 2 and 4 are also further investigated.

* 1. Economic Assessment

**Demacon Market Studies** were commissioned by **Fourth Element Consulting (Pty) Limited** to perform a specialist economic impact assessment to determine the anticipated economic impacts of the Roodepoort sub-station and associated power line development in the Johannesburg North region.



High economic growth, especially between the period between 2004 and 2008 coupled with positive growth expectations and a roll-out plan by government to supply electricity to all households within the country, has seen a demand for electricity in South Africa increase substantially. As a result of increased demand, Eskom initiated the development of new coal power stations as the primary source for additional power supply. Consequently, the necessary ancillary infrastructure associated with this type of development includes new sub-stations and power lines to distribute the increased power supply.

The continued growth and development is especially evident in the urban areas of South Africa, where the majority of job opportunities are located. This has led to the expansion of urban areas up to the existing urban edge and even beyond. It is especially evident in the study area between Mogale City, Johannesburg and Lanseria where residential and commercial expansion took place.

For this project, five alternative sub-station sites and six power line Options have been identified. Each of the Options has a 1km buffer area that will be assessed.

**STUDY AREA ECONOMIC OVERVIEW**

The study area is located in the City of Johannesburg and Mogale City. The economic trends over the past few years are indicated in Figure 1 and 2.

*Source: Demacon, 2011*

**Figure 2: Formal Economic Growth 1996 - 2010**

**Figure 3: Formal Employment Growth 1996 - 2010**

The average economic growth rate for the two local economies (i.e. Mogale City and City of Johannesburg) in which the power line development is situated, exceeded both the national and provincial average annual growth rate (3.2%). Consequent to the above, growth in electricity demand will exceed the national demand growth figure for this area. This is furthermore supported by the size of the local economies with a combined size of R236 billion (gross geographic value added in terms of constant prices, 2010), which is the highest within South Africa. Employment growth is also higher than the national average – thus illustrating the agglomeration effect of the employment opportunities that are available within the area.

**ECONOMIC IMPACT ASSESSMENT**

In order to determine the preferred power line Option and sub-station site the economic assessment requires a multi-dimensional approach, as one single aspect alone would not be able to provide the best solution. The following **four economic aspects** are taken into consideration in order to determine the economic impact:

1. ***Attributes associated with the location of the site***

In the context of the economic growth and development that is taking place within the study area, the purpose of the power line and sub-station development is to provide electricity to address this growing demand. Given this need, the construction of the power lines and sub-station is an important building block for growth and development of the study area.

The positive impact needs to be optimised while potential negative impacts need to be minimised. For this reason, it is proposed that agriculture, residential, tourism, commercial or industrial activity should as far possible be avoided and open spaces should be preferred.

1. ***Economic activity located within or on each site***

The following table illustrates the sensitivity per route option which excludes the sub-station. This table summarises the amount of land in hectare for each option that can be classified from no impact i.e. low sensitivity, to ‘No Go’ areas with extremely high sensitivity.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sensitivity** | **Option 1** | **Option 2** | **Option 3** | **Option 4** | **Option 5** | **Option 6** |
| No Go | 112 | 219 | 159 | 142 | 150 | 209 |
| High | 96 | 94 | 473 | 0 | 0 | 60 |
| Medium – High | 249 | 392 | 329 | 477 | 512 | 491 |
| Medium | 0 | 0 | 26 | 25 | 0 | 17 |
| Medium - Low | 83 | 340 | 0 | 0 | 0 | 0 |
| Low | 200 | 226 | 173 | 304 | 223 | 174 |
| No Impact | 650 | 754 | 282 | 812 | 623 | 603 |
| Total Corridor Size (ha) | 1391 | 2025 | 1441 | 1760 | 1508 | 1495 |

**Table 1: Sensitivity per route option (ha)**

The route option with the amount of ‘No Go’ land affected is Option 1, followed by Option 4. Option 2 has the highest amount ‘No Go’ land with 219 ha followed by Option 6 with 209 ha.

With regards to the sub-station, any activity that falls within this footprint will cease to exist.

1. ***The economic value added of the site given current the economic activity***

The following table illustrates the value of economic activity (gross geographic value added constant 2011 prices) per sub-station Site and power line corridor Option.

| Site/Option | Gross Estimate Economic Value | Largest Land Use |
| --- | --- | --- |
| **SUB-STATION SITES** | | |
| Site A | R70 million | Tourism (Proposed for Housing) |
| Site B | R65 million | Small-Holding (Proposed for Housing) |
| Site C | R28 million | Small-Holding |
| Site D | R83 million | Small-Holding |
| Site E | R 85 million | Small-Holding |
| **POWER LINE OPTIONS** | | |
| Option 1 | R2 192 million | Small-Holding |
| Option 2 | R4 477 million | Small-Holding |
| Option 3 | R3 443 million | Conservation |
| Option 4 | R2 827 million | Small-Holding |
| Option 5 | R2 724 million | Small-Holding |
| Option 6 | R2 955 million | Small-Holding |

**Table 2: Value of Economic Activity per Site/Option (Current Land Use)**

The site/route with a relatively low aggregate economic value is preferred to a site/route with a high aggregate economic value. Site C has the lowest current economic value and therefore the lowest anticipated loss while route Option 1 has the lowest economic value.

