DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

for

THE PROPOSED CONSTRUCTION OF RIVER CROSSINGS ALONG 132kV/88kV HIGH VOLTAGE (HV) UNDERGROUND CABLES FEEDER WITHIN CROYDON/GERMISTON AREA IN THE CITY OF EKURHULENI, GAUTENG PROVINCE

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TABLE OF CONTENTS

APPENDICES

DEFINITIONS AND TERMINOLOGY

Alien species: A species that is not indigenous to the area or out of its natural distribution range.

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Assessment: The process of collecting, organising, analysing, interpreting and communicating information which is relevant.

Biological diversity: The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity as per the EIA Regulations. Construction begins with any activity which requires Environmental Authorisation.

Cumulative impacts: The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Ecosystem: A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that is made up of:

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Authorisation (EA): means the authorisation issued by a competent authority (Department of Environmental Affairs) of a listed activity or specified activity in terms of the National Environmental Management Act (No 107 of 1998) and the EIA Regulations promulgated under the Act.

Environmental assessment practitioner (EAP): An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.

Environmental Control Officer (ECO): An individual appointed by the Owner prior to the commencement of any authorised activities, responsible for monitoring, reviewing and verifying compliance by the EPC Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing and reporting environmental impacts associated with an activity.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Habitat: The place in which a species or ecological community occurs naturally.

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800.

Indirect impacts: Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Method Statement: a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.

Pre-construction: The period prior to the commencement of construction, which may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Red Data Species List: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

Vulnerable species: A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

Waste: Any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 of the NEM WA; or any other substance, material or object that is not included in Schedule 3 of the NEM WA that may be defined as a waste by that is identified as waste by the Minister of Environmental Affairs (by notice in the Gazette). Any waste or portion of waste, referred to in the section above, ceases to be a waste:

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;

(ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered;

(iii) where the Minister of Environmental Affairs has, in terms of Section 74 of the NEM WA, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or

(iv) where the Minister of Environmental Affairs has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste

1. PROJECT DETAILS

1.1 Background

Eskom SOC (Pty) Ltd is proposing a replacement and network strengthening strategy for HV cable systems in the Gauteng Province to sustain load growth as well as provide a high-level of network reliability for the future. Many areas supplied by HV cables in the Gauteng Operating Unit are economically important and also enjoy moderate to high media attention (Soweto Soccer stadiums, JSE, Gautrain, etc.) . A major part of all the HV cable feeders supplied by Gauteng Operating Unit are from the 88kV Craighall MTS, where annualised growth for Sandton alone is estimated at ±3.5% p.a over the last 5 years. These HV cables systems need to be replaced before extensive interruptions in the region is experienced, as these HV cables systems have reached their end of life. A number of areas within both the City of Joburg (CoJ) and the City of Ekurhuleni (CoE)have been consided for the replacement strategy including Craighall (Sandton), Randburg and Croydon (Germiston). The proposed HV cables systems will be crossing watercourses in certain areas as shown in **Figure 1.1**. This assessement will be focussed on river crossings along HVcable within Croydon/Germiston area and the other areas will be assessed through a separate EIA process

In terms of sections 24(2) and 24D of the National Environmental Management Act (Act No. 107 of 1998), as read with the Environmental Impact Assessment (EIA) Regulations of GNR 982 to R985 (as amended), **river crossings is a listed activity** for which a Basic Assessment Process is required in order for Eskom to obtain environmental authorisation for the construction of the cables through watercourses. NB: the **upgrade of the HV cables is not a listed activity** and therefore will not be discussed in details in this report, what necessitate this study is the fact that these cables are crossing watercourses, **river crossings of the HV cables** will therefore be the **focus of this Basic Assessment Report**.

The following **Eight (8) River crossings** are proposed to be constructed in support of upgrading the HV cable systems within Croydon/Germiston area:

- **River Crossing 1** is located along Croydon / Bedfordview Munic 1 & 2 132kV HV Feeder on Boeing Road E, Bedfordview : Point a) (Lat:: 26° 9'46.020"S; Long: 28° 9'0.230"E); Point b) (Lat:: 26° 9'45.186"S; Long: 28° 9'1.639"E);
- **River Crossing 2** is located along the Croydon / Bedfordview Munic 1 & 2 132kV HV Feeder on Gibson Rd in Hurleyvale: a) (Lat:: 26° 9'11.97"S; Long: 28°10'2.89"E); b) (Lat:: 26° 9'11.317"S; Long: 28°10'3.645"E);
- **River Crossing 3** is located along the Croydon / Bedfordview Munic 1 & 2 132kV HV Feeder on Minauch Road in Burrendal: a)(Lat:: 26° 8'52.34"S; Long: 28°10'35.62"E) b) (Lat:: 26° 8'51.718"S; Long: 28°10'36.928"E)
- **River Crossing 4** is located along the Croydon / Bedfordview Munic 1 & 2 132kV HV Feeder at the T-Junction of Hurleyvale Av & Gibson Rd, Hurleyvale: a) (Lat: 26° 8'30.58"S; Long: 28°11'19.64"E) b) (Lat:: 26° 8'29.930"S; Long: 28°11'20.668"E)

- **River Crossing 5** is located along the Croydon / Germiston North 2 132kV HV Feeder on ERF 605, Avondgloed Road in Klopperpark (Germiston) Klopperpark (Germiston) : a) (Lat:: 26° 8'39.03"S; Long: 28°11'33.59"E) b) (Lat:: 26° 8'38.079"S; Long: 28°11'34.620"E)
- **River Crossing 6** is located along the Croydon / Germiston North 2 132kV HV Feeder on Avondgloed Road in Klopperpark (Germiston) : a) (Lat:: 26° 8'52.30"S; Long: 28°11'21.18"E) b) (Lat:: 26° 8'52.30"S; Long: 28°11'21.18"E)
- **River Crossing 7** is located along the Croydon / Germiston North 2 132kV HV Feeder at the cnr of Pretoria Road & Oak Avenue in Primrose (Germiston): a)(Lat:: 26°11'5.393"S; Long: 28°10'19.293"E); b) (Lat:: 26°11'5.026"S; Long: 28°10'19.891"E)
- **River Crossing 8** is located along the Croydon / Germiston North 2 132kV HV Feeder on Portion 132 of farm Driefontein 87/IR, Stanley Street in Primrose (Germiston): a)(Lat:: 26° 11'16.860"S; Long: 28°10’19.435"E) b)(Lat:: 26° 11'17.828"S; Long: 28°10'19.808"E)

Please refer to Appendix A for detailed maps of each crossing

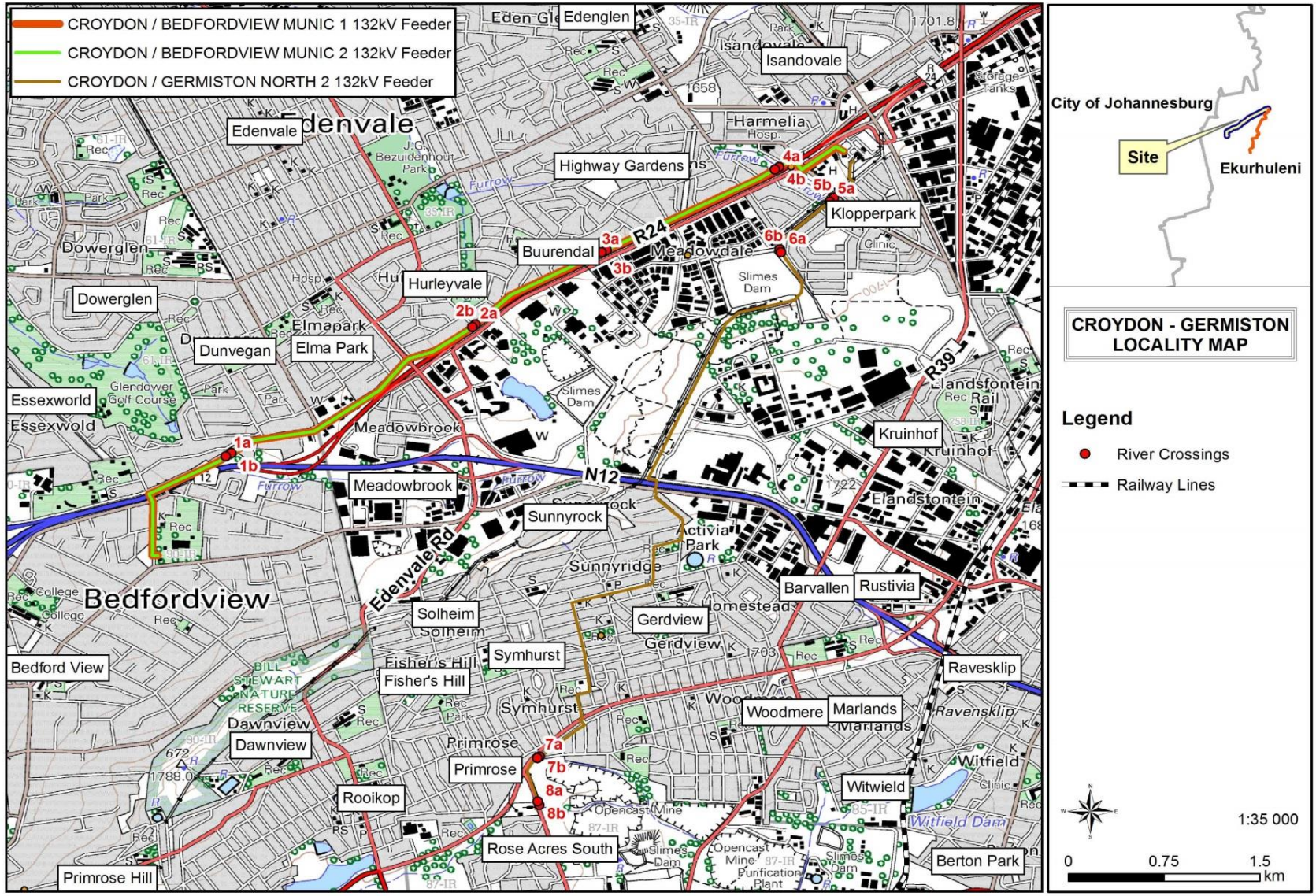

Figure 1: Locality map showing the proposed river crossings along HV feeder cables (refer to **Appendix A** for A3 maps)

1.2 Findings of the Basic Assessment

This section provides a summary of the environmental assessment and conclusions drawn for the proposed water crossing to be constructed in support of upgrading the HV cable systems within Croydon/Germiston:. Through the assessment of impacts associated with the proposed substations and power line both potentially positive and negative impacts have been identified. The most significant environmental impacts associated with the proposed project include:

Vegetation Assessment:

The vegetation at the eight water crossings was found to be in a moderate to poor ecological state, dominated by alien and invasive plant species and with an altered vegetation structure and species composition. The majority of the water crossings traverse watercourses that are piped or channelled underneath roads and the crossings will seemingly make use of pavement areas whereby the cable will likely run on top of these structures adjacent to roads i.e. the crossing does not directly impact on vegetation within the watercourse. In addition, no plant species of conservation concern were recorded at either of the water crossings. Most of the water crossings do not provide suitable habitat for such species due to altered streambeds and vegetation structure. Both the proposed methods of crossing the watercourse involve drilling or jacking the cable underneath the watercourse, without disturbing the aboveground vegetation in the watercourse. However, the above ground footprint of the drilling or pipe jacking entry location and machinery will impact on vegetation adjacent to the watercourse, some of which was in a fair condition, including indigenous grasses or trees. Disturbance to such vegetation could also lead to erosion and the colonisation of the disturbance footprint by alien and invasive plant species.

This vegetation assessment does not object to the water crossings, provided that the above impacts are mitigated as set out in the report and that all relevant legislation pertaining to watercourses be adhered to.

Although the vegetation was observed to be modified and dominated by alien and invasive plant species, it still plays an important role in flood attenuation, prevent soil erosion and sedimentation of water courses and promote the uptake of toxins from the water.

Fauna Assessment:

In is concluded that the impact of the proposed development on the stream and the riparian section of the crossings is ranked as low during the construction phase and moderate once operational. Calculating the impact (consequence) does not take into account the ecologically transformed nature of the riparian zones where crossing will be located. Taking the latter into account, the realistic impact is significantly less. Either pipe jacking or directional drilling will be suitable as a construction method from fauna perspective. Considering on the nature of the development and the implementation of conservation measures, it is expected that none of the terrestrial vertebrates with their habitat(s) will be displaced.

Aquatic Assessment:

The results of the PES assessment derived critically modified (class F) conditions in the A21C-1269 SQR considered in this assessment. The modified conditions were largely attributed to cumulative habitat level impacts which have resulted in the serious modification instream and riparian habitat. The results of the PES assessment

derived critically/seriously modified (class E/F) conditions in the A21C-1269 SQR considered in this assessment. The modified conditions were largely attributed to cumulative habitat level impacts which have resulted in the serious modification instream and riparian habitat.

The results of the risk assessment derived predominately low risks for the proposed project. The pipe jacking technological alternative which makes use of channel diversions and an instream trench was determined to have moderate risks associated with the activities. This was determined to be due to the nature of the activity which requires a trench to be constructed in the stream channel and river flows diverted. The risk for the directional drilling and pipe jacking method which does not divert or trench in the instream area, were determined to have similar risk ratings and therefore comparably acceptable methods. The operation of the proposed project was determined to have a moderate risk. This risk was largely due to the permanent nature of the structures which has increased the overall significance of the impact. **It is however anticipated that the overall impact of the proposed project will be low when considering the recommended mitigation measures.**

Wetlands Assessment:

Five watercourses were recorded within the study area. A total of 8 watercourse crossings were studied. Some of the watercourse crossings occur at cement/gabion lined sections of the watercourse. These watercourses were likely natural in the past and were lined in order to flow under highways and roads and as a result large sections of the watercourses now occur underground. Since the majority of the crossings occur near these cement lined sections of the watercourses it is likely that the proposed underground power cables will have a small impact on the overall health of the watercourses.

The two proposed methods are very similar in the effect they are likely to have on the wetland system although Pipe Jacking will probably have a larger disturbance footprint where the drilling rigs will be set up. For this reason, directional drilling is preferred. However, it is important to note that this is not a very significant difference. Should Pipe Jacking be better suited to the project due to other constraints, this method is not considered altogether unsuitable and disturbance of a larger footprint may be effectively rehabilitated.

Heritage Assessment:

Due to the density of the urban development in the region, it is very unlikely that any sites or features dating to the pre-colonial history of the region would still exist in the study area. However, isolated objects such as Stone Age artefacts might be exposed in areas close to stream beds. A large number of features, mostly houses, but also infrastructure related features, occur in the region. All of these are very formal and clearly visible. Due to the fact that the development will take place inside the river reserve, it is highly unlikely that any such features would be impacted on by the construction of construction of the HV underground cables feeder. Both the alternative technologies proposed for installing the HV cables would be suitable for constructing the underground HV feeder cables. From a heritage point of view it is recommended that the proposed development be allowed to continue. Should heritage features, archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

Floodline delineation

Due to all infrastructures (HV Feeder Cables) being located well below the surface of all the drainage/river crossings, the risk of damage to the mentioned infrastructure due to flooding is low to non-existent.

Although the risk to damage of the HV Feeder Cables by flooding is considered low to non-existent, routine site inspection is recommended after periods of extreme storm events so as to ensure the anticipated high flow velocities do not expose the subsurface cables due to erosion of the drainage/river bed.

Geohydrology Assessment:

The construction and operation of the HV cables are inferred to impose a moderate impact on watercourse crossing numbers 1 and 8. It is recommended that the required authorisation (e.g. Water License) be obtained for construction works at these crossings. t is required that suitable investigative work be conducted prior to construction to determine optimal installation starting and end points to prevent damage to watercourse banks, and to determine the optimal installation depth (i.e.: typical studies may include river hydrological studies – where required – to determine the influence depth of river scour, as well as geotechnical investigations in support of design and construction – which specifically address the anticipated impacts of the effects of groundwater during construction).

No substantial impacts are inferred for watercourse crossing numbers 2 to 7, provided that no construction takes place within the channel, and that the suitable investigative work be conducted prior to construction, in order to determine optimal installation starting and end points to prevent damage to watercourse banks, as well as to determine the optimal installation depth.

Social

From a Social perspective, the implementation of river crossings will have minimal impacts on the society within the study area

Cumulative Impact Assessment:

Due to the largely modified and secondary nature of much of the vegetation, the proposed development could accelerate degradation, fragmentation and erosion in the area. However, cumulative impacts on the vegetation and watercourse can be limited if mitigation measures as set out in this report are adhered to as a minimum. With regards to the fauna in the area, diminished species diversity and persistence in the area can take place if impacts are not properly mitigated.

No-go alternative

The No-go option implies that the upgrades will not proceed, and thus comprise of Eskom not going ahead with the construction of the proposed infrastructure. Ideally if the status quo of the environment remains unchanged no negative impacts will occur, however due to the growing demand for energy and activities that will require electricity in the area, this alternative is not feasible. Should Eskom rely on the existing network to supply future demand it is highly likely that present supply will be compromised due to the increased load on the network. Although the no-go alternative has been considered, it is not a practical project alternative in terms of providing stable electricity supply in the area as it implies a continuation of the current situation or the status quo; therefore, it doesn't render any positive outcomes. The project will improve the customer interruptions and also the

performance of the supply. By not increasing the supply to the greater area, development will be constrained as the already existing network is operating at near-capacity and will not be able to accommodate the amount of load that will be brought by future developments. The 'Do nothing' alternative is, therefore, not a preferred alternative.

1.3 Activities and Components associated with the Construction of watercourse crossings

Associated infrastructure1

Cable Trench: The HV underground cable will be positioned in an excavated trench (refer to **Figure 2**). The servitude required will be 3m width. Where the cable trench runs parallel to and under the road surface, it shall be positioned at least 200mm from the edge of the kerbing/road tarred surface. A tar cutting machine will be used and backfill will be done to the specifications of the relevant Road Agency.

The duct for the fibre optic cable shall be installed on the side of the trench closest to the property boundary (the spacing to be determined by the engineer). The duct shall be installed without any horizontal or vertical snaking (due to sagging). A sieve of 12mm mesh size will be used to sift soil. Where sand bags are installed before the installation of the cable, they shall be filled with bedding soil. To prevent sagging, the areas between the bag rows shall be filled with bedding soil and compacted before installing cables. Blanket soil will be compacted with hand compacting tools only.

Figure 2: Cable Trenching

The 132kv/88kV underground cable trench will be approximately 1m wide (within a 3m servitude) and up to 1m deep. The bedding layer will consist of compacted layer of sifted soil. The blanket layer will compacted by hand. The backfill layer will be compacted mechanically.