1. ***Future development considerations***

This study area is considered one of the growing areas within the local economy; which would ensure that any activity that is lost as a result of the development can be absorbed in future development of a similar nature in the immediate area.

This area is situated in the northern area of Johannesburg in which 30% – 40% of future metropolitan growth is expected to take place. Future development trends are informed by *inter alia* the Spatial Development Framework (SDF) of the area. The SDF is based on a broader area and not based on site specific solutions or land use recommendations. Table 3 indicates the future land use based on the SDF of the area.

|  |  |
| --- | --- |
| Site/Option | Predominant Future Land Use |
| **SUB-STATION SITES** | |
| Site A | Medium-High Density Residential |
| Site B | District Mixed Use Nodal Core |
| Site C | Urban Area |
| Site D | Rural Residential |
| Site E | Metropolitan Mixed Use Nodal Core |
| **POWER LINE OPTIONS** | |
| Option 1 | Rural residential, Conservation, Medium Density residential |
| Option 2 | Rural residential, Conservation, Medium Density residential |
| Option 3 | Rural Transitional Zone |
| Option 4 | Rural residential, Conservation |
| Option 5 | Commercial, Light Industrial, Mixed Use Nodes |
| Option 6 | Rural Transitional Zone |

**Table 3: Value of Economic Activity per Site/Option (Future Land Use)**

From Table 3 it is evident that sub-station Site C and D is earmarked as future rural residential areas and Site A as medium to high density residential, whereas Sites B and E are earmarked for mixed use nodes. Based on the information, the sites with the lowest anticipated loss in activity is Site C and D.

**ECONOMIC IMPACT FINDINGS**

***Sub-Station Recommendations***

In terms of the assessment the preferred site options in order of preference are:

1. Site C
2. Site B
3. Site A

**Findings:**

* *Site C is the most preferred site option. The advantage of Site C is that it contains current and future proposed industrial uses. The remainder of the site includes a combination of small-holdings and vacant land earmarked for urban development.*
* *Site B is located in the vicinity of Cosmo City. Cosmo City and surroundings are experiencing increased pressure to grow and expand. Due to its proximity to existing urban development, the length of feeder lines into the local grid will be reduced. The site is located on the boundary of the urban edge and high density residential development is evident around the site. There are no significant land uses that will be displaced which are crucial to regenerate elsewhere in the urban system.*
* *Site A is located on the existing Lion & Rhino Park. The park has long since been earmarked for urban development and was sold for purposes of a mixed residential development. The adjacent squatter settlement compromise the original intention of high-end residential units and the scheme was subsequently delayed (our company conducted research on this particular land holding more than 5 years ago).The proposed high density development may increase the value to acquire the land and the anticipated product offer will most likely cater for lower to middle income segments of the market.*

***Power Line Corridor Recommendations***

In terms of the assessment the preferred power line route Options in order of preference are:

1. Option 5
2. Option 1
3. Option 4

**Findings:**

* *Option 5 is the preferred route and was configured as an underground line (and assessed as an underground line). The analysis was done on the basis that the entire route will be underground which will then mitigate, to a large degree, the expected impact on economic activity. This is assuming that the route does not cross directly under high sensitive economic activity, therefore enforcing the servitude on the ground.*
* *Option 1 is the shortest of the routes and has the least amount of high sensitive uses. The corridor largely comprises of open spaces/rural uses and land earmarked for conservation, rural residential and medium density residential as future land use.*
* *Option 4 follows the existing N14 and this is one of the main reasons why this Option is preferred. The location of the Power Line should, as far as possible, follow the existing linear infrastructure. The corridor largely comprises open spaces and land earmarked for rural residential and medium density residential as future use.*

1. Impact Assessment and integration
   1. Introduction

As noted above, six primary route corridor options and five substation site options have been considered as part of this basic assessment report. Specialist studies have been completed as summarised above. This sections integrates the findings of those specialist studies, combined with a number of additional factors with a view to making a recommendation as to the preferred route corridor option and sub-station site.

* 1. Impact Integration Methodology

Following the specialist studies it is necessary to integrate all of the findings of these studies as well as any additional factors not captured by specialists in order to select a preferred route option. It is further necessary to apply expert judgment to the spatial outputs in order to arrive at a preferred servitude alignment for the proposed infrastructure. In order to arrive at a robust comparison of the routes a number of analytical techniques have been used:

* Route and Substation Preference Methodology
* Spatial Analysis
* Expert judgement

In the case of the latter, statistical analysis is enhanced by re-examining the situation ‘on the ground’ thereby allowing minor modifications of the selected route to avoid specific features that may not be identified in sufficient detail by the integrated mapping. In this particular circumstance for example, many of the identified impacts are of low to medium importance due to the already degraded environment. As such when a two low impacts is overlayed onto a medium-high impact it would (in simple terms) result in the averaged impact becoming low-medium. In spatial terms this may be an appropriate place to locate a power line however in practical terms it may not be possible. Furthermore, existing features such as highways and farm boundaries may in practice be a more practicable and less impacting location for the power line servitude and as such, these features are often taken into account when modifying the final route selection to provide the necessary 110m servitude.

* + 1. Route Preference Methodology

In carrying out their assessments, all specialists were asked to indicate their preferred route and substation option together with a ‘second preference’. These preferences were derived using the appropriate methodology for individual disciplines taking into account factors including sensitivity of the propose receptor/feature, magnitude of the impact experienced, duration of the impact and whether mitigation measures could be employed to reduce the impact. Individual specialist methodologies are described within the specialist reports found at Appendix X to the main BAR report.

If a route or substation was a first preference, it was given a score of 2 points, if it was a second preference it was given a score of 1 point. If it was neither first or second preference, it received no points. The total score for each route can then be calculated and an overall preference thereby derived.

It is acknowledged that this methodology alone is relatively crude and for this reason it is necessary to confirm the findings using the spatial methodology described below.

* + 1. Spatial Analysis

As indicated previously, each specialist was also asked to prepare a sensitivity map identifying key features and areas within their own study area and to apply to those features a sensitivity rating within a scale of zero to six. The ratings and colours indicated on the table below relate to the Sensitivity Maps provided at Figures 8.3.1a and 8.3.1b.

|  |  |  |
| --- | --- | --- |
| **Impact rating** | **Description** | **Score** |
| **0** | No Impact | 1 |
| **1** | Low Impact | 2 |
| **2** | Low to Medium Impact | 3 |
| **3** | Medium Impact | 4 |
| **4** | Medium to High Impact | 5 |
| **5** | High Impact | 6 |
| **6** | ‘No-Go’ Area | 7 |

Using GIS software the impacts from each of the specialists are then split into 5m x 5m pixels which are then overlayed and averaged to provide an overall impact map which takes account of all of the specialist disciplines. The overall route and substation sensitivity is then established by examining the total area (or in the case of substation sites percentage area to account for differences in site size) which is subjected to each of the above impact ratings. The area affected (either percentage or actual) is then multiplied by the score indicated above and the whole affected area summed to provide a score for each route or substation. These calculations can be seen in section 8.4.2 below.

* + 1. Expert Judgment and Non-Spatial Factors

As noted above, the statistical and spatial methodologies described above provide a sound basis for selection of the preferred route, however as each of the study corridors is one kilometre wide, the route selection must be further modified to enable selection of a 110m servitude. This is initially carried out by examining the spatial representation of the overall impact and choosing a path through the corridor which utilises areas of low, low to medium and medium impact. In the majority of cases it is possible to avoid any areas of medium impact and greater.

This path is then modified using common sense and expert judgment to avoid sensitive features, align with existing infrastructure, maximise the use of existing servitudes and take account of features identified on the ground which may have been ‘nuetralised’ by the impact integration for the reasons given above.

* 1. Route Analysis
     1. Route/Substation Preference Methodology

The route preferences indicated in table 8.4.1.1 below have been provided by specialists based on individual assessments of the sensitivity of the route corridors in the context of the proposed infrastructure. Table 8.4.1.2 ranks the routes and substations based on a score of 2 being given where an route corridor or substation is a ‘preferred option’ and 1 where it is a ‘second preference. A zero score is given where a route or substation option is neither of the above.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Route** | | **Substation** | |
| **Specialist** | **Preferred** | **Second Preference** | **Preferred** | **Second Preference** |
| Visual | 1 | 5 | A | B |
| Heritage | 1 | 2 | D | A/B |
| Socio-economic | 5 | 1/4 | E | B/D |
| Economic | 5 | 1 | C | B |
| Wetlands | 5 | 1 | E | A |
| Flora and Fauna | 2 | 1 | B | A |
| Avifauna | 5 | 2 | E | A/B |

**Table 8.4.1.1- Specialist Route and Substation Preferences**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Option/Alternative** | **Score** | Rank | **Preferred** | **Second Preference** |
| **Route Corridor Option** | Route Option 1 | 8 | 2 | **5** | **1** |
| Route Option 2 | 4 | 3 |
| Route Option 3 | 0 | 5 |
| Route Option 4 | 2 | 4 |
| Route Option 5 | 9 | 1 |
| Route Option 6 | 0 | 5 |
| **Sub-station Option** | Substation A | 6 | 2 | **B** | **E/A** |
| Substation B | 7 | 1 |
| Substation C | 2 | 5 |
| Substation D | 4 | 4 |
| Substation E | 6 | 2 |

**Table 8.4.1.2- Route and Substation Preference Scoring**

The above analysis shows that based on the preferences indicated by specialists and not taking into account other material factors**, the integrated preferred route option would be Option 5** (Malibongwe Drive). The second preference would be route Option 1. **The preferred substation is option B** with Options E and A being equal second preference.