[1] Please note that these infrastructures are not listed and therefore do not require environmental authorisations for construction, these are mentioned for the purpose of putting the proposed river crossings into perspective

The specialist report "General Wetland Rehabilitation- And Monitoring Plan To Mitigate the Construction Related Impacts" (**Appendix B**) describes special precautions and mitigation measures for impacts such as:

- The removal of vegetation,
- The disturbance of the soil layers, and
- Compaction of soil around construction footprint as well as along the servitude.

Underground Distribution Cable Specifications: The preferred technology alternative for the underground distribution cables are Cross-linked polyethylene cables (XLPE). The cables will be placed in cable pipe ducts and two different placement formations alternatives are available. The Flat Foil formation (refer to **Figure 3**) and Tre-Foil Formations (refer to **Figure 4**).

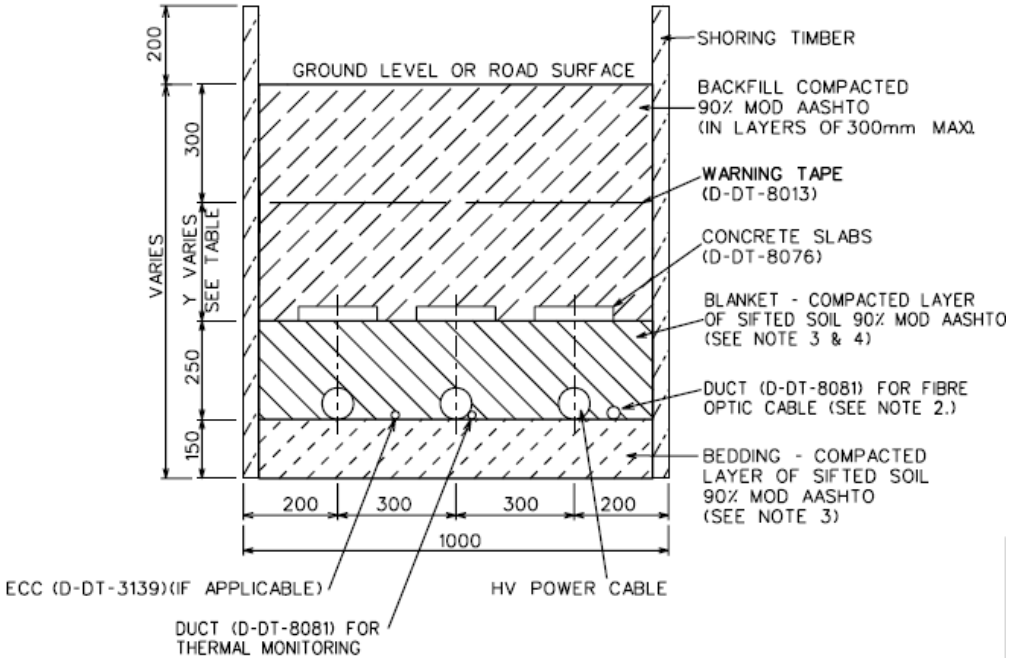

Figure 3: Flat Foil Formation

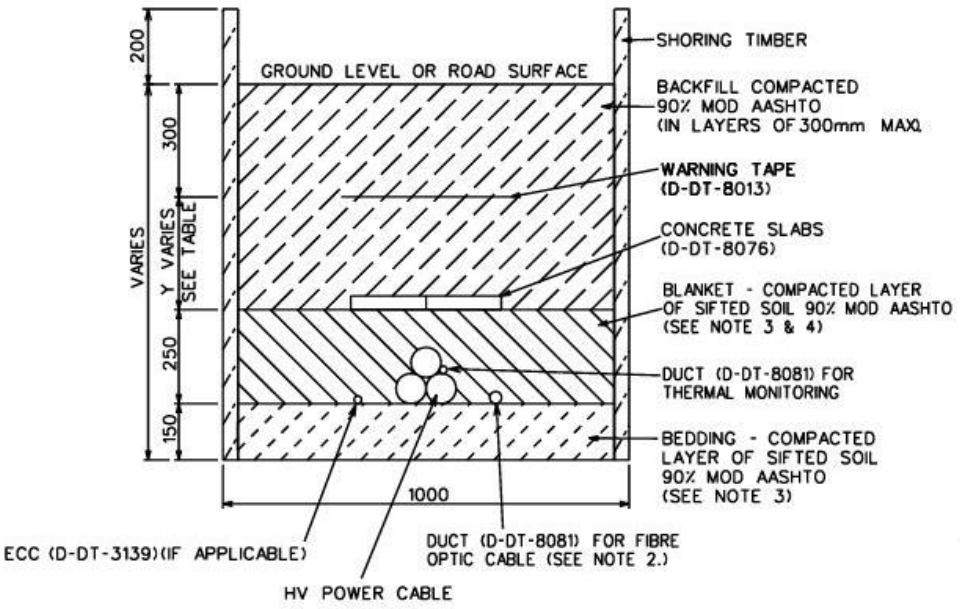

Figure 4: Tre-Foil Formation

In instances where space limitations and/or the presence of other underground services within the road reserve prevent the positioning of the trench and joint bays between the road and the adjacent property boundary, consideration may need to be given to the positioning of the trench and joint bays under the road surface. Where major interruptions to traffic flow in main roads cannot be avoided, open trench excavation may be restricted to shorter lengths (e.g. 100m) by the local authorities. In such a case, cable ducts shall be installed into which the cable can be pulled at a later stage. Where severe space limitations exist, consideration may need to be given to the use of underground cable tunnels where multiple feeders / circuits can be installed within a relatively confined space.

All of the aforementioned decommissioning activities would be subject to a separate Environmental Authorisation process at the appropriate time. In this regard, decommissioning activities have not been included in this Basic Assessment Process.

Technology alternatives

Two technology alternatives are being considered for the proposed river crossings along HV cables within CROYDON/GERMISTON and include:

- Horizontal Directional Drilling- Alternative 1
- Pipe jacking – Alternative 2

Horizontal Directional Drilling:

Directional drilling is a controlled horizontal trenchless drilling method by which ducting pipes are installed for underground applications (cables and auxiliary services/equipment) as part of the procedure, after drilling. Underground directional drilling equipment is used to drill holes that correspond to the pipe diameter being installed and is the Eskom preferred method for trenchless road, river, rail and service crossings or where it may not be possible to construct a standard cable trench. This method is limited by a combination of the maximum length of the drilling (+- 80m), depth of drilling and is not suitable to go through large rock formations.

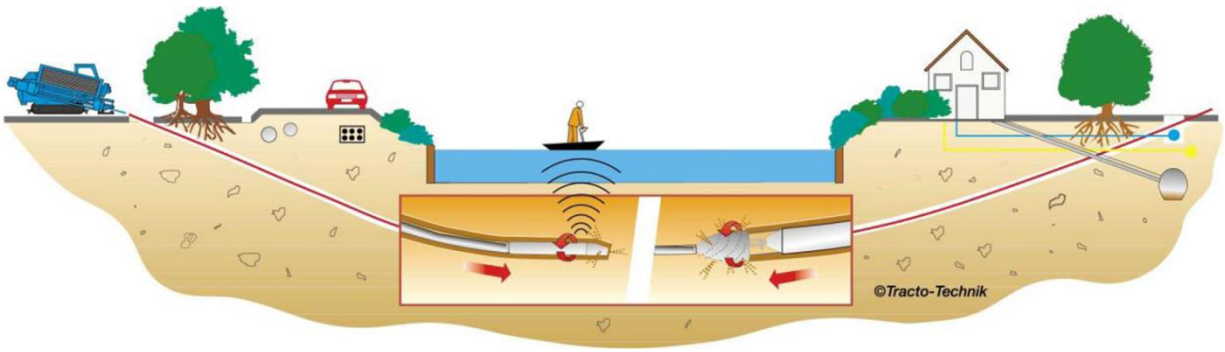

Figure 5: Horizontal directional drilling

Method: A Directional drilling rig and supporting equipment (**Figure 5**) is set-up at the drill entry location determined during the design phase. (This is typically close to, next to or inside the end of an already excavated cable trench, stabilised by wooden shoring.) The directional drilling rig is anchored to the ground surface using anchor stakes. The Directional drilling rig is used to drill (through the use of a drill string, and drill bit for mechanical cutting) a pilot hole through a predetermined drill path comprising of soil and rock. (Drill bits are capable of drilling through minor rock formations.) The drilling is also assisted by a natural fluid mixture of pure clay, oil and water, if required. This fluid is pumped out at low pressure at the tip of the drill head to: Transport drill cuttings to the surface, clean build-up on the drill bit, Cool the drill bit, Reduce the friction between the drill and bore wall, and stabilize the bore hole.

Periodic readings from electronic tracking components situated inside the head of the drill bit are used to determine the horizontal and vertical coordinates along the pilot hole in relation to the initial entry point. The pilot drill path may also be tracked using surface monitoring system. This information can then be used by the drill operator to control the drill bit head from the directional drilling rig. The drill path can be straight, at an arc or semi-circle, depending on the depth to be achieved and application.

Once the directional drilling rig and drill bit was successful in breaking the ground surface at the exit location (where another standard cable trench would be), the drill bit is replaced with a back reamer (similar to a drill bit but has a larger cutter head). The drill string is then pulled back through the pilot hole and the back reamer enlarges the diameter of the pilot drill hole. The back reamer may be used over a few passes in order to achieve the desired bore hole diameter. Once the desired bore hole diameter is achieved, the reamer is replaced with a pipe puller and a PVC pipe (composing of a single piece or multiple pieces welded together, +- up to 250mm in diameter) which is then pulled from the exit side of the bore hole to where the directional drilling rig is located. The same fluid as mentioned previously is used during back reaming as well installation of the PVC pipe.

The PVC pipe is protected with rollers inside the cable trench during the installation / back pulling. An inspection of the PVC pipe is performed to identify any damage done to the pipeline during the pull back. Upon successful pull back of the PVC pipe, the drilling equipment is dismantled and demobilized.

The PVC pipes installed can now be filled with cable, auxiliary equipment or kept as spares (fitted with non-metallic draw wires and sealed-off). The PVC pipes containing cable and auxiliary equipment may also be filled with bentonite, to allow for good thermal conduction to the surrounding environment as shown in **Figure 6**.

Once the above is completed, the cable trench (es) leading to the PVC pipe(s) are backfilled and the surfaces are re-instated.

Figure 6: Horizontal directional drilling

Pipe jacking:

Pipe jacking is horizontal trenchless hydraulic push method by which concrete pipes are jacked into position, and ducting pipes are installed inside the concrete pipes for underground applications (cables and auxiliary services/equipment). It is the Eskom preferred method for trenchless road, river, rail and service crossings where directional drilling cannot be applied. - This method is not as limited as directional drilling, and can be used over long distances, at greater depths and can go through larger rock formations.

Method: A pipe jacking rig and supporting equipment are set-up above ground level at the pipe jacking entry location determined during the design phase. (This is typically close to an already excavated cable trench.) The Pipe jacking rig comprises of a crane which is anchored to the ground surface using anchor stakes, and a hydraulic jack installed at the bottom of a shaft. Before pipe jacking can take place, a shaft has to be excavated. The shaft's dimensions must be adequate to allow a concrete pipe (+- Up to 1,5m diameter, +- 2,5m long) to be lowered comfortably in the shaft, to the required depth it must be installed. (The side wall of the shaft is also

stabilised using wooden shoring and concrete and is dependent on the soil conditions on-site.) A similar shaft is constructed at the remote end, which is aligned to the designed pipe jacking path.

Once excavations are done, a concrete pipe is lowered into the shaft. A hydraulic jack at the bottom of the shaft is used to push the concrete pipe horizontally forward, between the beginning and end shafts. Once the concrete pipe has been pushed / jacked into place, hand excavation is used to remove the soil and rock inside the concrete pipe. This process is then repeated by lowering the next concrete pipe, hydraulically jacking the pipe, removing the soil and rock inside it, until a continues concrete pipe tunnel is constructed between start and end shafts. Concrete screed is used between the individual concrete pipes to seal the concrete pipe tunnel. (Should large rock formations be encountered, the rock can be jack hammered or blasted way.) The direction of the concrete pipe tunnel is carefully controlled through control over the hydraulic jack, to ensure a perfect connection between the start and end shafts.

Once the concrete pipe tunnel is complete, it is inspected for any defects. PVC pipes in varying diameters (composing of a single piece or multiple pieces welded together, +- up to 250mm in diameter) are then installed inside the concrete pipe tunnel and fixed into place with a bentonite filling. The PVC pipes are inspected for defects after installation. Upon successful completion of the installation, the pipe jacking rig is dismantled and demobilized.

The PVC pipes installed can now be filled with cable, auxiliary equipment or kept as spares (fitted with non-metallic draw wires and sealed-off). The PVC pipes containing cable and auxiliary equipment may also be filled with bentonite, to allow for good thermal conduction to the surrounding environment (as shown in **Figure 7** and **Figure 8**)

Once the above is completed, the cable trench(es) and pipe jacking shaft leading to the PVC pipes are backfilled and the surfaces are re-instated.

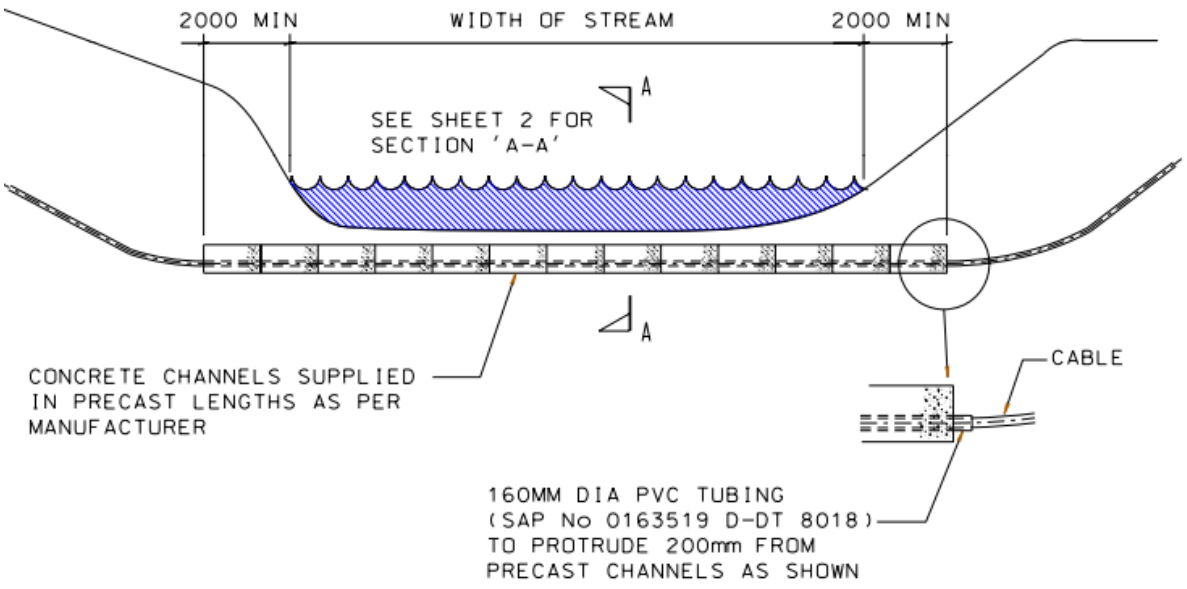

Figure 7: Pipe jacking Technology

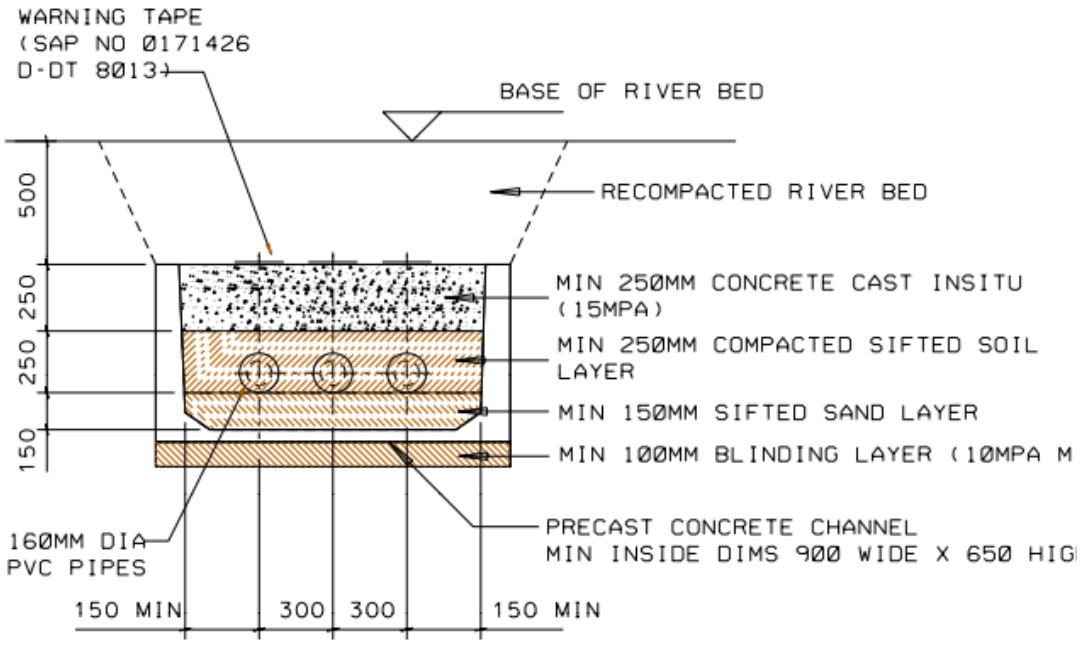

Figure 8: Pipe jacking Technology

2. PURPOSE AND OBJECTIVES OF THE EMPr

It is understood that any development can pose various risks to the environment as well as the residents or businesses in the surrounding area. These possible risks should be taken into account during the planning phase of the development. An Environmental Management Programme (EMPr) is required for the proposed project as per the National Environmental Management Act (Act No. 107 of 1998) (NEMA) EIA Regulations, 2014. The implementation of this EMPr, through the appointed contractor, remains the responsibility of the applicant, Eskom.

The purpose of this EMPr is to formulate mitigatory measures that should be made binding to all contractors during construction of the proposed development, as well as measures that should be implemented during the operational phase. The point of departure for this EMPr is to take a pro-active route by addressing potential problems before they occur. The EMPr will also provide management responses that will ensure that the impacts of the development are minimised. This should limit corrective measures needed during the construction and operational phases of the development. Additional mitigation will be included throughout the project's various phases as necessary. This EMPr is, therefore, a stand-alone document, which must be used on site during each phase of the development (planning, construction and operational phases).

This document should be flexible so as to allow the contractor and developer to conform to the management commitments without being prescriptive. The management commitments prove that the anticipated risks on the environment will be minimised if they are adhered to consistently. The onus set out in the EMPr rests with the developer, main contractors and subcontractors, which promotes responsibility and commitment. Any parties responsible for transgression of the underlying management measures outlined in this document will be held responsible of non-compliances and will be dealt with accordingly.