It should be noted that using this methodology the scores for Route Options 5 and 1 were very close and this was also the case when comparing the sub-station preferences. Furthermore, it should also be noted that all options were assessed by specialists using a ‘worst case scenario’. In the case of Option 5 this meant a longer route (connecting with sub-station C) than would necessarily be the case. This issue is addressed below where the more detailed spatial analysis allows us to investigate different combinations of route and substation options rather than simply recommending a preferred route based on its full length.

* + 1. Spatial Analysis

***Route Corridor Options***

Figure 8.4.2 is a spatial representation of the identified impacts from each of the specialist discipline overlayed and averaged to demonstrate the overall impacts arising from the implementation of the proposed scheme. The tables below summarise the information contained in that plan to evaluate the impacts arising from the various route options. In this case option 5a is introduced which shows route Option 5 terminating at Substation Option E, thereby reducing the total route length and removing the section of line that runs above the ground along the N14.

Table 8.4.2.1 shows a spatial analysis for each of the route options whereby the total area impacted and the magnitude of the impact is the key indicator of sensitivity to the proposed infrastructure. Table 8.4.2.1 uses the percentage of the proposed route that is impacted and the magnitude of the impact as the indicators of sensitivity to the proposed power line infrastructure. Using each of the methodologies a rank for each of the route options has been developed and finally a combined ranking derived. This can then be combined with the preference methodology to provide a robust indication (notwithstanding the additional factors described below) of the preferred route option.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Area Affected (5 x 5m pixel)** | | | | | | | |
| **Route 1** | **Route 2** | **Route 2a** | **Route 3** | **Route 4** | **Route 5** | **Route 5a** | **Route 6** |
| **No Impact** | 2714 | 621 | 316 | 10 | 1882 | 647 | 1596 | 12 |
| **Low** | 79323 | 108676 | 75776 | 32542 | 63971 | 62248 | 69850 | 34712 |
| **Low-Medium** | 359199 | 520666 | 397367 | 180402 | 363398 | 286362 | 210024 | 153128 |
| **Medium** | 140150 | 209522 | 173457 | 132008 | 273176 | 252673 | 6570 | 183786 |
| **Medium-high** |  |  |  | 112870 | 275 | 243 |  | 225529 |
| **High** |  |  |  | 135271 |  |  |  |  |
| **No-go** |  |  |  |  |  |  |  |  |
| **TOTAL AREA** | **581386** | **839485** | **646916** | **593103** | **702702** | **602173** | **288040** | **597167** |
|  |  |  |  |  |  |  |  |  |
| **Score (Area affected x Impact Score)** | | | | | | | |
| **Route 1** | **Route 2** | **Route 2a** | **Route 3** | **Route 4** | **Route 5** | **Route 5a** | **Route 6** |
| **No Impact (1)** | 2714 | 621 | 316 | 10 | 1882 | 647 | 1596 | 12 |
| **Low (2)** | 158646 | 217352 | 151552 | 65084 | 127942 | 124496 | 139700 | 69424 |
| **Low-Medium (3)** | 1077597 | 1561998 | 1192101 | 541206 | 1090194 | 859086 | 630072 | 459384 |
| **Medium (4)** | 560600 | 838088 | 693828 | 528032 | 1092704 | 1010692 | 26280 | 735144 |
| **Medium-high (5)** | 0 | 0 | 0 | 564350 | 1375 | 1215 | 0 | 1127645 |
| **High (6)** | 0 | 0 | 0 | 811626 | 0 | 0 | 0 | 0 |
| **No-go (7)** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **SCORE** | **1799557** | **2618059** | **2037797** | **2510308** | **2314097** | **1996136** | **797648** | **2391609** |
| **RANK (a)** | **2** | **8** | **4** | **7** | **5** | **3** | **1** | **6** |

**Table 8.4.2.1- Route Corridor Options, Area Effected Ranking Table.**

The above analysis demonstrates that route 5a which terminates at substation E is clearly the preferred option. However Routes 5 and 5a require undergrounding which is discussed in further detail below. Should route 5a be deemed infeasible or unreasonable for operational or economic reasons, then Route 1 would be the second preference.

***Sub-station Options***

The potential substation sites vary in size in order that the precise location of the substation can be agreed on the basis of practicability and in consultation with affected landowners. As a result of this size variance sites are not comparable by total area affected and as such the analysis below is based on the percentage affected and magnitude of impact indicators described above.



**Table 8.4.2.2- Substation Options, Percentage Affected Ranking Table**

The above analysis shows that substation C is the preferred option with Substation E as a second preference. Substation D is the least preferred option and it is clear that substation C cannot be a strongly favoured option given that Route Options 3 and 6 were the least preferred. Route Option 4 which also connects with substation C is not a ‘no-go’ option however when examined using both the preference methodology and the spatial methodology it is not a strong option and therefore can be effectively ruled out. Substation E connects only with the underground options discussed below and as such should these options be infeasible then the choice is between substations A and B which connect with routes 1 and 2.