EXPLANATION OF INCLUSIONS AND EXCLUSIONS
A vegetation assessment was conducted as part of the Basic Assessment (BA) process. All protected species/ species of conservation concern that are found during construction will thus require a plant rescue and protection plan. This plant will have to be compiled for the construction phase of this project after the final route has been determined.
No open space plan is required due to no open space zoning for this linear project. The substation site will be designed as per requirements and the nature of the usage will not enable open space planning, landscaping apart from maintenance of the surface area (paved or surfaced with gravel) inside the fence around the substation.
A wetland rehabilitation plan was conducted as part of the BA process. It is attached as Appendix C of this EMPr as well as the BA Report.
ESKOM has its own minimum standards for bush clearing and maintenance of overheard powerlines and applicable servitudes. This document forms part of the tender agreements with contractors. The requirements outlined in the standards must be adhered to during the construction of the powerline.
A storm water plan in the design of the substations is required and must incorporate these requirements in the detailed design drawings. The design has not yet been finalised. Prior to construction, the storm water management plan must be submitted to the GDARD for their information and approval (if required).
Mitigation measures for the management and control of soil erosion have been included as part of the BA Report and this draft EMPr
Mitigation measures for erosion management have been included as part of the BA Report and this draft

EMPr.
A traffic impact assessment is not required. This is a predominantly rural area with low traffic volumes. The proposed projects will only have limited increase in traffic during the construction phase.

This EMPr has been based on the findings of the on site assessment undertaken by Envirolution and the specialist studies. All the environmental specifications and the procedures discussed this EMPr were also developed in accordance with the relevant legislation applicable to the development.

2.1 Project Team

This draft Environmental Management Programme was compiled by:

Company Name:	Envirolution Consulting (Pty) Ltd
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- Cheda Sheila Bolingo, the principle author of this Basic Assessment holds an Msc degree in Environmental Management and has 7 years of experience in the environmental management field. Her key focus areas are on strategic environmental assessment and advice on environmental impact assessments; public participation; environmental management programmes, and mapping through ArcGIS for variety of environmental projects. She is currently involved in several diverse projects across the country. Her key focus areas are on strategic environmental assessment and advice on environmental impact assessments; public participation; environmental management programmes, and mapping through ArcGIS for variety of environmental projects. She is currently involved in several diverse projects across the country.
- Gesan Govender, the project manager and Environmental Assessment Practitioner (EAP) responsible for this project, is a registered Professional Natural Scientist and holds an Honours degree in Botany. He has over 15 years of experience within the field of environmental management. His key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. He is currently responsible for the project management of EIA's for several diverse projects across the country.

Curricula vitae for the project team consultants are included in **Appendix C** of this report.

Inputs to compile this EMPr was received from the following specialists:

- Aquatic - Andrew Husted of The Biodiversity Company
- Fauna – Dr Rautenbach and company

- Vegetation – Antoinette Eyssel of Dimela EcoConsulting
- Heritage - Johan van Schalkwyk of Johan Heritage Consultant
- Geohydrology – Robert Crosby of AGES
- Floodline - Sivan Dhaver of SD Hydrological Services (Pty) Ltd
- Wetland- Antoinette Bootsman of Limosella Consulting

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3. KEY LEGISLATION APPLICABLE TO THIS PROJECT

The following legislation and guidelines have informed the scope and content of this EMPr:

- National Environmental Management Act (NEMA) (Act No 107 of 1998)
- Environmental Impact Assessment (EIA) Regulations, published under sections 24 (5) of the NEMA (GNR R982, GNR 983, GNR 984 and GNR 985 in Government Gazette 38282 of 4 December 2014)
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
    - Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
    - Public Participation in the EIA Process (DEA, 2010)

Several other Acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the table that follows.

Table 1: Relevant legislative and permitting requirements applicable to the proposed project

LEGISLATION	APPLICABLE REQUIREMENTS	RELEVANT AUTHORITY
National Environmental Management Act (Act No 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 982 of 2014 (as amended), a Basic Assessment Process is required to be undertaken for the proposed project. ***The final BA report is to be submitted to the DEA in support of the application for authorisation.***	Department of Environmental Affairs (DEA) – competent authority Gauteng Department of Agriculture and Rural Development (GDARD)
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts. ***While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the BA phase and will continue to apply***	DEA GDARD

LEGISLATION	APPLICABLE REQUIREMENTS	RELEVANT AUTHORITY
	throughout the life cycle of the project.	
National Water Act (Act No 36 of 1998)	The development also triggers activities that require a Water Use License (WUL) because it crosses several water courses. Therefore, before construction activities may take place, the activity will require a Water Use License as per requirement in the National Water Act (Act No.36 of 1998) (NWA) under Section 21 Water Uses. In terms of the NWA, this development requires a Water Use License for the following water uses: • Section 21(c) impeding or diverting the flow of water in a watercourse and; • Section 21 (i) altering the bed, banks, course or characteristics of a watercourse. ***A water use license (WUL) is required in terms of Section 21(c) and 21 (i) of the National Water Act. If wetlands or drainage lines are impacted on, or the regulated area of a watercourse (being the riparian zone or the 1:100yr floodline whichever is greatest).***	Department of Water and Sanitation (DWS)
National Environmental Management: Air Quality Act (Act No 39 of 2004)	S18, S19, and S20 of the Act allow certain areas to be declared and managed as "priority areas." Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. GN R 827 – National Dust Control Regulations prescribes general measures for the control of dust in all areas	DEA City of Ekurhuleni
National Heritage Resources Act (Act No 25 of 1999)	» S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent » The relevant Heritage Authority must be notified of developments such as linear developments (i.e. roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. » Stand-alone HIAs are not required where an EIA is carried	South African Heritage Resources Agency (SAHRA) Provincial Heritage Resources Authority

LEGISLATION	APPLICABLE REQUIREMENTS	RELEVANT AUTHORITY
	out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component. ***A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development***	
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	In terms of S57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA Phase. The Act provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (GG 34809, GN 1002), 9 December 2011). GNR 598: The Alien and Invasive Species (AIS) Regulations provides for the declaration of weeds and invader plants. ***An ecological study has been undertaken as part of the BA process, as such the potential occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered within this report***.	DEA GDARD
National Forests Act (Act No. 84 of 1998)	In terms of S5(1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to	Department of Agriculture, Forestry and Fisheries

LEGISLATION	APPLICABLE REQUIREMENTS	RELEVANT AUTHORITY
	an (applicant and subject to such period and conditions as may be stipulated" GN 908 provides a list of protected tree species. ***While no permitting or licensing requirements arise from this legislation, and this Act will find application during the construction and operational phase of the project.***	
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S13 the landowner would be required to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. In terms of S13 the landowner must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires. ***While no permitting or licensing requirements arise from this legislation, and this Act will find application during the construction and operational phase of the project.***	Department of Agriculture, Forestry and Fisheries
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance » Group IV: any electronic product; and » Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force. ***It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the***	Department of Health

LEGISLATION	APPLICABLE REQUIREMENTS	RELEVANT AUTHORITY
	Department of Health	
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 921), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities (Category A and B) while Category C Activities (such as storage of waste) must be undertaken in accordance with the necessary norms and standards. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented. ***As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in the EMPr. The volumes of waste to be generated and stored on the site during construction and operation of the facility will not require a waste license***.	DEA: Chemicals and Waste Management GDARD: General waste
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to	South African National Roads Agency Limited (SANRAL) (national roads)

LEGISLATION	APPLICABLE REQUIREMENTS	RELEVANT AUTHORITY
	the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations. ***An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include:*** ***Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m.***	Provincial Department of Transport
Conservation of Agricultural Resources Act (Act No 43 of 1983)	Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: Category 1 plants: are prohibited and must be controlled. Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E. ***While no permitting or licensing requirements arise from this legislation, this Act will find application during the BA process and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented.***	DAFF
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details the subdivision of agricultural land and provisions under which the act is triggered. It also provides for the approval of such division by the Minister of Agriculture. Applies for subdivision of all agricultural land and long-term leasing of portions of	(DAFF) Provincial Departments of Agriculture and Environment -

LEGISLATION	APPLICABLE REQUIREMENTS	RELEVANT AUTHORITY
	agricultural land. *Long-term leases on portions or subdivision of the site properties will require an approval of the Minister of Agriculture. An application to DAFF will need to be submitted detailing the areas to be subdivided or leased for the purposes of the proposed development. An application in terms of SALA will need to be undertaken and submitted following the issuing of an environmental authorisation for the proposed project.*	commenting authority. Local Municipality – competent authority
Spatial Planning And Land Use Management Act 16 OF 2013	**This Act** has the main objectives to: • provide for a uniform, effective and comprehensive system of spatial planning and land use management for the Republic; • ensure that the system of spatial planning and land use management promotes social and economic inclusion; • provide for development principles and norms and standards; • provide for the sustainable and efficient use of land; • provide for cooperative government and intergovernmental relations amongst the national, Regulations under the SPLUMA not in force yet. Legislation that regulates Land Use Planning has led to "spatial planning tools" that are contained in Municipal and District Strategic Management Frameworks (SMFs), Strategic Development Initiatives (SDIs) and Municipal By-laws	City of Ekurhuleni
Development Facilitation Act (Act No 67 of 1995)	The Development Facilitation Act contains development facilitation regulations under the Regulations under Development facilitation Act 3. The Act is directed at provincial and local spheres of government; and serves to re-address the imbalances of the past and to ensure that there is equity in the application of spatial development planning and land use management systems. Provides for the overall framework and administrative structures for planning throughout the Republic. S (2-4) provides general principles for land development and conflict resolution. The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.	GDARD

4. PHASES OF THE PROJECT

The process which was followed in compiling the EMPr is in compliance with NEMA EIA Regulations (2014), and applies the principle of Integrated Environmental Management (IEM).

The EMPr deals with the following phases as detailed below.

4.1 The Planning Phase

The EMPr offers an ideal opportunity to incorporate pro-active environmental management measures with the goal of attaining sustainable development.

Pro-active environmental measures minimize the chance of impacts taking place during the construction and operational phase. There is still the chance of accidental impacts taking place; however, through the incorporation of contingency plans (e.g. this EMPr) during the planning phase, the necessary corrective action can be taken to further limit potential impacts.

4.2 The Construction Phase

The bulk of the impacts during this phase will have immediate effect. If the site is monitored on a continual basis during the construction phase; it is possible to identify these impacts as they occur. These impacts will then be mitigated through the contingency plans identified in the planning phase, together with a commitment to sound environmental management from the developer.

4.3 Rehabilitation Phase

Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed.

4.4 The Operational Phase

By taking pro-active measures during the planning and construction phases, potential environmental impacts emanating during the operational phase will be minimised. This, in turn, will minimise the risk and reduce the monitoring effort, but it does not make monitoring obsolete.

5. RESPONSIBILITIES OF THE ROLE PLAYERS

5.1 Developer (Eskom)

The developer remains ultimately responsible for ensuring that the development is implemented according to the requirements of the EMPr. Although the developer appoints specific role players to perform functions on his/her behalf, this responsibility is delegated. The developer is responsible for ensuring that sufficient resources (time, financial, human, equipment, etc.) are available to the other role players (e.g. the ECO, ELO and contractor) to efficiently perform their tasks in terms of the EMPr. The developer is liable for restoring the environment in the event of negligence leading to damage to the environment.

The developer must ensure that the EMPr is included in the tender documentation so that the contractor who is appointed is bound to the conditions of the EMPr.

The developer must appoint an independent Environmental Control Officer (ECO) during the construction phase to oversee all the environmental aspects relating to the development.

5.2 Contractor

The contractor, as the developer's agent on site, is bound to the EMPr conditions through his/her contract with the developer, and is responsible for ensuring that he adheres to all the conditions of the EMPr. The contractor must thoroughly familiarise him/herself with the EMPr requirements before construction begins and must request clarification on any aspect of these documents, should they be unclear. The contractor must ensure that he/she has provided sufficient budget for complying with all EMPr conditions at the tender stage.

The contractor must comply with all orders (whether verbal or written) given by the ECO, project manager or site engineer in terms of the EMPr.

5.3 Resident Engineer (RE)

The Resident Engineer (RE) will be appointed by the 'Consultant' and will be required to oversee the construction programme and construction activities performed by the Contractor. The RE is expected to liaise with the Contractor and ECO on environmental matters, as well as any pertinent engineering matters where these may have environmental consequences. He/she will oversee the general compliance of the Contractor with the EMPr and other pertinent site specifications. The RE will also be required to be familiar with the EMPr specifications and further monitor the Contractor's compliance with the Environmental Specifications on a daily basis, through the Site Diary, and enforce compliance.

5.4 The Environmental Control Officer (ECO)

The Environmental Control Officer (ECO) is appointed by the developer as an independent monitor of the implementation of the EMPr. He/she must form part of the project team and be involved in all aspects of project planning that can influence environmental conditions on the site. The ECO must attend relevant project

meetings, conduct inspections to assess compliance with the EMPr and be responsible for providing feedback on potential environmental problems associated with the development. In addition, the ECO is responsible for:

- Liaison with relevant authorities;
- Liaison with contractors regarding environmental management; and
- Undertaking routine monitoring and appointing a competent person/institution to be responsible for specialist monitoring, if necessary.

The ECO has the right to enter the site and do monitoring and auditing at any time, subject to compliance with health and safety requirements applicable to the site (e.g. wearing of safety boots and protective head gear).

(a) Liaison with Authorities

The ECO and Eskom Environmental Representatives will be responsible for liaising with DEA. The ECO must submit environmental audit reports to the authorities should they be required for the project. These audit reports must contain information on the contractor and developer's levels of compliance with the EMPr. The audit report must also include a description of the general state of the site, with specific reference to sensitive areas and areas of non-conformance. The ECO must indicate suggested corrective action measures to eliminate the cause of the non-conformance incidents. In order to keep a record of any impacts, an Environmental Log Sheet (refer to **Appendix 1 of this EMPr)** is to be kept on a continual basis.

(b) Liaison with Contractors

The ECO is responsible for informing the contractors of any decisions that are taken concerning environmental management during the construction phase. This would also include informing the contractors of the necessary corrective actions to be taken.

5.5 Environmental Liaison Officer (ELO)

The contractor must appoint an Environmental Liaison Officer (ELO) to assist with day-to-day monitoring of the construction activities. Any issues raised by the ECO will be routed to the ELO for the contractors' attention. The ELO shall be permanently on site during the construction phase ensuring daily environmental compliance with the EMPr and should ideally also be a senior and respected member of the construction crew. Past experience has revealed that, ELO's that can relate to the work force are the most effective for information transfer and ensuring compliance with the EMPr.

All the responsible parties mentioned in this section are responsible for ensuring the implementation of the EMPr procedures outlined in the Tables, for the duration of the project.

6. ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

The EAP and Project specialists have evaluated all potential impacts along the proposed HV cable systems within CROYDON/GERMISTON. The table that follows forms the core of this EMPr for the construction and operational phases of the development. This table should be used as a checklist on site, especially during the construction phase.

Compliance with this EMPr must be audited during the construction phase and following completion of construction.

6.1 Planning Phase EMPr

Overall Goal: undertake the pre-construction (planning and design) activities in a way that:

- Ensures that the design responds to the identified environmental constraints and opportunities.
- Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements
- Ensures that adequate regard has been taken of any landowner and community concerns and that these are appropriately addressed through design and planning (where appropriate).
- Ensures that the best environmental options are selected for the linear components.
- Enables the construction activities to be undertaken without significant disruption to other land uses and activities in the area.

In order to meet this goal, the following activity/actions and the action required have been identified, together with necessary actions and monitoring requirements.

Table 2: Planning & Design Phase

Activity / issue	Action required	Responsible party	Frequency
Appointment and Duties of ECO	The Developer must appoint an independent Environmental Control Officer (ECO) who must monitor the contractor's compliance with the environmental management plan.	Developer	Once-off
	The developer must provide the ECO and contractor with a copy of the EMPr.	Developer	Once-off
	The priority of the ECO is to maintain the integrity of the development conditions outlined in the EMPr.	ECO	Continuous
	The ECO must form part of the project management team and attend all project meetings.	ECO	Continuous
	The contractor must ensure that the construction crew attend an environmental briefing and training session presented by the ECO prior to commencing activities on site.	ECO, Contractor	Once-off
Appointment and Duties of	The contractor must appoint an Environmental Liaison Officer (ELO). This person will be	Contractor	Once-off

Activity / issue	Action required	Responsible party	Frequency
ELO	required to monitor the situation with a direct hands-on approach, and ensure compliance and co-operation of all personnel.		
EMPr	This EMPr must be made binding to the main contractor as well as individual contractors and mustbe included in tender documentation for the construction contract.	Developer, ECO	Once-off
	All activities on the site must comply with the **City of Ekurhuleni's** By-Laws.	Developer, ECO and Contractor	Continuous
Environmental Protection Plan	Within 21 days of the Commencement Date, the Site Contractor shall prepare and submit to the Project Manager for approval in consultation with the ECO an Environmental Protection Plan. The Plan shall cover all environmental protection works and shall also include descriptions of environmental safeguards and emergency procedures.	Developer, ECO, Contractor	Once - off
	The Plan shall include a description of the administrative structure and lines of communication which shall be established between the Contractor's and his subcontractors' workforce for the implementation of environmental protection procedures. Details of the expertise available for the implementation of environmental protection procedures must also be provided.	Contractor, RE, ECO	Once off
	In addition this plan must have a site layout plan and showing the final positions and extent of all permanent and temporary site structures and infrastructure, including: • Buildings • Contractors' accommodation. • Contractors' camp • Roads and access routes • Gates and fences. • Essential services (permanent and temporary water, electricity and sewage) • Rubble and waste rock storage and disposal sites. • Site toilets and ablutions.	Contractor, RE, ECO	Once off

Activity / issue	Action required	Responsible party	Frequency
	• Firebreaks. • Excavations and trenches. • Topsoil stockpiles. • Spoil areas. • Construction materials stores. • Vehicle and equipment stores. • All temporary and permanent water management structures including bunds and sumps		

Activity / issue	Action required	Responsible party	Frequency
Structure design at watercourse crossings	○ • Project engineers must compile a method statement, outlining the construction methodologies. The required mitigation measures to limit the impacts on the, as well as the associated buffers must be contained within the method statement. The method statement must be approved by the ECO and be available on site for reference purposes • The footprint of construction through all vegetation must be kept to a minimum to avoid unnecessary removal of vegetation • Planning of the construction site must include eventual rehabilitation / restoration of vegetative cover and monitoring for alien invasive species • Avoid linear disturbances that run parallel to a watercourse • Plan access roads in such a way as to minimise impact on watercourses • Plan construction activities that necessitate water crossings to only cross watercourses at designated points • Plan construction camps to be placed outside of watercourses and their associated buffer zones • <u>The crossing shall take place at the narrowest point in the wetland and must take place as close as possible to a perpendicular angle to the direction of flow of the system.</u>	Contractor, RE, ECO	Once off

Activity / issue	Action required	Responsible party	Frequency
Limit the footprint of construction thereby reducing compaction and destruction of natural vegetation	Wetlands: • Access roads must be restricted in wetland areas and buffers. These access areas must be designated in the planning phase to prevent contractors taking "short-cuts" through wetland areas and buffers • Construction within wetlands and buffers must be planned to take place in the drier winter months • Plan construction activities to have the smallest possible footprint • No stockpile areas should be located within wetland boundaries, or within the associated buffer zone • No activity or movement of vehicles be allowed to occur within 30m buffer zone, except for the cable diggings within the prescribed footprint. If it is necessary to undertake work in such an area, the contractors must avoid large scale trampling of the sensitive area and work only within the clearly demarcated servitude marked with poles painted red in colour. Fauna and flora: • Plan to demarcate the construction area and ensure that no disturbance to vegetation and soils outside of the planned construction site take place. • Maintain site demarcations in position until the cessation of construction work. • Gabions stabilising water courses must not be disturbed during the construction as it could destabilise vegetation and soils.	Contractor, Developer	Continuous
Avoid or rescue and relocate protected species	The construction of the underground cable could result in the removal of plant species of conservation concern; however, no such species were recorded at the water crossings and it is highly unlikely to occur. However, some areas could not be accessed and in others, invasive species could have obscured cryptic species. As the cable will likely be drilled or pipe jacked underneath the watercourse, it is the vegetation adjacent to the watercourse where machinery will be placed that are of concern. Most of these areas were also in a poor condition, however, the exact footprint of such areas was not known. Thus, the following is recommended:	Contractor, RE, ECO	Continuous

Activity / issue	Action required	Responsible party	Frequency
	• Vegetation around water crossing 1 may support plant species of conservation concern. Although the probability is low, as best practice, it is recommended that the machinery footprint adjacent to watercourses (e.g. terrestrial vegetation) be scanned during the growing period of such species that may occur. • If found to be present these plants must be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority). • Construction workers may not tamper or remove these plants, and neither may anyone collect seed from the plants without permission from the local authority. • It is recommended that the plants be relocated during winter when they are dormant. If the plants are not visible, they could be located by the markers and coordinates that the specialist recorded in the search phase • Specific requirements for rescue and relocation will depend on the species recorded and must be specified by the botanist/ecologist that located the species, or a suitably qualified horticulturist • If removed species are used as part of rehabilitation, their survival must be monitored for at least two growing seasons after rehabilitation was completed • The new localities must be marked, and the coordinates recorded • A record of the number and new localities of each species must be kept. The survival of the relocated species must be monitored during construction and at least for three years during the operational phase		
Sourcing of plant material for rehabilitation purposes	• Vegetation, particularly grass sods, can be rescued and used to rehabilitate disturbed areas back to the state it was prior to construction. This could save costs and ensure a diversity of species. • The planning pre-construction must make provision for the collection of such species for re-vegetation as well as for the use as mulch	Contractor, Developer	Continuous

Activity / issue	Action required	Responsible party	Frequency
	• Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area		
Removal of topsoil for rehabilitation purposes	• Prior to construction, the topsoil must be removed and stored separately from subsoil. The topsoil is imperative for the successful re-establishment of indigenous vegetation • Where possible, collect boulders and rocks from the sites to be cleared for construction and stockpile prior to the commencement of construction activities	Contractor, Developer	Continuous
Geohydrology considerations:	• It is required that suitable investigative work be conducted prior to construction to determine optimal installation starting and end points to prevent damage to watercourse banks, and to determine the optimal installation depth (i.e.: typical studies may include river hydrological studies – where required – to determine the influence depth of river scour, as well as geotechnical investigations in support of design and construction – which specifically address the anticipated impacts of the effects of groundwater during construction) • The exact positions of buried storm water channels must be determined prior to construction to prevent any damage	Contractor, Developer	Continuous
Permits and Permissions	The Developer shall ensure that all pertinent permits, certificates and permissions have been obtained prior to any activities commencing on site and ensure that they are strictly enforced / adhered to. This includes, for example, updating the Department of Water Affairs (DWA) licence and obtaining biodiversity permits, etc.	Contractor, Developer	Continuous
	The Contractor shall maintain a database of all pertinent permits and permissions required for the contract as a whole and for critical activities for the duration of the contract.	Contractor, Developer	Continuous

Activity / issue	Action required	Responsible party	Frequency
Effective communication mechanisms	• Undertake negotiations with affected landowners and agree on landowner-specific conditions for construction and maintenance • Implement a grievance mechanism procedure for the public • Visible safety barriers (with nets or tape) must be erected along the route to ensure that no harm is brought to the public and animals.	Contractor, Developer	Continuous
Method Statements	The Contractor shall submit written Method Statements to the RE for the activities identified by the RE or ECO. Activities that will require method statements include: • Logistics for the Environmental Awareness Training Course • Location and Layout of Construction camp • Construction procedures • Protection of heritage resources (graves, old buildings and bridges) • Solid and Hazardous Waste Management • Drainage and Storm water planning • Dust Control • Stockpiling area • Vegetation removal • Materials and equipment to be used • Getting the equipment to and from the site • How the equipment material will be moved while on site • How and where material will be stored • The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur • Timing and location of activities • Compliance/non compliance with Specifications • Site camp establishment • Concrete pre-cast and batching operation	Contractor, RE, ECO	As necessary

Activity / issue	Action required	Responsible party	Frequency
	• Emergency procedures • Materials, equipment and staffing requirements • Transporting the materials and/or equipment to, from and within the site • Stockpiling of rubble • General and Hazardous waste management on site • The storage provisions for the materials and/or equipment • The proposed construction procedure designed to implement the relevant Environmental Specifications • Other information deemed necessary by the RE and/or ECO. Method Statements shall be submitted at least ten working days prior to the proposed commencement of work on an activity to allow the RE (and/or ECO) time to study and approve the method statement.		
	Contractor shall not commence work on that activity until such time as the Method Statement has been approved in writing by the RE contract.	Contractor, RE, ECO	Continuous
	The Contractor shall carry out the activities in accordance with the approved Method Statement.	Contractor, RE. ECO	Continuous
	Under certain circumstances, the RE may require changes to an approved Method Statement. In such cases the proposed changes must be agreed upon in writing between the Contractor and the RE, and appropriate records retained.	Contractor, RE	Continuous

Activity / issue	Action required	Responsible party	Frequency
	Approved Method Statements shall be readily available on the site and shall be communicated to all relevant personnel. Approval of the Method Statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the EMPr specifications.	Contractor, Developer	Continuous
Environmental Awareness and Training	• The Contractor shall ensure that all site personnel have a basic level of environmental awareness training. Topics covered should include; ∗ What is meant by "Environment" ∗ Why the environment needs to be protected and conserved ∗ How construction activities can impact on the environment ∗ What can be done to mitigate against such impacts ∗ Awareness of emergency and spills response provisions ∗ Social responsibility during construction of the power lines e.g. being considerate to local residents • It is the Contractor's responsibility to provide the site foreman with environmental training and to ensure that the foreman has sufficient understanding to pass this information onto the construction staff. • Training should be provided to other staff members in the use of the appropriate fire-fighting equipment. Translators are to be used where necessary. • Use should be made of environmental awareness posters on site. • The need for a "clean site" policy also needs to be explained to the workers. • Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks. • The Contractor must monitor the performance of construction workers to ensure that the points relayed during their introduction have been properly understood and are being followed.	Developer, Contractor, ECO	Continuous

Activity / issue	Action required	Responsible party	Frequency
Existing Services and Infrastructure	The Contractor shall ensure that existing services (e.g. roads, pipelines, power lines and telephone services) are not damaged or disrupted.	Contractor, RE, ECO	Continuous.
	The Contractor shall be responsible for the repair and reinstatement of any existing infrastructure that is damaged or services which are interrupted.	Contractor	As necessary
	Such repair or reinstatement will be to the Contractor's cost and shall receive top priority over all other activities.	Contractor	Continuous
	A time limit for the repairs may be stipulated by the RE in consultation with the Contractor.	Contractor, RE, ECO	Continuous

6.2 Construction Phase EMPr

Overall Goal: Undertake the construction phase in a way that:

- Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
- Enables construction activities to be undertaken without significant disruption to other land uses and activities in the area, in particular concerning noise impacts, traffic and road use, and effects on local residents.
- Minimises the impact on the indigenous natural vegetation, and habitats of ecological value.
- Minimises impacts on fauna in the study area.
- Minimises the impact on heritage sites should they be uncovered.
- Establishes an environmental baseline during construction activities on the site, where possible.

Table 3: Construction Phase

Activity / issue	Action required	Responsible party	Frequency
Site establishment	If construction camp is required in the study area, the contractor must establish a construction camp in an area as agreed with the ECO. The site for the construction camp must not be in an environmentally sensitive area such as close proximity to a watercourse, on a steep slope or on erosive soils. The area must be properly demarcated prior to establishment to prevent the construction camp from being unnecessarily large. The camp must be properly fenced.	ECO, Contractor	Once off
	The siting of the construction equipment camp/s must take cognisance of any sensitive areas reflected on the sensitivity map.	ECO, Contractor	Once off
	The working width of the construction area must be clearly demarcated by the installation of coloured pegs prior to construction. Particularly sensitive areas (e.g. river or drainage lines) must be demarcated with danger tape.	ECO, Contractor	Once off, monitor weekly
	The lateral spread of the construction must be monitored on a weekly basis.	ECO, ELO, Contractor	Monitor weekly

Activity / issue	Action required	Responsible party	Frequency
	The use of roads on landowner property must be determined based on discussions with landowners during the negotiation process. Letters of agreement with landowners must be kept on a file	ECO, Contractor	Continuous,
	ELO will also be required to monitor unauthorised movement of construction crew.	ELO, Contractor	Once off, monitor daily
	The developer must provide dustbins to be used during site preparation and surveying.	Developer	Once off
	To prevent excessive disturbance of natural vegetation, the contractor must use existing disturbed or paved areas wherever possible.	ECO, Contractor	Once off, monitor weekly
	To prevent the deterioration of surface water quality, the contractor must provide adequate ablution facilities. However these facilities must not be placed within the vicinity of watercourses. Toilets are to be emptied regularly throughout the construction phase. Every effort must be made to prevent the contamination of surface or sub-surface water.	Contractor	Bi-weekly inspections

Activity / issue	Action required	Responsible party	Frequency
Limit the construction footprint and related impacts	• Only use access roads as designated during the planning phase • Only cross watercourses at designated points • Crossings to be undertaken with only one vehicle that have the minimum footprint as decided on during planning • Limit the removal of indigenous vegetation around the construction footprint and keep demarcations to prevent access to rocky outcrops in place • Limit compaction by not working in wet conditions and limiting vehicular access • Do not permit vehicular or pedestrian access into natural areas or into seasonally wet areas during and immediately after rainy periods, until such a time that the soil has dried out (DWAF, 2005) • Watercourse boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete • Only necessary traffic should be allowed within these demarcated areas • Limit clearing of vegetation between servitude and construction camps • Contractors should refrain from impacting areas beyond the demarcated construction area • A temporary fence or demarcation must be erected around the construction area (include the servitude, construction camps, areas where material is stored and the actual footprint of the drilling or pipe jacking entry location) • Minimise disturbance and loss of soil • No materials are allowed to be stored on wetlands or wetland buffer areas • The contractor must avoid traffic or storing of equipment and material in vegetated areas that will not be cleared • No open fires or harvesting plants or trees for firewood are permitted	Contractor, ECO	Continuous
Prevention of pollution	• Contractors responsible for construction and maintenance in close vicinity to wetland areas must sign a declaration stating that they will adhere to all stipulations of the Environmental Management Plan relating to wetland / stream crossings as well as	ELO, Contractor	Monitor daily - weekly

Activity / issue	Action required	Responsible party	Frequency
	measures as set out by this report • The contractors must provide and maintain a method statement for "cement and concrete batching". The method statement must provide information on proposed location, storage, washing & disposal of cement, packaging, tools and plant storage • Cement must only be mixed within mixing trays. Washing and cleaning of equipment should also be done within a bermed area, in order to trap any cement or plaster and avoid excessive soil erosion. These sites must be rehabilitated prior to commencing the operational phase • The mixing of concrete must only be done at specifically selected sites on mortar boards or similar structures to contain run-off into drainage lines, streams and natural vegetation • Materials such as fuel, oil, paint, herbicide and insecticides must be sealed and stored in bermed areas or under lock and key, as appropriate, in well-ventilated areas • These substances must be confined to specific and secured areas within the contractor's camp, and in a way that does not pose a danger of pollution even during times of high rainfall • Storage of materials as described above may not be within the 1:100 floodline, watercourses or associated buffer areas • In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water and Sanitation (DWS) must be informed immediately and corrective action taken • All equipment should be parked overnight and/or fuelled at least 500 meters from a watercourse • Drip trays (minimum of 10cm deep) must be placed under all vehicles that stand for more than 24 hours. Vehicles suspected of leaking must not be left unattended, utilise drip trays • Drip trays must be utilised during repairs and maintenance of all machinery. The depth of the drip tray must be determined considering the total amount / volume of oil in the		

Activity / issue	Action required	Responsible party	Frequency
	vehicle. The drip tray must be able to contain the volume of oil in the vehicle. • Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone • Remove all construction equipment and material on completion of construction • No water should be abstracted from any river / wetland • Run-off from the camp site must not discharge into neighbours' properties or into adjacent wetlands, rivers or streams • Management of on-site water use and prevent stormwater or contaminated water directly entering the watercourse • Management of point discharges		
Prevent/limit sedimentation	• Contractors responsible for constructing in close vicinity to wetland areas along the route must sign a declaration stating that they will adhere to all stipulations of the Environmental Management Plan relating to wetland / stream crossings as well as measures as set out by this report • Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced; this must be done in consultation with the ECO • The contractor shall ensure that excessive quantities of sand, silt and silt-laden water do not enter watercourses. Appropriate measures, e.g. erection of silt traps, or drainage retention areas to prevent silt and sand entering drainage or watercourses must be taken • Sediment barriers must be installed immediately after initial disturbance of the watercourse or adjacent upland • Where wetlands are adjacent to the construction areas and these areas slopes toward the wetland, install sediment barriers along the edge of the construction areas as necessary to prevent sediment flow into the wetland. • Sediment barriers must be properly maintained throughout construction and reinstalled as necessary until replaced by permanent erosion controls or restoration of adjacent	ELO, Contractor	Continuous

Activity / issue	Action required	Responsible party	Frequency
	upland areas is complete • It is important that topsoil should be conserved in areas where bedrock is shallow to avoid sedimentation • Run-off from the camp site must not discharge into neighbours' properties or into adjacent wetlands, rivers or streams.		
Persistence of fauna species	• The areas earmarked for exclusion from development must be fenced off during the construction phase to ensure that the developer and his contractors do not damage these areas or do not cover them with soil, builders' rubble or waste. • Trees naturally growing in the wetlands must be retained • Outside lighting should be designed to minimize impacts on important pollinators. All outside lighting should be directed away from sensitive areas. • Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible. • Where possible, work must be restricted to one area at a time, as this will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories. • Where possible the construction of the proposed development should take place during the winter months during the time when most avifaunal species are not breeding. • The contractor must ensure that no fauna is disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.	ELO, Contractor	Continuous
Prevent destruction of protected species	• Construction workers must be instructed to minimise disturbance of birds at all times. • Illegal hunting of birds must be strictly prevented • If any bulbous or succulent species are unearthed by construction, these should be identified by an ecologist/botanist. If the species are found to be of conservation	ELO, Contractor	Continuous

Activity / issue	Action required	Responsible party	Frequency
	concern, the Gauteng Department of Agriculture and Rural, Development should be consulted for a permit to either replant the species or relocate them to suitable habitat		
Preventing spread of alien invasive plants	Several invasive species are present at each water crossing. To successfully eradicate these, the catchment and upstream areas also needs to be cleared, which falls outside of the scope of Eskom's mandate. It is thus recommended that the disturbance footprint be monitored for any additional species that could have been introduced to the watercourses because of the proposed project and these be eradicated as soon as it becomes apparent. • Construction equipment must be cleaned prior to site access. This will prevent alien invasive seed from other sites to spread into disturbed soils • Alien invasive species, in particular category 1b species that were identified within the study area, must be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation. • Manual removal is preferred to chemical control, particularly in the moist grassland. • Only suitably trained contractors (e.g. certified by the South African green Industries Council (SAGIC)) with knowledge of the species in question must be employed. • All alien seedlings and saplings must be removed as they become evident for the duration of construction. • If filling material is to be used, this must be sourced from areas free of invasive species.	ELO, Contractor	Continuous
Waste Management	• Construction method and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities. • Construction contractors must provide specific detailed waste management plans to deal with all waste streams. • Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap), and contaminated waste as required. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including	ELO, Contractor	Monitor daily - weekly

Activity / issue	Action required	Responsible party	Frequency
	prevention of contaminated runoff, seepage, and vermin control. • Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.). • Bins and skips must be labelled for ease of waste management. • Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors. • Uncontaminated waste shall be removed at least weekly for disposal; other wastes can be removed for recycling/ disposal at an appropriate frequency or ECO's discretion. • Disposal of waste shall be in accordance with relevant legislative requirements, including the use of licensed contractors. • Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area. • Waste must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal. • Spilled cement will be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site. • Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time. • Regularly serviced chemical toilets facilities must be used to ensure appropriate control of sewage. Waste from these toilets must be disposed of at a licensed wastewater treatment works. • Upon the completion of construction, the area must be cleared of potentially polluting materials.		

Activity / issue	Action required	Responsible party	Frequency
	• Dispose of all solid waste collected at an appropriately registered waste disposal site. Waste disposal shall be in accordance with all relevant legislation and under no circumstances may waste be burnt on site. • Where a registered waste site is not available close to the construction site, provide a method statement with regard to waste management. • Proof of appropriate disposal of all waste must be obtained from the waste contractors and kept on file.		