* + 1. Expert Judgment and Non-Spatial factors

The above analysis provides a strong indication of the preferred routes however a number of additional factors that have not been captured by specialist studies must be taken into account before a final recommendation can be made.

***Electro-Magnetic Fields (EMF’s)***

As noted above, the public in particular raise particular concern regarding the risks associated with EMF’s emanating from high voltage power lines. This is an understandable concern whilst primary research falls outside of the scope of this study, a literature review has been undertaken and key findings of this review can be found at Appendix X. In particular the readers’ attention is drawn to the following documents:

* Dr PH Pretorius, *Electric and Magnetic Fields from Overhead power Lines* (2006) Empetus CC
* Dr Salim Vohra, Review of Empetus Report on Electric and Magnetic Fields (EMF) from Overhead Power Lines (2006) Peter Brett Associates
* Dr PH Pretorius, *Technical Memorandum on Particular Aspects relating to 400kv Transmission* (2012) Eskom
* *Technical Memorandum, Heath Hazards from Electric and magnetic Fields of Power Lines* (2011) Fourth Element Consulting

The last of the above documents was prepared by Fourth Element Consulting specifically in the context of this Basic Assessment Report and provides a review of readily available literature. It should be noted that this document was prepared by an Environmental Practitioner and not a medical practitioner and as such does not seek to interpret evidence or statements provided by others. It should also be noted that in recent years there have been numerous studies carried out across the globe and as such this information review does not purport to be an exhaustive list of all of those studies. Rather it seeks to provide an over view of current thinking which is summarised in the context of the proposed study as follows.

In South Africa, the potential effects of EMF’s and exposure limits are controlled (voluntarily) under the International Commission on Non-Ionising Radiation Protection (ICNIRP) guidance. Since 1998 there has been little progress in terms of identifying conclusive link between long term EMF exposure and cancers or other in-vitro congenital malformations or in developing internationally recognised limit values for EMF exposure. Nonetheless, Eskom should and do adopt a precautionary approach to the siting of power lines, minimising public access to servitudes and avoiding sensitive receptors where longer term exposure might become a factor.

The World Health Organisation (WHO) are currently leading an integrated effort to coordinate international research and standards however at this time the primary information source remains the International Commission on Non-Ionising Radiation Protection (1998) document *ICNIRP Guidelines for Limiting Exposure to Time varying Electric, Magnetic and Electromagnetic Fields.* This document continues to be referenced by the World Health Organisation (<http://www.who.int/peh-emf/standards/en/>) and the South African Department of Health although it relates primarily to short-term exposure and effects including ‘*stimulus of nerves, shocks and burns and increases in tissue temperatures’*. In terms of long term exposure the guidelines note that *‘****In the case of potential long-term effects of exposure, such as an increased risk of cancer, ICNIRP concluded that available data are insufficient to provide a basis for setting exposure restrictions, although epidemiological research has provided suggestive, but unconvincing, evidence of an association between possible carcinogenic effects*** *and exposure at levels of 50/60 Hz magnetic flux densities substantially lower than those recommended in these guidelines. In-vitro effects of short-term exposure to ELF or ELF amplitude-modulated EMF are summarized. Transient cellular and tissue responses to EMF exposure have been observed, but with no clear exposure-response relationship. These studies are of limited value in the assessment of health effects because many of the responses have not been demonstrated in vivo. Thus, in-vitro studies alone were not deemed to provide data that could serve as a primary basis for assessing possible health effects of EMF*.’

A number of comments were also raised in relation to animal exposure to EMF’s. In this regard, any link with diseases of livestock and/or game are equally inconclusive and it is generally accepted that grazing activities can continue within power line servitudes.

As noted above, Eskom’s current policy supports the use of precautionary measures and does not allow the construction or operation of any building for the use of humans or animals within the servitude, as this may result in long-term exposure to the EMFs. However, most land use activities may continue, including most forms of cultivation and animal grazing.

***Reasonableness and Feasibility Concerning the Question of Undergrounding***

The National Environmental Management Act (NEMA) clearly stipulates a requirement for proponents of power line schemes to consider ‘*all feasible and reasonable alternatives*’. In this case six alternatives have been considered one of which (Route Option 5) involves undergrounding of the power line for a length of approximately 6.5km. First and foremost it should be understood that whilst the undergrounding option is often perceived to cause a lesser environmental impact this is not necessarily the case.

This route was introduced as a result of public comment however, the undergrounding of a 400kv line of this length has never been undertaken in South Africa. Technically it could be argued that such an undertaking is ‘feasible’ as there are other environments in which high voltage power lines have been undertaken. However it is usually the case that such an option is only preferred in highly constrained (usually very high density urban) or extremely sensitive areas where no other alternative is available. Furthermore, the unique environment that will be encountered in this locality remains an unknown, High temperatures are the norm for long periods of the year, meaning that in order to ensure adequate cooling the lines will need to be buried very deep in order to mitigate any risks of overheating and therefore failure. Constraints also exist in terms of access requirements. Ground conditions themselves also form a constraint with rocky ground such as that encountered in the area under consideration adding further complexity to the project. Thus, at this stage, feasibility must be considered to be an ‘unknown’.