Activity / issue	Action required	Responsible party	Frequency
Traffic management and transportation of equipment and materials to site	• Appropriate dust suppression techniques must be implemented to minimise dust from gravel roads. These could include the use of water or other appropriate dust suppressants, as determined by the local site conditions. • Construction vehicles and those transporting materials and goods should be inspected by the contractor or a sub-contractor to ensure that these are in good working order and not overloaded. • Strict vehicle safety standards should be implemented and monitored. • All relevant permits for abnormal loads must be applied for from the relevant authority. • A designated access to the proposed site must be created to ensure safe entry and exit. • No deviation from approved transportation or construction routes must be allowed, unless roads are closed for whatever reason outside the control of the contractor. • Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures. • Any traffic delays resulting from the presence of construction traffic must be co-ordinated with the appropriate authorities. • The movement of all vehicles within the site must be on designated roadways. • Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards).	Contractor, RE	Daily

Activity / issue	Action required	Responsible party	Frequency
	• Signs must be placed along construction roads to identify speed limits, travel restrictions, and other standard traffic control information. Signage must be appropriately maintained for the duration of the construction period. • Appropriate maintenance of all vehicles of the contractor must be ensured. • An appropriate speed limit as agreed with the ECO should be implemented for vehicles travelling on site in order to minimise dust generation and ensure safety of personnel and the environment and lessen environmental degradation. • All construction vehicles and or machineries travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.		
Reduction of Visual Impacts	• The watercourse crossings design and construction activities must take into consideration the visual impacts and should keep the natural and sense of place of the area.	Contractor, RE	Daily

Activity / issue	Action required	Responsible party	Frequency
Management of dust and air emissions	• Roads must be maintained in a manner that will ensure that nuisance from dust emissions from road or vehicle sources are not visibly excessive. • Ensure that any damage to roads attributed to construction activities is repaired before completion of the construction phase. • Appropriate dust suppressant must be applied on all exposed areas and stockpiles as required to minimise/control airborne dust. These could include the use of water or other appropriate dust suppressants, as determined by the local site conditions. • Haul vehicles moving outside the construction site carrying material that can be wind-blown must be covered with tarpaulins • An appropriate speed limit must be implemented for vehicles travelling on site in order to minimise dust generation and ensure safety of personnel and the environment. • Dust-generating activities or earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased during periods of high winds if excessive visible dust is blowing toward nearby residences outside the site. • Strictly control vibration pollution from compaction plant or excavation plant.	Developer, Contractor	Daily
Minimise soil degradation and erosion	• Identify disturbance areas and restrict construction activity to these areas. • Rehabilitate disturbance areas as soon as practicable when construction in an area is complete. • Any new access roads required to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil. • Where new access roads cross natural drainage lines, culverts must be designed to	ELO, Contractor	As necessary

Activity / issue	Action required	Responsible party	Frequency
	allow free flow and regular maintenance must be carried out. Permit to disturb the drainage lines must be obtained from the Department of Water & Sanitation. • Minimise removal of vegetation which adds stability to soil. • Soil conservation: Stockpile topsoil for re-use in rehabilitation phase, protect stockpile from erosion • Erosion control measures (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, shade nets, or temporary mulching over denuded area as required). • Control depth of excavations and stability of cut faces/sidewalls. • Compile and implement an appropriate stormwater management plan.	ELO, Contractor	Continuous
Noise control	Construction and the use of construction machinery should be limited between 06h00 and 18h00 on weekdays only.	Developer, Contractor	Monitor daily
	Institute noise control measures throughout the construction phase for all applicable activities, including the construction times.	ELO, Contractor	Once off, as necessary
	Inform residents of nearby residential areas of planned noisy activities outside the timeframes stated above.	ECO, ELO, Contractor	Once off, as necessary
	No construction should occur during weekends, unless the adjacent residents (± 1km) have been notified in writing at least three days in advance.	ELO, Contractor	Once off, as necessary
	Construction activities must abide by the national noise laws and the municipal noise by-laws with regard to the abatement of noise caused by mechanical equipment.	Developer, ELO, Contractor	Continual
	Prior to blasting (if required), the contractor must inform the adjacent landowners at least five days in advance.	ELO, Contractor	As necessary
Destruction of heritage resources	The contractors and workers should be notified that heritage resources might be exposed during the construction work.	ECO	Once off

Activity / issue	Action required	Responsible party	Frequency
	Should any heritage resources be exposed during excavation, work on the area where the heritage resources were discovered, shall cease immediately and the Environmental Control Officer shall be notified as soon as possible.	ECO, Contractor	Continuous
	All discoveries shall be reported immediately to the South African Heritage Resources Authority (SAHRA) and the Gauteng Provincial Heritage Resources Agency (PHRA-G) so that an investigation and evaluation of the finds can be made. Acting upon advice from SAHRA, the Environmental Control Officer will advise the necessary actions to be taken.	ELO, Contractor	Continuous
	Under no circumstances shall any heritage resources be removed or interfered with by anyone on the site unless under the instruction of SAHRA. Destruction of heritage resources is not allowed.	ELO, Contractor	Continuous
	Contractors and workers shall be advised of the penalties associated with the unlawful removal of heritage resources as set out in section 51(1) of the National Heritage Resources Act (Act No. 25 of 1999).	ECO	Once off
	A person or entity, e.g. the Environmental Control Officer, should be tasked to take responsibility for the heritage resources and should be held accountable for any damage.	Developer	Once off

Activity / issue	Action required	Responsible party	Frequency
Geohydrology Impacts Altering of watercourse banks	• Prevent construction works directly within (or in in close proximity to) the banks of the watercourses (and artificial watercourses). • Safe working distance from artificial watercourse banks to be determined b.m.o. engineering review of existing structures • Build properly designed and constructed erosion protection structures where poor natural watercourse bank stability prevails, or where artificial watercourse erosion protection structures are of poor quality. ***NB: The stability of all adjacent embankments must be considered during all planning, design and construction activities to prevent induced slope failure (e.g.: in the vicinity of the constructed embankment between crossing numbers 5 and 6).*** • Erosion control and prevention will also be required at watercourses where existing infrastructure is already exposed due to scour (e.g.: crossing numbers 3 and 8) • Prevent induced slope failure and ravelling adjacent existing infrastructure and in close proximity to existing structures, embankments, properties etc. (safe excavation depths and distances, and drill starting points, to be determined by Professional Engineer)	Developer, Contractor	Monitor daily

Activity / issue	Action required	Responsible party	Frequency
Geohydrology impacts Construction of buried sleeves by means of HDD / Pipe Jacking beneath watercourses	• Ensure that cable construction (e.g.: b.m.o. horizontal directional drilling or the constructing of vertical pipe jacking shafts with connecting horizontal tunnel) commences at a suitable distance away from watercourse banks to prevent sidewall collapse and failure, sedimentation into the watercourse, and watercourse flow direction alteration due to bank instability and alterations • Ensure that storm water, surface water, and groundwater inflow into excavations are limited to prevent collapse and transportation of pollutants, including – but not limited to: o the installation of temporary excavation shoring o localized dewatering of excavations o waterproofing of natural ground surfaces beneath construction equipment, with suitable sumps • Ensure borehole / micro-tunnel construction (and subsequent installation of cable sleeves) are done at a suitable depth below the watercourse base to prevent: o scour by stream flow (along banks and/or base) o exposure of infrastructure within watercourse banks due to stream migration, scour or erosion o alterations to the hydrological and geohydrological character of the watercourse caused by installing infrastructure at insufficient depth that could potentially hamper base flow • Spillage prevention and collection, carting of spoil off site and disposing the prescribed manner, sealed return-water / drilling mud attenuation pond, employ minimum required environmental protection measures and procedures	Developer, Contractor	Monitor daily

Activity / issue	Action required	Responsible party	Frequency
Aquatic Impacts Degradation of downstream water quality and downstream habitat quality deterioration	• The pipe trenching and directional drilling methods which make use of no instream trenches or diversions should be used. • The working/drilling areas should be outside of the proposed 30m buffer zone; • Working areas should have a stormwater management plan compiled to ensure that runoff from the working area does not increase erosion downstream. • No excavations must be made within the banks of the river channels. If possible, the excavations must be made outside of the defined 30m buffer zone. • Water used for the drilling activities should not be obtained from the watercourse being crossed. Instead, water should be brought in on a tanker; • Monitoring of the water levels/condition downstream of the construction area must be done concurrently with construction activities. In particular, water clarity and volumes must be inspected. • **No chemicals, building materials hydrocarbons or soils must be stockpiled within the 30m buffer zone;** • Existing sewage pipelines should be identified and avoided for each crossing point; • Should the river be diverted it must be done in a manner that avoids downstream erosion; • Should stream banks be disturbed, rehabilitation activities must be planned and take place; • The cable structure should be sufficiently below the stream surface so as to avoid the dewatering of the stream; • Any disturbed areas must be revegetated with indigenous plant species.	Contractor	Monitor daily

Activity / issue	Action required	Responsible party	Frequency
Employment Creation and Local Procurement	• The use of local labour should be maximised where possible. • Eskom and the appointed contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses and SMME's during the construction process. • Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses and SMME's from the local sector	Eskom and Contractor	Once off

6.3 Rehabilitation Phase EMPr

Overall Goal: Undertake the rehabilitation measures in a way that:

- Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed (**please refer to the rehabilitation and monitoring plan in Appendix B**).

Table 4: Wetland rehabilitation plan

Activity / issue	Action required	Responsible party	Frequency
Destruction of vegetation Areas where vegetation will be impacted include the area directly impacted on by drill rigs and crew camps	• Access roads must be restricted in wetland areas and buffers. Only use access as designated during the planning phase • Disturb as little of the vegetation as possible. Where vegetation needs to be removed, remove as sods that can be replanted as part of the rehabilitation of disturbed areas • Temporary measures should be taken to prevent topsoil from washing away during rainfall • Where structures are installed in areas that slope towards wetlands, the slops must be re-vegetated by either using removed sods or by seeding with a grass mixture containing species naturally occurring in the area. Sloped areas where vegetation has been removed or destroyed should be replanted immediately after the initial disturbance to reduce the potential of erosion or invasion of the disturbed soils by alien invasive plant species	Contractor, ECO	• Immediately after installation of rehabilitation infrastructure • As and when monitoring indicate degradation of vegetation or failure of the rehabilitation
Erosion Erosion and sedimentation is likely to occur where vegetation has been cleared and where excavated material is stored in close proximity to a watercourse.	• The contractor shall be responsible for rehabilitating all eroded areas in such a way that the erosion potential is minimised after construction has been completed • All slopes that are disturbed during construction should be stabilised immediately to prevent erosion • Re-vegetation should be done immediately after construction, especially in sloped areas • Disturbances on site should be kept to a minimum to reduce the loss of material by erosion	Contractor	• During and immediately after any construction phase • As and when monitoring indicate erosion is taking place during the operation

Activity / issue	Action required	Responsible party	Frequency
Disturbance of steep slopes by the removal of vegetation may result in slope instability and erosion by rain and surface run-off.	• Disturbed areas that require rehabilitation should be mulched to encourage vegetation re-growth. • Stockpiled soil should be protected from erosion due to water runoff • Near vertical slopes of 1(V):1(H) or 1(V):2(H) must be stabilised using hard structures, preferably with a natural look, and with facilities allowing for plant growth. The EO / ECO will specify a solution in terms of the most appropriate approved method and technology. One or more of the following methods may be required: o Retaining walls (loffel or otherwise) (DWAF 2005) o Stone pitching. o Gabions. o Shotcrete. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within work areas • Where access cannot be avoided into sensitive areas, the amount of vehicle and personnel traffic should be kept to a minimum and should make use of only one route • Where crossings of watercourses are unavoidable eco-friendly soft options (such as wooden poles) should be placed over the wet area to be driven over • Where all preventative measures have failed and erosion persists soft and hard rehabilitation options, such as eco-logs or weirs, should be considered in conjunction with an engineer and wetland specialist • Erosion control of all banks must take place so as to reduce erosion and sedimentation into river channels or wetland areas.		al phase of the underground cables
Soil Compaction Soil compaction is likely to occur on access roads, and temporary	• Areas where soil has been compacted should be ripped to encourage vegetation growth • Ripping shall be done to a depth of 250 mm in two directions at right angles. • Do not rip and / or scarify areas under wet conditions, as the soil will not break up and	Contractor	• Immediately after any construction phase • As and when

Activity / issue	Action required	Responsible party	Frequency
work platforms where heavy vehicles and personnel move around. Soil compaction will decrease permeability of the soil, negatively impact the sub-surface flows and compromise vegetation establishment.	compaction will be worsened • Do not permit vehicular or pedestrian access into natural areas or into seasonally wet areas during and immediately after rainy periods, until such a time that the soil has dried out (DAWF, 2005) • Rip and / or scarify all disturbed (and other specified) areas of the construction site, including temporary access routes and roads, compacted during the execution of the Works. (DWAF, 2005).		monitoring indicate severe compaction due to maintenance
Mobilisation of pollutants The mobilisation of sediments, excavations, removal and disturbances to vegetation, mobilisation of sulphur, hydrocarbon and pyrite compounds could have various negative impacts on wetlands and their associated functionality.	• In case of emergencies or unforeseen events, the problem must be remediated immediately and any spillage into any watercourses be reported to the Department of Water Affairs. In addition, the soil must be stabilised (import additional topsoil if necessary) and re-vegetated as soon as possible. Re-vegetation should include seeds from the adjacent grassland and any rescued protected plants and/or plants of conservation concern that might have been impacted upon by the emergency / unforeseen event. • Remove all project-related material / support equipment immediately on completion of any of the construction phases	Contractor	• Immediately after a construction phase • At any time during operational phase of the underground cables, when maintenance activities might have resulted in pollution
Spread of Alien Invasive Species Degradation of natural habitat through habitat transformation and spread of alien invasive plants negatively affects the end land use requirements, particularly for biodiversity	• Appointment of alien plant working group / assign this duty to specific staff • Alien invasive species that were identified within the servitudes should be removed prior to construction related soil disturbances. This will prevent seed spreading into disturbed soils or to downstream areas • All alien seedlings and saplings must be removed as they become evident for the duration of construction • Manual / mechanical removal is preferred to chemical control • If herbicide must be used it should be registered for aquatic use • Acquire the necessary equipment for removal and control	Contractor	During and after construction phases

Activity / issue	Action required	Responsible party	Frequency
	• Planned sequence of areas to be cleared of invasive plants • A register of the methods used, dates undertaken, as well as herbicides and dosage used must be kept and available on site. The register must also include incidents of poisoning or spillage • Ensure that contractors can identify the relevant plants and are aware of the removal procedures • All construction vehicles and equipment, as well as construction material should be free of plant material. Equipment and vehicles should be thoroughly cleaned other prior to access on to the construction site.		
Sedimentation This is particularly a risk results from cleared areas where vegetation cover can no longer hold, or trap, soils during rain events	• Sedimentation should be prevented though sufficient mitigation throughout construction as well as during the operational phase • If structures are used on sensitive sloped areas it is important that sediment does not pass through these structures e.g. gabions should be lined • Should sedimentation be observed to accumulate and smother vegetation, a wetland specialist should be consulted to find a suitable solution for the specific wetland and its species composition.	Contractor	• During and after construction • During the operational phase of the underground cables as recorded as part of the monitoring phase • •

Table 5: Fauna and flora rehabilitation plan

Phase	Action required		Frequency
Phase 1: Collection of existing plant material	• The provincially protected *Zanthedeschia aethiopica* was recorded adjacent to the bridge supporting Monkor Road over the watercourse. The locality (26° 6'56.67"S and 27°57'23.88"E) might be impacted on by 1a and edge effects from the pipe jacking or drilling.	Contractor	• Pre-construction

Phase	Action required		Frequency
	• This species should be avoided by construction and related activities. The species should be marked or cordoned off in order to protect them from construction activities and machinery. Construction workers should be made aware of the species and the aim to protect them from damage. • If these species are deemed to be under threat from the construction activity, these plants must be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority and as provided for in the Record of Decision). • The Specialist or ECO must identify within the construction footprint any viable plant material that could be used in rehabilitation. *This phase could reduce the need for hydro seeding as well as the risk that natural revegetation does not take place.* • Areas where plants or grass sods will be removed must not be mowed prior to removal • No harvesting should take place outside the area to be disturbed by construction activities • Grass and indigenous vegetation can be removed as sods or runners and stored within transformed vegetation – remove alien invasive vegetation from the sods, prior to removal • Smaller shrubs, trees and bulbs could also be removed and used for rehabilitation. The plants must preferably be removed during the winter months and be replanted by latest springtime. Bulbous plants may be transplanted at any time of the year, although the winter months are preferred. • Do not disturbed large indigenous trees • Grass sods should <u>not</u> be stacked on top of each other. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 4 weeks • Sods should include at least a 50 mm topsoil layer and the roots shall be minimally disturbed. The soil shall be compatible with that removed from the area to be revegetated and shall not have been compacted by heavy machinery		

Phase	Action required		Frequency
	• Indigenous grass seed from the site can be harvested (take care not to include alien invasive plant species). Harvested seed should be dried under cool airy conditions and kept pest free		
Phase 2: Topsoil management	• Where trenches or drilling or pipe jacking entry location will remove soils, the topsoil must always be removed and stored separately from subsoil (up to 30 cm of the upper soils) • Topsoils should be removed (and stored) under dry conditions to avoid excessive compaction • Topsoil handling should be limited to stripping, piling (once), and re-application, within the shortest time frame possible. • Any movement of heavy machinery or vehicles over stored topsoils must be strictly prohibited	Contractor	• Pre-construction, during site clearing
Phase 3: Soil preparation	Prior to re-vegetation the soil should be stabilised and optimised for establishment of vegetation • Do not disturb soil or vegetation in watercourses unnecessary during rehabilitation activities • Once construction is complete, break the surface crust and prevent erosion • Before replacing the topsoils, remove any foreign objects such as concrete or construction materials introduced to the site during the construction • Shape the subsoil to blend in with the surrounding landscape and rip compacted soils to about 20cm • Soil should be stabilised with effective measures, particularly where the construction activities took place upslope from the watercourse **(note the slope south of water crossing 9 are particularly prone to further erosion)** • Apply topsoil evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed to follow the natural contours of the land (in general, topsoils should be reapplied to a depth equal to slightly greater than the topsoil horizon of a pre-selected undisturbed reference site -the minimum depth of topsoil needed for revegetation to be successful is approximately 20 cm) • If the amount of topsoil available is limited, a strategy must be worked to out to optimise revegetation efforts with the topsoil available	Contractor	• Post construction

Phase	Action required		Frequency
	• Prevent compaction of the topsoil • Boulders and rocks removed from the construction footprint should be replaced as part of rehabilitation to help create micro-habitats • Protect all areas susceptible to erosion • Prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas • Erosion channels that may develop must be back-filled and restored to a proper condition • Do not allow erosion to develop on a large scale before taking action • Apply mulch, preferably by hand, to achieve a layer of uniform thickness. Mulch made on site should be used or commercial mulch, depending on the experience and recommendation of the contractor. Ensure that the mulch is weed free • Alternatively, suitable geotextiles or organic erosion mats can be used as necessary, depending on the vegetation used and the experience and expertise of the contractor • Continued monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation • Re-applied topsoils need to be re-vegetated as soon as possible		
Phase 4: Re-vegetation	• After construction the disturbed footprint as well as stockpiled topsoil must be cleared of alien invasive plant species • If filling material is to be used, this should be sourced from areas free of invasive species. • Progressive rehabilitation or a phased approach is recommended whereby rehabilitation takes place continuously as the construction in a specific area is complete and should be implemented where feasible • Revegetation could take place as follows below. It is recommended that at least a combination of the existing seedbank and replanting of vegetation removed prior to construction be implemented.	Contractor	• Post construction or progressively as construction on a certain area is complete