In terms of reasonableness, this must be viewed in the context of costs versus benefits to the consumer and the general public as Eskom’s primary stakeholder. The recent Technical Memo provided by Dr Pretorius and referenced above in the context of EMF’s suggests that the costs of undergrounding a 400kv power line are some 12 – 17 times greater than those of an overhead alternative. Past research undertaken by Fourth Element (2005) suggests that costs could be up to 20 times greater. The lower cost range would appear to be defendable due to technology moving forward in the past 7 years since our own research was carried out.

Thus, it is argued here that in order to represent a ‘reasonable’ alternative the benefit of undergrounding would need to significantly outweigh the impact of implementing an overhead line. In this context, with the exception of routes three and six which border the Cradle of Humankind World Heritage Site there are few highly valuable environmental features that cannot be mitigated or avoided through careful route selection and other measures as outlined in each of the specialist reports. Thus it must be questioned whether the additional cost associated with the undergrounding option is indeed reasonable. Furthermore, if we presume that the underground route would need to run along the western boundary of Malibongwe Drive due to the proximity of the airport and existing buildings/accesses to the road, in practice the underground route would traverse an area identified as being of high ecological sensitivity in the context of flora and fauna.

***Evacuating Power from the Sub-Station***

At this time it has not been possible to provide detailed information regarding evacuation routes as future spatial development plans within Mogale City are still to be finalised and Eskom will modify their own plans in accordance with those needs. Nonetheless we can be reasonably confident that the load centre is likely to centre around the urban expansion of Cosmo City and the surrounding area.

Given this information it is argued here that if possible the substation should not be located to the South of Cosmo City as the necessary distribution lines would need to ‘double back’ therby increasing the total length of lines required in the area. It is therefore recommended that substations B and C are not adopted unless there is no other option than to do so.

***The No-Go Option***

The ‘no-go option was discussed above in section 3.3 above. To summarise the issue, the provision of electrical power supply is in the national interest and in order to provide that power difficult decisions regarding location have to be taken. It is Eskom’s policy that ‘*schemes for the Gauteng province consist of extending the 275 kV network (built at 400kV level to allow for future upgrading to 400kV*’ to cater for an average 2.66% increase in the forecast load (2.9% in Johannesburg itself). The scheme that is the subject of this application contributes to that upgrade and further addresses local requirements in terms of reliability of supply and local growth centring around the Cosmo City growth area.

Unreliability of supply and network risk is an issue in the national interest, particularly in areas of high economic productivity (such as Johannesburg). In this context the proposed development can be viewed as directly contributing to two of Eskom’s 5 key performance indicators as outlined in the SOC’s shareholder compact:

* **Ensuring adequate future electricity** measured by generation capacity installed (MW) transmission lines installed (km) and transmission capacity installed (MW);
* **Ensuring reliable electricity supply** measured by management of national supply/demand constraints and demand side management efficiency (GWh); and indirectly
* **Supporting South Africa’s developmental objectives** measured by % local content in contracts placed and total learners in the system (engineers, technicians, artisans).

In the context of the above, the proposed scheme links with Apollo-Pluto 400kV line with the proposed Demeter substation additionally providing transformational capacity which is a further constraint in terms of future power supply within the region. For this reason it must be considered that **there is not a ‘no-go’ option** and this BAR is an exercise in selecting a reasonable and feasible route option that results in the least possible adverse impact.

***Double Circuit Lines***

The issue of double circuit lines has been a feature of discussion in the context of this project and at wider (policy) level. Arguably, despite the increased height, such an option can reduce the overall impact of implementing transmission infrastructure as a result of the reduced land take for the servitude. At this time we are not aware that a double circuit cross rope structure has been implemented in South Africa, though concept designs do exist.

The significant potential down-side of using a double circuit configuration is the N-1 failure risk and it is for this reason that policy has not been finalised. There are undoubtedly certain operational and environmental benefits in certain circumstances however they have not formed part of this assessment due to the policy uncertainties associated with them. With the possible exception of visual impact, the assessment carried out here is considered to represent a worst case scenario, however should there be a policy modification prior to implementation of this development it may be necessary to prepare an addendum to this study that considers a double circuit configuration.

1. Recommendations
   1. Rationalising Route and Substation Preferences

As noted above, routes and sub-stations were assessed by specialists using a ‘worst case scenario’ in each case. For example, in the case of Options 1 and 2 this meant that the line was assessed as connecting with substation B such that the longest possible route was taken. In practice, both of these route options could terminate at either substation A or B with A representing the shorter route. For this reason, the preferences indicated above should be modified using expert judgment and further statistical analysis in order to select the most appropriate route.