Phase	Action required		Frequency
	• **Existing seed bank** • Revegetation of the prepared area could occur spontaneously to some degree where topsoil could be re-applied within 6 months. Seeds present in the topsoil will germinate over time, however, this will not include a diversity of species and assumes that the seeds are still viable. In addition, the majority of water crossings included alien invasive plant species which seeds will likely also be present in the seedbank • **Replanting of rescued species and collected seeds** • Replant rescued plant species and sods in similar soil conditions and to the same depth as in their original position • Replanting specifications depend on the species involved • Geophytic plants shall be planted in groups or as features in selected areas • During transplanting care shall be taken to limit or prevent damage to roots • Sods shall be protected against drying out and be kept moist from the time of harvesting until they are finally placed • Plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots • No plants or plants with exposed roots shall be subjected to prolonged exposure to drying winds and sun, or subjected to water logging • Replanting and reseeding should ideally coincide with the start of the rainy season, else irrigation will be required • Planting around wetland areas and watercourses should take place during late winter or early spring after the first rains, avoid compaction of the moist soils • A horticulturist or suitably qualified person should supervise and inform planting • **Hydroseeding (planting process that use water-based slurry to establish grass on large areas)** • Re-seeding should coincide with the first rains in the area, otherwise irrigation will be necessary • Species that are well adapted to local climatic and soil conditions should be used according to		

Phase	Action required		Frequency
	the supplier's instructions. It is recommended that the grass mix used contain grass species that were present at the crossings as *Cynodon dactylon, Eragrostis curvula, E capensis, Hetropogon contortus Melinis repens* and*, Hyparrhenia hirta.* • The ratio of the seed mix used for re-vegetation is usually specified by the supplier and based on site conditions • Perennial species should form the basis of the grass mix, while at least one species used must provide rapid and dense ground cover during the establishment season. This is likely to include annual, fast growing species • Protected plant species not re-planted in suitable habitat prior to construction (e.g. due to seasonality issues or rainfall) should be replanted during this phase		
Phase 5: Maintenance and monitoring	• No traffic should be allowed in re-vegetated areas • Designated tracks shall be created for pedestrian of vehicle traffic where necessary • Areas where plants have not established successfully for two growing seasons after the first planting will be replanted • In the absence of regular / weekly rainfall post revegetation, all re-vegetated areas should be irrigated regularly at specified intervals. Irrigation methods should be specified by the contractor and not lead to compaction or erosion of rehabilitated areas • The contractor shall be responsible for maintaining the desired level of moisture necessary to maintain vigorous and healthy growth, while avoiding erosion • The contractor must control all alien/ invasive species and that these species are removed as per an Alien Invasive Management Plan or similar document • During the establishment period, all alien plants will be removed by hand once a month during the first growing season. • Re-vegetated areas must be monitored as per the monitoring plan (Section 7)	Contractor	• Post re-vegetation

6.4 Operational Phase EMPr

Overall Goal: To ensure that the operation of the proposed facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the facility in a way that:

- Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
- Enables the proposed facility operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to traffic and road use, and effects on local residents.
- Minimises impacts on fauna using the site.

An environmental manager must ensure the implementation of the operational EMPr

Table 6: Operational Phase

Activity / issue	Action required	Responsible party	Frequency
Prevent disturbances or damage during operational phase, including maintenance activities	• Planning must ensure that soil or vegetation in watercourses or re-rehabilitated areas are not disturbed unnecessary during operational or maintenance activities • Ensure that maintenance planning does not take place haphazardly, but according to a fixed plan • Maintenance planning to the cables or associated activities may not trample natural vegetation within watercourses and must be restricted to the previously disturbed footprint of construction	Developer	As necessary
Protection of Indigenous natural vegetation, fauna	Vehicle movements must be restricted to designated roadways.	Developer	Continuous
	No disturbance of vegetation outside of the project site must occur.	Developer	Continuous

Activity / issue	Action required	Responsible party	Frequency
	Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways.	Developer	Continuous
	An on-going alien plant monitoring and eradication programme must be implemented, where necessary.	Developer	Continuous
Maintenance of rehabilitation	Rehabilitate disturbance areas should the previous attempt be unsuccessful.	Developer	Continuous
	Maintain erosion control measures implemented during the construction phase (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, and shade nets).	Developer	Continuous
	A fire prevention and management plan must be implemented	Developer	Continuous
	Maintenance schedules should be communicated to the affected property owners, prior to maintenance being undertaken.	Developer	Continuous

Activity / issue	Action required	Responsible party	Frequency
Geohydrology considerations Operation of new HV electrical infrastructure constructed within underground sleeves	• Ensure sleeves was constructed at the required minimum depth and distance away from Watercourse banks • Ensure proper erosion control and/or prevention structures was constructed along crossings with: • a natural migrating character • high susceptibility to natural or induced erosion and • where construction took place in close proximity to the Watercourse banks or the Watercourse stream • Determine the depth of turbidity at each Watercourse where construction will not take place wholly within bedrock, to ensure sleeves are constructed at adequate depths to prevent base flow retardation, scour and subsequent induced flooding	Developer	Continuous
Limit impacts on watercourses	• Storm water should be managed according to the Eskom Guidelines for Erosion Control and Vegetation Management. • Stormwater should not be released into the wetlands river or their buffer zone • Control of alien invasive plants should form part of the maintenance plan • In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water and Sanitation (DWS) must be informed immediately and corrective action taken • Management of point discharges • Pollution control • Maintenance activities should follow best practice • Monitoring for downstream degradation • Apply best practice methods and the mitigation measures specified above for the construction phase	Developer	Continuous

7. MONITORING PROGRAMME

OBJECTIVE: Monitor the performance of the control strategies employed against environmental objectives and standards

The monitoring programme proposes to include:

- Establishing a baseline through the taking of photographs of identified environmental aspects and potential impacts on the watercourse prior to construction
- Bi-weekly monitoring during the first month where after monthly audits will be conducted by the Environmental Control Officer to ensure compliance to the EMP conditions, and where necessary make recommendations for corrective action. These audits can be conducted randomly and do not require prior arrangement with the Project Manager.
- Compilation of an audit report with a rating of compliance with the EMP. The ECO shall keep a photographic record of any damage to areas outside the demarcated site area. The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held liable. All claims for compensation emanating from damage should be directed to the ECO for appraisal.
- The Contractor shall be held liable for all unnecessary damage to the environment. A register shall be kept of all complaints from the Landowners or community. All complaints / claims shall be handled immediately to ensure timeous rectification / payment by the responsible part.

The above monitoring should also integrate wetland fauna and flora monitoring as set out here. Monitoring refers to the repetitive and continued observation, measurement and evaluation of environmental criteria to follow changes over a period of time and to assess the efficiency of control measures. The monitoring plan aims to establish whether rehabilitation was successful, whether maintenance or related activities have impacts and whether the constructed infrastructure have detrimental impacts on the watercourses after construction (**please refer to the rehabilitation and monitoring plan in Appendix D7**).

7.1 Method of Monitoring

The independent ECO will ensure compliance with the EMPr, and will conduct monitoring activities. The ECO will undertake site inspections on a monthly basis or as specified in the environmental authorisation once issued. The ECO will report all non-compliances to the Site Manager and submit such reports to DEA

Once-off Monitoring:

- On completion of construction activities, monitoring should be done in order to record compliance with the targets set out in the EMP and to highlight any areas where further action is required in terms of rehabilitation or routine monitoring

Routine Monitoring:

- Seasonal monitoring: rehabilitation success, as well as signs of erosion, sedimentation and the presence of alien vegetation should be monitored twice during the summer months: once at the start and once at the end of the rainy season. This should be continued for at least three years after construction of the rehabilitation structures was completed.

- Rapid monitoring: For the first two years, monitoring should take place immediately after heavy rainfall to ensure that rehabilitated areas are intact and that no erosion and subsequent sedimentation took place.
- Annual monitoring: after three years, provided that all rehabilitation where found to be successful and no additional problems arose, monitoring can take place once a year after the first seasonal rainfall.

Problems such as failed re-vegetation and erosion should be remediated as soon as it is recorded in the monitoring process. Corrective action should be taken and can include the re-initiation of rehabilitation in severe cases or by correction of the problem. If problems arise due to the cable infrastructure that was not pre-empted in this plan, an engineer, wetland and vegetation specialist should be consulted as soon as possible.
It is recommended that fixed point photography is used to monitor vegetation and soil stability. This involves taking pictures of the areas monitored from the same point during each monitoring event. The images can be compared and serves as a record of the success of rehabilitation or the failure thereof.

7.2 Non Conformance Report

All supervisory stuff and ECO must be provided a means to be able to submit a non-conformance report to the site manager. The non-conformance report will describe in detail, the cause and effect of any environmental non-conformance by the contractor. Records of penalties may be required by the Authorities within 48 hours. The non-conformance report will be updated upon completion of the corrective measures indicated on the finding sheet. The report must indicate that remediation measures have been implemented timeously and that the non-conformance can be closed out to the satisfaction of the site manager and ECO.

7.3 Monitoring Reports

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to DEA for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded if any, corrective action required, and details of those non-conformances or incidents which have been closed out.

7.4 Final Audit Report

A final environmental audit report must be compiled by an independent auditor and be submitted to DEA upon completion of the construction and rehabilitation activities (within 30 days of completion of the construction phase (i.e.: within 30 days of site handover) and within 30 days of completion of rehabilitation activities. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions and the requirements of the EMPr.

8. CONCLUSION

Provided this project is mitigated, as per the EMPr, the project will result in limited negative environmental impacts that can be mitigated through implementation of this EMPr. It is the applicant's responsibility to ensure that this EMPr is made binding on the contractor by including the EMPr in the contract documentation. The contractor must thoroughly familiarise himself with the requirements of the EMPr and appoint an environmental liaison officer (ELO) to oversee the implementation of the EMPr on a day-to-day basis.

Parties responsible for transgression of this EMPr should be held responsible for any rehabilitation that may need to be undertaken. Parties responsible for environmental degradation through irresponsible behaviour/negligence should receive penalties.

Key issues

- The Contractor and Developer must continuously apply all the relevant requirements by the OHSA Act and other legislations;
- Proper warning tape (e.g. orange danger nets) must be erected to inform public of the inherent dangers; and
- Should blasting activities be required on certain areas during foundations excavations, it is important that the relevant permits be obtained and that the adjacent landowners are informed of these planned activities five days in advance and that site notices informing the public are strategically placed at visible locations.

Should any additional recommendations or mitigation measures be reported during the review period of the Draft Basic Assessment Report and this EMPr, such additions will be added to the Draft EMPr that will be submitted along with the Final BAR.

APPENDIX A: AN EXAMPLE OF INCIDENT AND ENVIRONMENTAL LOG

ENVIRONMENTAL INCIDENT LOG				
Date	**Env. Condition**	**Comments** *(Include any possible explanations for current condition and possible responsible parties. Include photographs, records etc. if available)*	**Corrective Action Taken** (*Give details and attach documentation as far as possible)*	**Signature**

COMPLAINTS RECORD SHEET	File Ref: Page of ….	DATE: ……
COMPLAINT RAISED BY:		
CAPACITY OF COMPLAINANT:		
COMPLAINT RECORDED BY:		
COMPLAINT:		
PROPOSED REMEDIAL ACTION:		
ECO: _____ Date: _____		
NOTES BY ECO:		
ECO: _____ Date: _____ Site Manager: _____ Date: _____		

APPENDIX B - REHABILITATION & MONITORING PLAN

Proposed Underground High Voltage Eskom Cables, From Croydon/Germiston. Johannesburg, Gauteng Province.

General rehabilitation- and monitoring plan to mitigate the construction related impacts on wetlands, vegetation and fauna

December 2017

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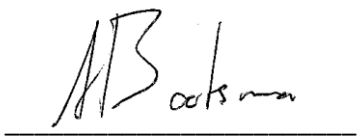
Declaration of Independence

I, **Antoinette Bootsma**, in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member; and
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.



2017.12.30

Antoinette Bootsma (PrSciNat) Date

Ecologist/Botanist

SACNASP Reg. No. 400222-09

Indemnity

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information at the time of study. Therefore, the author reserves the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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Table of Contents

Tables

FIGURES

1 INTRODUCTION

Limosella Consulting was appointed by Envirolution Consulting to undertake a wetland delineation and functional assessment to inform the environmental authorization for the proposed underground high voltage Eskom cables from Croydon/Germiston, Johannesburg, Gauteng Province. Dimela Eco Consulting and Dr. Rautenbach and associates were tasked with the assessment of the fauna and flora components of the environment. This assessment focused on the watercourse crossings associated with the underground cables and not the areas upslope from the crossings. Fieldwork was done in December 2017.

A general rehabilitation and monitoring plan was required to further inform the environmental authorization, to highlight specific rehabilitation and monitoring actions relevant to the proposed activities, as required in the Department of Water and Sanitation's Water Use License Application process and for inclusion into the Environmental Management Plan.

Eskom's proposed scope of work includes (Figure 1 and Table 1):

- Craighall - Germiston North 2 132kV Feeder Cable (Oil Filled)
- Croydon – Bedfordview - Munic 1 132kV Feeder Cable
- Croydon – Bedfordview - Munic 2 132kV Feeder Cable

Table 1: Summary of 8 watercourse crossings, lines and coordinates.

Name of the line	Crossing numbers	Coordinates
Croydon Bedfordview Munic 1 132kV Feeder Cable	1a & 1b	26° 9'46.52"S and 28° 9'0.41"E
Croydon Bedfordview Munic 2 132kV Feeder Cable	1a & 1b	
Croydon Bedfordview Munic 1 132kV Feeder Cable	2a & 2b	26° 9'12.57"S and 28°10'2.86"E
Croydon Bedfordview Munic 2 132kV Feeder Cable	2a & 2b	
Croydon Bedfordview Munic 1 132kV Feeder Cable	3a & 3b	26° 8'53.62"S and 28°10'35.84"E
Croydon Bedfordview Munic 2 132kV Feeder Cable	3a & 3b	
Croydon Bedfordview Munic 1 132kV Feeder Cable	4a & 4b	26° 8'32.70"S and 28°11'18.05"E
Croydon Bedfordview Munic 2 132kV Feeder Cable	4a & 4b	
Craighall Germiston North 2 132kV Feeder Cable (Oil Filled)	5a & 5b	26°11'17.12"S and 28°10'19.56"E

Name of the line	Crossing numbers	Coordinates
Craighall Germiston North 2 132kV Feeder Cable (Oil Filled)	6a & 6b	26°11'5.39"S and 28°10'19.40"E
Craighall Germiston North 2 132kV Feeder Cable (Oil Filled)	7a & 7b	26° 8'52.19"S and 28°11'20.93"E
Craighall Germiston North 2 132kV Feeder Cable (Oil Filled)	8a & 8b	26° 8'38.52"S and 28°11'34.16"E

Two methods for laying the underground cables are proposed, directional drilling and pipe jacking. Below follows a description of the two methods as received from the client.

Directional Drilling

Directional drilling is a controlled horizontal trenchless drilling method by which ducting pipes are installed for underground applications (cables and auxiliary services/equipment) as part of the procedure, after drilling. Underground directional drilling equipment is used to drill holes that correspond to the pipe diameter being installed and is the Eskom preferred method for trenchless road, river, rail and service crossings or where it may not be possible to construct a standard cable trench. This method is limited by a combination of the maximum length of the drilling (+- 80m), depth of drilling and is not suitable to go through large rock formations.

The method involves the following steps:

- A Directional drilling rig and supporting equipment are set-up at the drill entry location determined during the design phase. (This is typically close to, next to or inside the end of an already excavated cable trench, stabilised by wooden shoring.) The directional drilling rig is anchored to the ground surface using anchor stakes. The Directional drilling rig is used to drill (through the use of a drill string, and drill bit for mechanical cutting) a pilot hole through a predetermined drill path comprising of soil and rock. (Drill bits are capable of drilling through minor rock formations.) The drilling is also assisted by a natural fluid mixture of pure clay, oil and water, if required. This fluid is pumped out at low pressure at the tip of the drill head to:
    - Transport drill cuttings to the surface,
    - Clean build-up on the drill bit,
    - Cool the drill bit, Reduce the friction between the drill and bore wall, and
    - Stabilize the bore hole.

- Periodic readings from electronic tracking components situated inside the head of the drill bit are used to determine the horizontal and vertical coordinates along the pilot hole in relation to the initial entry point. The pilot drill path may also be tracked using surface monitoring system. This information can then be used by the drill operator to control the drill bit head from the directional

drilling rig. The drill path can be straight, at an arc or semi-circle, depending on the depth to be achieved and application.

- Once the directional drilling rig and drill bit was successful in breaking the ground surface at the exit location (where another standard cable trench would be), the drill bit is replaced with a back reamer (similar to a drill bit but has a larger cutter head). The drill string is then pulled back through the pilot hole and the back reamer enlarges the diameter of the pilot drill hole. The back reamer may be used over a few passes in order to achieve the desired bore hole diameter. Once the desired bore hole diameter is achieved, the reamer is replaced with a pipe puller and a PVC pipe (composing of a single piece or multiple pieces welded together, +- up to 250mm in diameter) which is then pulled from the exit side of the bore hole to where the directional drilling rig is located. The same fluid as mentioned previously is used during back reaming as well installation of the PVC pipe.

- The PVC pipes installed can now be filled with cable, auxiliary equipment or kept as spares (fitted with non-metallic draw wires and sealed-off). The PVC pipes containing cable and auxiliary equipment may also be filled with bentonite, to allow for good thermal conduction to the surrounding environment.

- Once the above is completed, the cable trench(es) leading to the PVC pipe(s) are backfilled and the surfaces are re-instated.

Pipe Jacking

Pipe jacking is horizontal trenchless hydraulic push method by which concrete pipes are jacked into position, and ducting pipes are installed inside the concrete pipes for underground applications (cables and auxiliary services/equipment). It is the Eskom preferred method for trenchless road, river, rail and service crossings where directional drilling cannot be applied. This method is not as limited as directional drilling, and can be used over long distances, at greater depths and can go through larger rock formations.

The method involves the following steps:

- A pipe jacking rig and supporting equipment are set-up above ground level at the pipe jacking entry location determined during the design phase. (This is typically close to an already excavated cable trench.) The Pipe jacking rig comprises of a crane which is anchored to the ground surface using anchor stakes, and a hydraulic jack installed at the bottom of a shaft. Before pipe jacking can take place, a shaft has to be excavated. The shaft's dimensions must be adequate to allow a concrete pipe (+- Up to 1,5m diameter, +- 2,5m long) to be lowered comfortably in the shaft, to the required depth it must be installed. (The side walls of the shaft is also stabilised using wooden shoring and concrete and is dependent on the soil conditions on-site.) A similar shaft is constructed at the remote end, which is aligned to the designed pipe jacking path.

- Once excavations are done, a concrete pipe is lowered into the shaft. A hydraulic jack at the bottom of the shaft is used to push the concrete pipe horizontally forward, between the beginning and end shafts. Once the concrete pipe has been pushed / jacked into place, hand excavation is used to remove the soil and rock inside the concrete pipe. This process is then repeated by lowering the next concrete pipe, hydraulically jacking the pipe, removing the soil and rock inside it, until a continuous concrete pipe tunnel is constructed between start and end shafts. Concrete screed is used between the individual concrete pipes to seal the concrete pipe tunnel. (Should large rock formations be encountered, the rock can be jack hammered or blasted way.) The direction of the concrete pipe tunnel is carefully controlled through control over the hydraulic jack, to ensure a perfect connection between the start and end shafts.
- Once the concrete pipe tunnel is complete, it is inspected for any defects. PVC pipes in varying diameters (composing of a single piece or multiple pieces welded together, +- up to 250mm in diameter) are then installed inside the concrete pipe tunnel and fixed into place with a bentonite filling. The PVC pipes are inspected for defects after installation. Upon successful completion of the installation, the pipe jacking rig is dismantled and demobilized.

- The PVC pipes installed can now be filled with cable, auxiliary equipment or kept as spares (fitted with non-metallic draw wires and sealed-off). The PVC pipes containing cable and auxiliary equipment may also be filled with bentonite, to allow for good thermal conduction to the surrounding environment.

- Once the above is completed, the cable trench(es) and pipe jacking shaft leading to the PVC pipes are backfilled and the surfaces are re-instated.

1.1 Assumptions and limitations

- This document is based on information as received by Envirolution Consulting.
- The document takes into account likely impacts that can arise during the construction of high voltage underground cables. However, some unique impacts may arise that must be recorded during monitoring and appropriate corrective actions taken.
- Engineering drawings and the specification of rehabilitation structures falls outside of the scope of this general rehabilitation plan.
- This document does not include a high level of detail regarding fauna species since it is assumed that the integrity of vegetation provides the basic requirement for the persistence of fauna species.

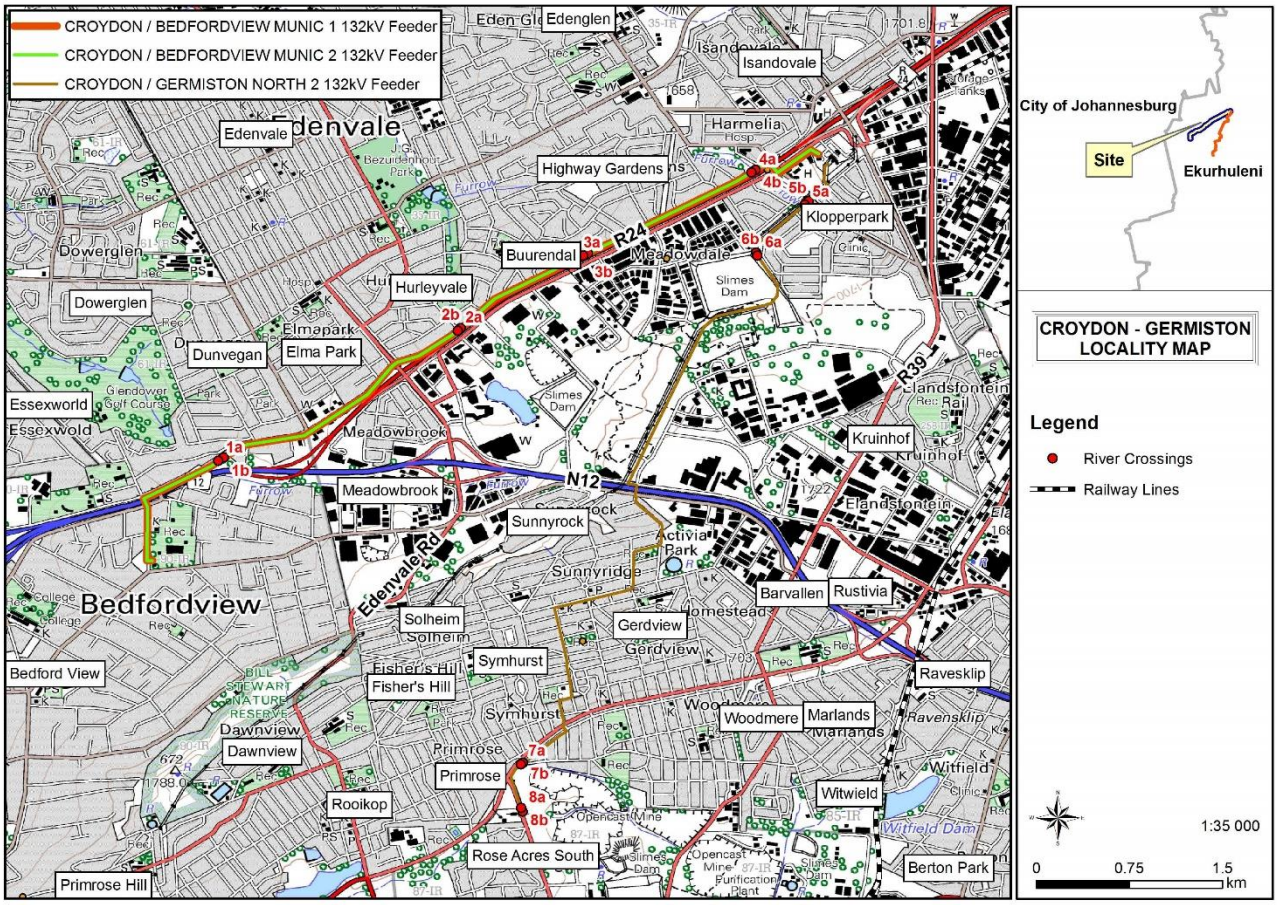

Figure 1: Locality Map

1.2 Objective and aims

This rehabilitation and monitoring plan is specific to the construction of underground high voltage cables. The overall objective is to return the environment in and around the rehabilitated areas to a state as close to the state prior to construction and to limit or negate any construction associated impacts by:

- Ensuring the effective design of rehabilitation infrastructure;
- Ensuring the footprint of the impact on the watercourses and sensitive vegetation is as small as possible;
- Providing guidelines for the re-establishment of vegetation cover with suitable plant species;
- Providing guidance on rehabilitation of areas that are temporarily disturbed during construction; and
- Recommending monitoring and corrective actions in order to mitigate impacts as soon as they become apparent.

2 METHODOLOGY

In order to realise the objective of the rehabilitation plan, it is necessary to limit the impact as much as possible to reduce the need for costly rehabilitation and corrective action. Therefore, mitigation should

already start in the planning phase in order to direct construction to have the least impact possible, reducing follow-up rehabilitation and corrective actions. Therefore, this rehabilitation document comprises of three plans (Table 2):

1. Mitigation Plan: to focus pre-construction planning and activities on limiting the possible impacts that can arise during construction.
2. Rehabilitation Plan: aimed at rehabilitating the areas temporarily disturbed by the construction.
3. Monitoring Plan: aimed at monitoring the success of rehabilitation as well as recording any impacts that may arise during the operational phase of the structures in the watercourse (including maintenance), for which corrective action is needed.

Table 2: Plans in relation to the relevant project phases

Plan	Project Phases
1. Mitigation plan	• Pre-construction planning and activities including design of structures • Construction phases
2. Rehabilitation plan	• Construction: New infrastructure • Operation
3. Monitoring and corrective action	• Construction: New infrastructure • Operation

3 DESCRIPTION OF ENVIRONMENT

3.1 Wetlands

3.1.1 Delineated Water Courses

The study area is located in an urban built up environment with small open areas. These open areas either form part of parks, golf courses or are fenced off to the public. Some of the wetlands are incorporated into green spaces that serves as parks, dog walkways etc. The wetlands in this area are an important feature as they form ecological corridors for dispersal and migration of fauna. It also serves as specialised habitat and breeding areas. The southernmost extent of the proposed line is located adjacent to old mining areas and informal settlements.

Five watercourses and 8 watercourse crossings were studied. Some of the watercourse crossings occur at cement/gabion lined sections of the watercourse. These watercourses were likely natural in the past and were lined in order to flow under highways and roads and as a result large sections of the watercourses currently occur underground. Since the majority of the crossings occur near these cement lined sections of the watercourses it is likely that the proposed underground power cables will have a small impact on the overall health of the watercourses.

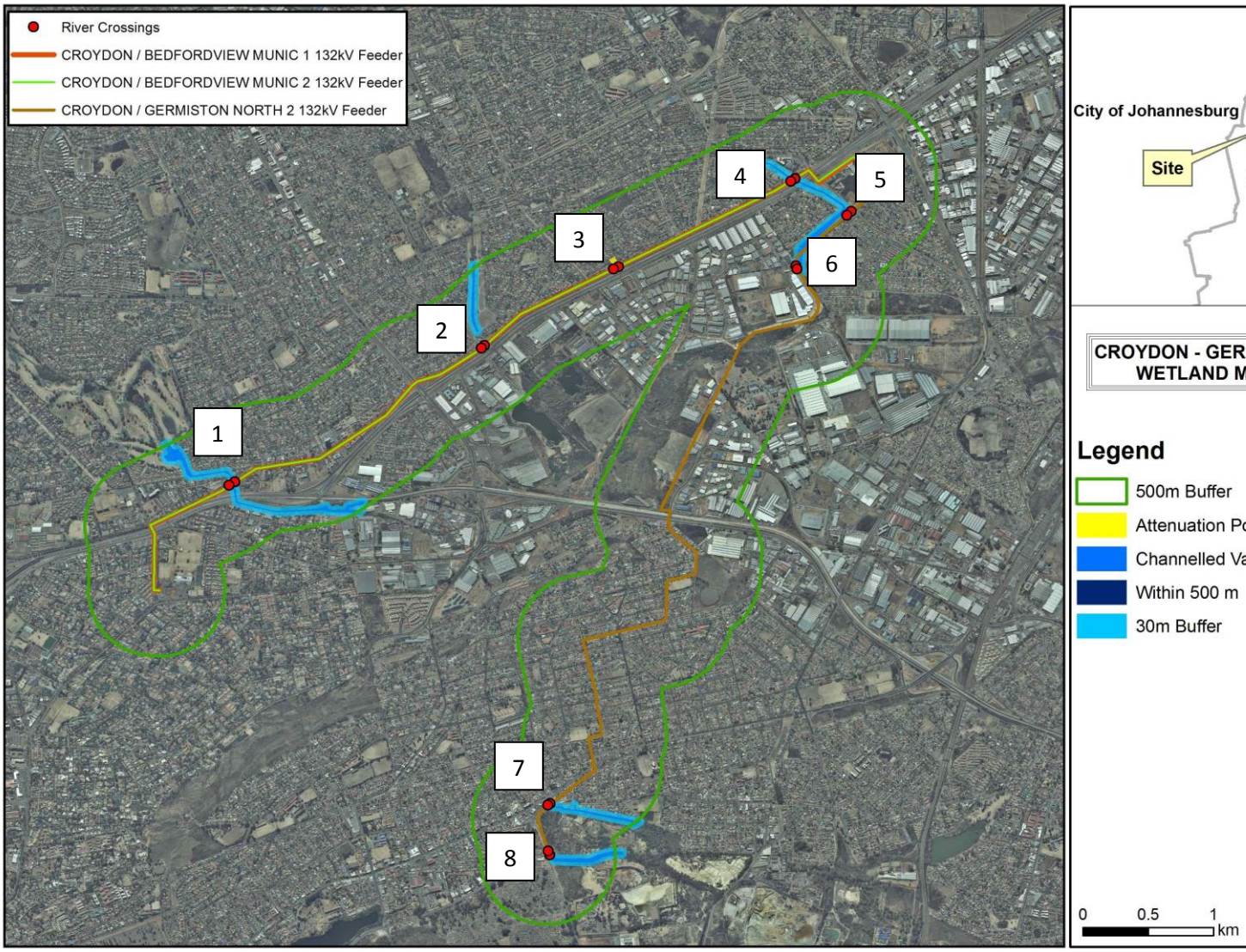

Figure 2: Wetland areas associated with the proposed underground cables.

3.1.2 Wetland Integrity and Function

3.1.2.1 Present Ecological Status (PES)

The PES scores of the wetland system is reflected in the table below (Table 3).

The functionality of the wetlands has been significantly impacted by the increased hardened surfaces in the catchment due to increased development and development encroachment onto the wetlands. This has led to an increase in exotic species in the area, increased sediment and a change in geomorphology. The hydrology has been impacted by the input of foreign materials input from the roads and industrial areas, inadequate stormwater management and run-off from roads and surfaces leading to an increase in hydro-carbon contamination and sediment input. The geomorphology of the wetlands has been impacted by dumped material including rubble and garden refuse, trenches, gullies and many roads and footpaths traversing the wetland. Lastly, the vegetation composition has also been impacted as a result of the changes discussed above. The current species composition is dominated by exotic plants with a few hardy indigenous individuals surviving. Furthermore, the vegetation has also been impacted by grass cutting and

vegetation clearing (reduced surface roughness). It is important to note that the flood peaks of the majority of the wetlands in this area has been greatly altered with flooding occurring regularly often resulting in damages of property and watercourses.

Large sections of the wetlands have been altered and are now lined with gabion or cement with large sections underground.

Table 3: Summary of hydrology, geomorphology and vegetation health assessment for the channelled valley bottom wetland system affected by the proposed activities (Macfarlane *et al*, 2009).

Watercourse Crossing and Associated Wetland	Impact Score	Change Score
1a & 1b – Channelled Valley Bottom 1	5.3	0
PES Category and Projected Trajectory	**D**	→
2a & 2b – Underground Section of Channelled valley Bottom 2	5.8	-1
PES Category and Projected Trajectory	**D**	→
3a & 3b - Underground Section of Channelled valley Bottom	5.9	0
PES Category and Projected Trajectory	**E**	→
4a & 4b - Channelled Valley Bottom 4	5.7	0
PES Category and Projected Trajectory	**D**	→
5a & 5b - Channelled Valley Bottom 4	5.7	0
PES Category and Projected Trajectory	**D**	→
6a & 6b - Channelled Valley Bottom 4	5.7	0
PES Category and Projected Trajectory	**D**	→
7a & 7b - Channelled Valley Bottom 3	7.2	-2
PES Category and Projected Trajectory	**E**	↓
8a & 8b - Channelled Valley Bottom 5	7.1	-2
PES Category and Projected Trajectory	**E**	↓

3.1.2.2 Ecological Importance and Sensitivity (EIS)

The EIS scores for the wetlands studied during the study site visit are summarised below (Tables 4 and 5). The watercourse crossings at 1a & 1b 2a & 2b, 3a & 3b, 4a & 4b, 5a & 5b, 6a & 6b share similar characteristics and were calculated together while the watercourses at 7a & 7b and 8a & 8b also shared similar characteristics and were also calculated together. The wetlands all scored a **1.0 - Low/Marginal**.

Wetlands in this category are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers (DWAF, 2009) (Tables 4 and 5).

Table 4: WIS scores obtained for the wetlands in Quarternary Catchment A21C icluding the EIS score (DWAF, 1999).

Wetland	WETLAND IMPORTANCE AND SENSITIVITY	Importance	Confidence
1a & 1b 2a & 2b, 3a & 3b ,4a & 4b, 5a & 5b, 6a & 6b - Channelled Valley Bottom	Ecological importance & sensitivity	1.0	3.0
	Hydro-functional importance	0.5	3.0
	Direct human benefits	0.2	3.0
	EIS score	**1.0 C/D**	

Table 5: WIS scores obtained for the wetlands in Quarternary Catchment C22B including the EIS score (DWAF, 1999).

Wetland	WETLAND IMPORTANCE AND SENSITIVITY	Importance	Confidence
7a & 7b, 8a & 8b - Channelled Valley Bottom 3	Ecological importance & sensitivity	1.0	3.0
	Hydro-functional importance	0.8	3.0
	Direct human benefits	0.2	3.0
	EIS score	**1.0 C/D**	

3.2 WetEcoServices

The ecosystem services provided by the wetlands on the study site is summarised in Tables 6 to 7 below. The table is listed from the lowest scores to the highest scores:

Table 6: Results and brief discussion of the Ecosystem Services provided by the wetlands located at 1a & 1b 2a & 2b, 3a & 3b ,4a & 4b, 5a & 5b, 6a & 6b

Function	Score	Significance
Cultural significance	0,0	Low
Education and research	0,0	Low
Opportunities	0,0	Low

Function	Score	Significance
Tourism and recreation	0,3	Low
Water supply for human use	0,5	Low
Carbon storage	0,7	Low
Natural resources	0,8	Low
Cultivated foods	0,8	Low
Maintenance of biodiversity	0,9	Low
Streamflow regulation	1,0	Low
Streamflow regulation	1,0	Moderately Low
Nitrate removal	1,1	Moderately Low
Erosion control	1,3	Moderately Low
Phosphate trapping	1,6	Moderately Low
Toxicant removal	1,7	Moderately Low
Sediment trapping	1,9	Moderately Low
Threats	3,0	High

Table 7: Results and brief discussion of the Ecosystem Services provided by the wetlands at 7a & 7b, 8a & 8b

Function	Score	Significance
Carbon storage	0,0	Low
Tourism and recreation	0,0	Low
Education and research	0,0	Low
Opportunities	0,0	Low
Water supply for human use	0,1	Low
Streamflow regulation	0,7	Low
Nitrate removal	1,1	Moderately Low
Maintenance of biodiversity	1,1	Moderately Low
Cultural significance	1,3	Moderately Low

Function	Score	Significance
Erosion control	1,6	Moderately Low
Toxicant removal	1,8	Moderately Low
Flood attenuation	1,9	Moderately Low
Sediment trapping	2,0	Moderate
Phosphate trapping	2,0	Moderate
Cultivated foods	2,0	Moderate
Natural resources	2,4	Moderately High
Threats	3,0	High

3.3 Recommended Ecological Category

Following Rountree *et al*, (2013) the REC is set at **D**. Summary of Findings

Table 8 provides a summary of the results recorded for the wetland system potentially affected by the proposed powerline cables.