Whilst the underground option cannot be considered feasible or reasonable given the current state of knowledge, should a decision be taken by Eskom or policy makers at a national level that undergrounding is in the national interest then the recommendation for this scheme is relatively straightforward. In this circumstance substation E should be combined with route 5a.

Given that this is an unlikely scenario, it is incumbent on the environmental practitioner to recommend an implementable alternative. In this regard Route Corridor Option 1 is statistically the route which results in the least impact. Route Corridor option 2a is also statistically similar but due to social, ecological and visual sensitivities at it’s northern extent. A variation on Option 4 is also theoretically possible whereby it connects with Route 1 in the vicinity of Substation D. This has been assessed as option 4b however the proximity of Lanseria airport and its direct line with the flight path of aircraft means that this route is operationally impossible using overhead lines.

In terms of the substation options, A and B remain on the table and could connect with either of routes 1 and 2. Statistically Substation B seems to be the better option however it results in a significantly longer and therefore higher impacting route option and would, in all probability, also require distribution lines to double back to serve Cosmo City thereby increasing significantly the physical quantity of infrastructure required.

* 1. Preferred Route Corridor Option

Based on the information provided above we would recommend that Route Corridor Option 1 combined with Substation option A be taken forward, It is acknowledged that Sub-station A presents a number of constraints both for the existing owners and in terms of future development plans. Nonetheless, these constraints are not insurmountable. The primary issue arising from the use of Substation A is the fact that this site has been zoned for development and the owners have agreed to sell to a private developer. Whilst it is not the role of this BAR to prescribe the means of compensation, it is clear that the value of that land would need to be considered as well as the devaluation of any associated land already zoned. Given that one of the major drivers for this development is the expansion of Cosmo City and ultimately the land at Substation A would be subsumed into Cosmo City it seems reasonable that a sub-station be located here. Furthermore, the site area is significantly larger than that required for a substation and as such developers and landowners as well as Eskom would have some flexibility in the precise location such that loss of land value and sterilisation of development land is minimised.

* 1. Selecting a Suitable 110m Servitude within the Preferred Corridor

Within Route options 1, 2 and 4, there is some scope to select a servitude which further minimises the impact of the proposed development. Figure 9.3.1 shows that servitude can be selected which affects only areas of low sensitivity and can be further modified to minimise land take and integrate with existing infrastructure such as roads and existing power lines.

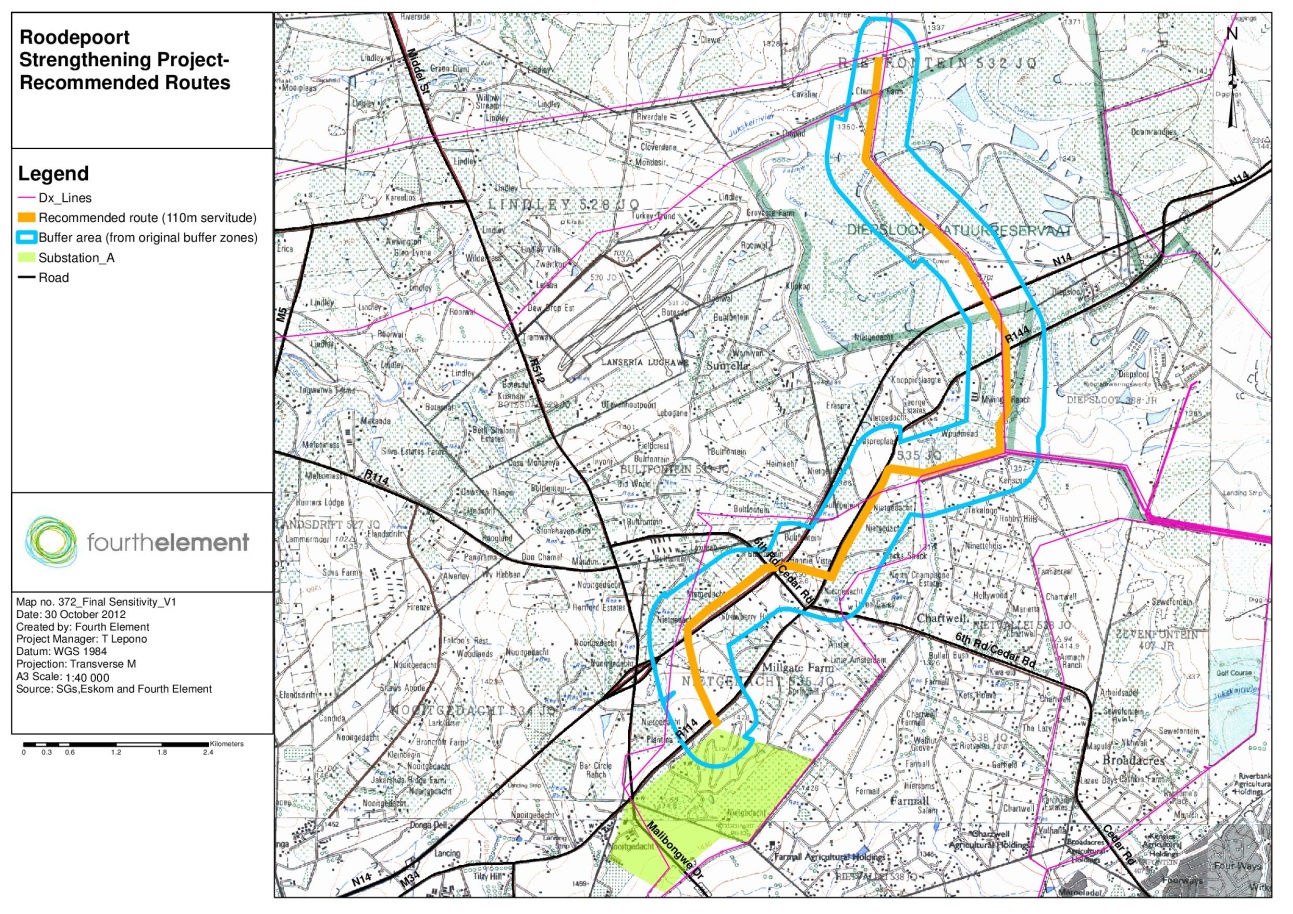
Detailed servitude selection will take place after further, more detailed surveys and a site walkover. Furthermore, the specialist reports and environmental management plan appended to the main BAR document will need to be implemented in order to minimise any adverse impacts associated with the scheme.

Figure 2: Recommended Route

This servitude is approximately 12km and follows existing transmission power line on Farm Rietfontein 532JQ on Route Option 1. It then cuts across Diepsloot Nature Reserve, over the N14 on Farm Nietgedacht 535JQ, still following the existing transmission line. It then turns south along Chartwell AH and Nietgedacht 535JQ on the 10th Road, across Jukskei River. The line then turns south, and runs along the western side of R114 for approximately 1.5km before turning west towards the N14. The line then crosses N14/Cedar Road Junction and turns south along the western side of the N14. This part of the route is within Route Option 3. After about 1.4km along the N14, the route then crosses over the N14 in south easterly direction towards Substation A.

1. conclusion

In summary, Fourth Element Consulting (Pty) Limited were commissioned by Eskom SOC Limited to undertake an Environmental Assessment of the proposed Roodepoort Strengthening Project. It was established that a Basic Assessment Report is the appropriate level of assessment for this project. A total of six route corridor options and five substation site options have been considered as part of this Basic Assessment Report and the results and recommendations presented above.

In addition to an extensive public consultation exercise, a number of specialist studies were undertaken in order identify potential environmental impacts arising from the implementation of the proposed infrastructure. Based on the information gathered by specialists and received from Interested and Affected Parties (I&AP’s) that responded during the public consultation process, a sensitivity map was prepared to indicate the main social and environmental features present within the study area and the likely impact of transmission line infrastructure on them. GIS based analysis allowed a comparison of the route corridors and substations and this analysis was then compared with the recommendations made by individual specialists.

All of the route corridor alternatives pass through complex and varied environmental conditions with features including the Cradle of Humankind World Heritage Site at the western extent of the study area, nature reserves and residential areas on the eastern extent and lanseria Airport in the centre. Despite these challenging conditions, the final evaluation of routes eliminated the ‘no-go’ option based on conformance with Eskom’s own performance objectives and national, regional and local priorities for the provision new transmission infrastructure.

Our findings suggest that, although it is likely that the undergrounding option using Malibongwe Drive (Option 5a) will be preferred by the public and may result in a lower overall impact at a corridor level, this option is not considered feasible or reasonable based on the available knowledge. Furthermore, when examined at a servitude level it is less clear that such an option would result in significantly lower environmental impacts (it would need to run along the western side of Malibongwe Drive which is more sensitive than the eastern edge) than overhead lines, the impact of which can often be mitigated through placement and design considerations.. Given the cost of taking forward this option (up to 20 x the cost of an overhead line) it is our view that there is too much uncertainty regarding feasibility and insufficient environmental benefit to justify the cost of such a proposal thereby passing the test of reasonableness.

Thus, taking into account all of the factors identified through extensive study, **Route Corridor Option 1 and Substation Option A** are recommended. Though there are a number of potentially unavoidable impacts resulting from the selection of this route, these are generally limited to visual impact. The route is able to follow existing infrastructure for the majority of its length and furthermore can be sited in the most part in such a way that it only passes through atreas of low to medium sensitivity. The mitigation measures outlined in specialist reports and the Environmental Management Plan appended to this document will need to be implemented as part of the proposed development.

REFERENCES

PBA International (SA), 2009b. Atlasville Stormwater Assessment: Stormwater assessment and flood analysis. Draft for Discussion. Project ref: 315. Issued September 2009.

VC Management Services, 2009. Atlasville Basic Assessment Report.

1. International Commission on Non-Ionizing Radiation Protection, a non-government organisation formally recognised by the World Health Organisation, that has published guidelines on exposure limits for all EMFs. [↑](#footnote-ref-1)