Table 8: Summary of results for the wetlands discussed

Classification (Ollis *et al*, 2013)	PES (Macfarlane *et al*, 2007)	EIS (DWAF, 1999)	REC Rountree et al, (2013)	WetEcoServices (3 most prominent scores)	Buffer (GDARD, 2014 and Macfarlane et al, 2015)
1a & 1b 2a & 2b, 3a & 3b ,4a & 4b, 5a & 5b, 6a & 6b – **Channelled Valley Bottom**	D	1.0 C/D	D	Phosphate Trapping 1,6 Toxicant removal 1,7 Sediment trapping 1,9	30 m
7a & 7b and 8a & 8b – **Channelled Valley Bottom**	E	1.0 C/D	D	Phosphate Trapping 2,0 Cultivated foods 2,0 Natural resources 2,4	30 m

3.4 Fauna and Flora

Natural water crossings within the area is expected to comprise mainly moist grassland and riparian areas with some indigenous tree species. However, the wc's were all in a disturbed or modified state. Modified landscapes are regarded as areas where the vegetation structure and composition have been compromised

and are not representative of the reference state. Modified land can range from moderately modified to severely or irreversibly modified. Subsequently, these areas are usually of a poor to fair ecological condition (SANBI, 2016).

The condition of the vegetation at each water crossing followed the following definitions:

Good ecological condition: An ecological condition class in which composition, structure and function are still intact or largely intact. Can apply to a site or an ecosystem (Natural or near natural).

Fair ecological condition: An ecological condition class in which ecological function is maintained even though composition and structure have been compromised (Moderately modified, semi-natural).

Poor ecological condition: An ecological condition class in which ecological function has been compromised in addition to structure and composition. Can apply to a site or an ecosystem (Severely or irreversibly modified).

The vegetation at the eight water crossings was found to be in a moderate to poor ecological state, dominated by alien and invasive plant species and with an altered vegetation structure and species composition (Table 9). Most of the water crossings traverse watercourses that are piped or channelled underneath roads and the crossings will seemingly make use of pavement areas whereby the cable will likely run on top of these structures adjacent to roads i.e. the crossing does not directly impact on vegetation within the watercourse. In addition, no plant species of conservation concern were recorded at either of the water crossings. Most of the water crossings do not provide suitable habitat for such plant species due to altered streambeds and vegetation structure.

Table 9: Summary of vegetation findings at each water crossing

Name of the line	WC	Coordinates	Summary of findings
Croydon Bedfordview Munic 1 132kV Feeder Cable	1	26° 9'46.52"S and 28° 9'0.41"E	Moist grassland with invasive plant species and limited indigenous species. *Phragmites australis* (common reed) dominated on the eastern section of the crossing with some *Typha capensis* (bulrush) present within the streambed. The grass layer was dominated by the exotic *Pennisetum clandestinum* (kikuyu). Vegetation classified as being in a fair ecological condition. A likelihood that *Hypoxis hemerocallidea, Gnapnalium nelsonii a*nd *Crinum bulbispermum* may occur in proximity to the wc, however, none was observed at the time of the site visit.
	2	26° 9'12.57"S and 28°10'2.86"E	Mowed lawns, dominated by the exotic grass *Pennisetum clandestinum* (kikuyu). No natural moist grassland (e.g. wetland vegetation) or riparian vegetation are present and the vegetation is classified as being modified and in a poor ecological condition. No plant species of conservation concern present or suitable habitat.
	3	26° 8'53.62"S and 28°10'35.84"E	Grassland around the water channel is mowed and included indigenous species such as *Hyparhenia hirta* and *Eragrostis curvula*, as well as the exotic *Penisetum clandestinum* along the road edge. The indigenous forb

Name of the line	WC	Coordinates	Summary of findings
			layer was very limited and species within the water channel included the exotic *Conyza* species and *Persicaria capitata*. No natural moist grassland (e.g. wetland vegetation) or riparian vegetation are present and the vegetation is classified as being in a poor ecological condition. No plant species of conservation concern present or suitable habitat.
	4	26° 8'32.70"S and 28°11'18.05"E	Mowed grassland with a number of indigenous grass species flanking the water crossing. However, the watercourse itself comprised *Pennisetum clandestinum* dominated lawn and the exotic tree *Salix babylonica* tree. None was recorded at the small crossing at the time of the site visit and no suitable habitat is present.
Craighall Germiston North 2 132kV Feeder Cable (Oil Filled)	5	26° 8'38.52"S and 28°11'34.16"E	The vegetation at the given point comprised terrestrial grassland with no species indicating moist grassland conditions. Regularly mowed with pedestrian and likely some vehicular traffic. The species diversity was low and dominated by hardy and pioneer species and regarded as being in a poor ecological condition. No plant species of conservation concern present or suitable habitat.
	6	26° 8'52.19"S and 28°11'20.93"E	Moist, channelled grassland, however, the area is likely only temporarily wet with limited hydrophilic species present. Alien invasive plant species were abundant, and the vegetation was classified as being in a fair ecological condition. The channelization likely destroyed species of conservation concern. Although the author has recorded *Crinum bulbispemum* within such channelled watercourses in Gauteng before, this species was not recorded at the time of this site visit and it is unlikely to occur at the water crossing
	7	26°11'5.39"S and 28°10'19.40"E	Modified with some grassland around the storm water channel that constitutes the water crossing. The vegetation was dominated by alien and invasive plant species with limited indigenous species present and in a poor ecological condition. No plant species of conservation concern present or suitable habitat.
	8	26°11'17.12"S and 28°10'19.56"E	The vegetation comprised degraded moist grassland dominated by alien and invasive plant species with limited indigenous species present. Indigenous plants were mostly grasses and weedy, pioneer forb species and the vegetation is classified as being in a poor ecological condition. The area is regarded as too degraded for plant species of conservation concern to persist

4 EXPECTED IMPACTS

4.1 Wetlands

The expected impacts are primarily centred around the damage caused to the wetlands by the drill rigs for Directional Drilling and Pipe Jacking. The two proposed methods are very similar in the effect they are likely to have on the wetland system although Pipe Jacking will probably have a larger disturbance footprint where the drilling rigs will be set up. For this reason, **directional drilling is preferred**. However, it is important to note that this is not a very significant difference. Should Pipe Jacking be better suited to the project due to other constraints, this method is not considered altogether unsuitable and disturbance of a larger footprint may be effectively rehabilitated.

The valley bottom wetlands will potentially be impacted in the following ways:

- Changes in water flow regime due to the alteration of surface characteristics
- Changes in water quality due to toxic contaminants and increased nutrient levels entering the system.
- Changes in the amount of sediment entering and exiting the system.
- Loss and disturbance of wetland habitat and fringe vegetation.
- Introduction and spread of alien invasive vegetation.

4.2 Vegetation

The hydrological processes within watercourses are closely associated with the intactness of the vegetation within and surrounding these areas. Although the vegetation was observed to be modified and dominated by alien and invasive plant species, it still plays an important role in flood attenuation, prevent soil erosion and sedimentation of water courses and promote the uptake of toxins from the water.

Both proposed technologies to install the cable over water courses, directional drilling and pipe jacking, will have an above ground impact on the vegetation on either side of the water course (the drill entry location or the pipe jacking entry location). Thus, from a vegetation perspective, the method with the smallest above ground footprint is preferred (likely directional drilling), while the entry locality should avoid all indigenous trees.

The greatest impact that the proposed cable is envisaged to have at the water crossings is the potential to lead to deterioration of soil conditions, an increase in alien and invasive plant species, barren soils leading to erosion and sedimentation of the watercourse. In addition, gabion structures at water crossing 6 should not be disturbed during the construction as it could destabilise vegetation and soils.

5 MITIGATION PLAN

Degradation to the environment resulting from habitat transformation negatively impacts on the end land-use requirements, particularly in terms of biodiversity. On site mitigation and effective design of structures can limit the impact of construction and operational activities and reduce the need for expensive rehabilitation and the need for corrective action. In addition, sedimentation is very difficult and sometimes impossible to rehabilitate without further impacting on watercourses. Therefore, sedimentation should be

prevented through mitigation. Table 10 lists the mitigation measures that should be implemented during the planning and construction phase in order to limit the need for rehabilitation. Central to the mitigation is to create environmental awareness with all workers on the project.

Table 10: Mitigation plan

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated

Pre-construction planning	Structure design at watercourse crossings	• Confirm the presence of dispersive soils and ensure appropriate design of structures
		• Care should be taken at the design phase that effective erosion control and other structures be implemented
		• Structures should take into account for
		  ○ pH (high pH can be corrosive to concrete)
		  ○ slopes of channels and the effect of bends in these channels in terms of potential erosion formation

	Limit the footprint of access roads and constructing camps, as well as the drilling or pipe jacking entry locations thereby reducing compaction and destruction of semi-natural vegetation	• Project engineers should compile a method statement, outlining the construction methodologies. The required mitigation measures to limit the impacts on the, as well as the associated buffers should be contained within the method statement. The method statement must be approved by the ECO and be available on site for reference purposes • The footprint of construction through all vegetation should be kept to a minimum to avoid unnecessary removal of vegetation • Planning of the construction site must include eventual rehabilitation / restoration of vegetative cover and monitoring for alien invasive species • Avoid linear disturbances that run parallel to a watercourse • Plan access roads in such a way as to minimise impact on watercourses • Plan construction activities that necessitate water crossings to only cross watercourses at designated points • Plan construction camps to be placed outside of watercourses and their associated buffer zones
	Limit the footprint of construction thereby reducing compaction and destruction of natural vegetation	<u>Wetlands:</u> • Access roads must be restricted in wetland areas and buffers. These access areas must be designated in the planning phase to prevent contractors taking “short-cuts” through wetland areas and buffers • Construction within wetlands and buffers must be planned to take place in the drier winter months

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated
		• Plan construction activities to have the smallest possible footprint • No stockpile areas should be located within wetland boundaries, or within the associated buffer zone • No vehicles and access of persons should be allowed through any wetland, except where approved by the relevant authority <u>Fauna and flora:</u> • Plan to demarcate the construction area and ensure that no disturbance to vegetation and soils outside of the planned construction site take place. • Maintain site demarcations in position until the cessation of construction work. • Gabions stabilising water courses should not be disturbed during the construction as it could destabilise vegetation and soils.
	Avoid or rescue and relocate protected species	The construction of the underground cable could result in the removal of plant species of conservation concern; however, no such species were recorded at the water crossings and it is highly unlikely to occur. However, some areas could not be accessed and in others, invasive species could have obscured cryptic species. As the cable will likely be drilled or pipe jacked underneath the watercourse, it is the vegetation adjacent to the watercourse where machinery will be placed that are of concern. Most of these areas were also in a poor condition, however, the exact footprint of such areas was not known. Thus, the following is recommended: • Vegetation around water crossing 1 may support plant species of conservation concern. Although the probability is low, as best practice, it is recommended that the machinery footprint adjacent to watercourses (e.g. terrestrial vegetation) be scanned during the growing period of such species that may occur. • If found to be present these plants must be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation after the construction (Note, these plants may only be removed with the permission of the provincial authority). • Construction workers may not tamper or remove these plants, and neither may anyone collect seed from the plants without permission from the local authority. • It is recommended that the plants be relocated during winter when they are dormant. If the plants are not visible, they could be located by the markers and coordinates that the specialist recorded in the search phase • Specific requirements for rescue and relocation will depend on

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated
		the species recorded and should be specified by the botanist/ecologist that located the species, or a suitably qualified horticulturist • If removed species are used as part of rehabilitation, their survival must be monitored for at least two growing seasons after rehabilitation was completed • The new localities should be marked, and the coordinates recorded • A record of the number and new localities of each species should be kept. The survival of the relocated species must be monitored during construction and at least for three years during the operational phase
	Sourcing of plant material for rehabilitation purposes	• Vegetation, particularly grass sods, can be rescued and used to rehabilitate disturbed areas back to the state it was prior to construction. This could save costs and ensure a diversity of species. • The planning pre-construction should make provision for the collection of such species for re-vegetation as well as for the use as mulch • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area
	Removal of topsoil for rehabilitation purposes	• Prior to construction, the topsoil must be removed and stored separately from subsoil. The topsoil is imperative for the successful re-establishment of indigenous vegetation • Where possible, collect boulders and rocks from the sites to be cleared for construction and stockpile prior to the commencement of construction activities
Construction phases	Limit the construction footprint and related impacts	• Only use access roads as designated during the planning phase • Only cross watercourses at designated points • Crossings to be undertaken with only one vehicle that have the minimum footprint as decided on during planning • Limit the removal of indigenous vegetation around the construction footprint and keep demarcations to prevent access to rocky outcrops in place • Limit compaction by not working in wet conditions and limiting vehicular access • Do not permit vehicular or pedestrian access into natural areas or into seasonally wet areas during and immediately after rainy periods, until such a time that the soil has dried out (DAWF, 2005) • Watercourse boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete • Only necessary traffic should be allowed within these

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated
Construction phases		demarcated areas • Limit clearing of vegetation between servitude and construction camps • Contractors should refrain from impacting areas beyond the demarcated construction area • A temporary fence or demarcation must be erected around the construction area (include the servitude, construction camps, areas where material is stored and the actual footprint of the drilling or pipe jacking entry location) • Minimise disturbance and loss of soil • No materials are allowed to be stored on wetlands or wetland buffer areas • The contractor must avoid traffic or storing of equipment and material in vegetated areas that will not be cleared • No open fires or harvesting plants or trees for firewood are permitted

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated
Construction phases	Prevention of pollution	• Contractors responsible for construction and maintenance in close vicinity to wetland areas must sign a declaration stating that they will adhere to all stipulations of the Environmental Management Plan relating to wetland / stream crossings as well as measures as set out by this report • The contractors must provide and maintain a method statement for "cement and concrete batching". The method statement must provide information on proposed location, storage, washing & disposal of cement, packaging, tools and plant storage • Cement should only be mixed within mixing trays. Washing and cleaning of equipment should also be done within a bermed area, in order to trap any cement or plaster and avoid excessive soil erosion. These sites must be rehabilitated prior to commencing the operational phase • The mixing of concrete should only be done at specifically selected sites on mortar boards or similar structures to contain run-off into drainage lines, streams and natural vegetation • Materials such as fuel, oil, paint, herbicide and insecticides must be sealed and stored in bermed areas or under lock and key, as appropriate, in well-ventilated areas • These substances must be confined to specific and secured areas within the contractor's camp, and in a way that does not pose a danger of pollution even during times of high rainfall • Storage of materials as described above may not be within the 1:100 floodline, watercourses or associated buffer areas • In the case of pollution of any surface or groundwater, the Regional Representative of the Department of Water and Sanitation (DWS) must be informed immediately and corrective action taken • All equipment should be parked overnight and/or fuelled at least 500 meters from a watercourse • Drip trays (minimum of 10cm deep) must be placed under all vehicles that stand for more than 24 hours. Vehicles suspected of leaking must not be left unattended, utilise drip trays • Drip trays must be utilised during repairs and maintenance of all machinery. The depth of the drip tray must be determined considering the total amount / volume of oil in the vehicle. The drip tray must be able to contain the volume of oil in the vehicle. • Provision of adequate sanitation facilities located outside of the wetland/riparian area or its associated buffer zone • Remove all construction equipment and material on completion of construction • No water should be abstracted from any river / wetland • Run-off from the camp site must not discharge into neighbours' properties or into adjacent wetlands, rivers or streams • Management of on-site water use and prevent stormwater or contaminated water directly entering the watercourse • Management of point discharges

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated
	Prevent/limit sedimentation	• Contractors responsible for constructing in close vicinity to wetland areas along the route must sign a declaration stating that they will adhere to all stipulations of the Environmental Management Plan relating to wetland / stream crossings as well as measures as set out by this report • Increased run-off during construction must be managed using berms and other suitable structures as required to ensure flow velocities are reduced; this must be done in consultation with the ECO • The contractor shall ensure that excessive quantities of sand, silt and silt-laden water do not enter watercourses. Appropriate measures, e.g. erection of silt traps, or drainage retention areas to prevent silt and sand entering drainage or watercourses must be taken • Sediment barriers should be installed immediately after initial disturbance of the watercourse or adjacent upland • Where wetlands are adjacent to the construction areas and these areas slopes toward the wetland, install sediment barriers along the edge of the construction areas as necessary to prevent sediment flow into the wetland. • Sediment barriers must be properly maintained throughout construction and reinstalled as necessary until replaced by permanent erosion controls or restoration of adjacent upland areas is complete • It is important that topsoil should be conserved in areas where bedrock is shallow to avoid sedimentation • Run-off from the camp site must not discharge into neighbours' properties or into adjacent wetlands, rivers or streams.
	Persistence of fauna species	• The areas earmarked for exclusion from development must be fenced off during the construction phase to ensure that the developer and his contractors do not damage these areas or do not cover them with soil, builders' rubble or waste. • Trees naturally growing in the wetlands should be retained • Outside lighting should be designed to minimize impacts on important pollinators. All outside lighting should be directed away from sensitive areas. • Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible. • Where possible, work should be restricted to one area at a time, as this will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories. • Where possible the construction of the proposed development should take place during the winter months during the time when most avifaunal species are not breeding.

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated
		• The contractor must ensure that no fauna is disturbed, trapped, hunted or killed during the construction phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
	Prevent destruction of protected species	• Construction workers must be instructed to minimise disturbance of birds at all times. • Illegal hunting of birds must be strictly prevented • If any bulbous or succulent species are unearthed by construction, these should be identified by an ecologist/botanist. If the species are found to be of conservation concern, the Gauteng Department of Agriculture and Rural, Development should be consulted for a permit to either replant the species or relocate them to suitable habitat
	Preventing spread of alien invasive plants	Several invasive species are present at each water crossing. To successfully eradicate these, the catchment and upstream areas also needs to be cleared, which falls outside of the scope of Eskom's mandate. It is thus recommended that the disturbance footprint be monitored for any additional species that could have been introduced to the watercourses because of the proposed project and these be eradicated as soon as it becomes apparent. • Construction equipment must be cleaned prior to site access. This will prevent alien invasive seed from other sites to spread into disturbed soils • Alien invasive species, in particular category 1b species that were identified within the study area, should be removed from the development footprint and immediate surrounds, prior to construction or soil disturbances. By removing these species, the spread of seeds will be prevented into disturbed soils which could thus have a positive impact on the surrounding natural vegetation. • Manual removal is preferred to chemical control, particularly in the moist grassland. • Only suitably trained contractors (e.g. certified by the South African green Industries Council (SAGIC)) with knowledge of the species in question should be employed. • All alien seedlings and saplings must be removed as they become evident for the duration of construction. • If filling material is to be used, this should be sourced from areas free of invasive species.

Project Phase	Mitigation Objective	Mitigation to Limit Impact and Size of the Area to be Rehabilitated
Operational phase	Prevent disturbances or damage during operational phase, including maintenance activities	• Planning must ensure that soil or vegetation in watercourses or re-rehabilitated areas are not disturbed unnecessary during operational or maintenance activities • Ensure that maintenance planning does not take place haphazardly, but according to a fixed plan • Maintenance planning to the cables or associated activities may not trample natural vegetation within watercourses and must be restricted to the previously disturbed footprint of construction

6 REHABILITATION PLAN

Rehabilitation in this document refers to the reinstatement of the temporarily disturbed areas affected by the construction, or due to construction related activities, to a state that resemble the conditions prior to the disturbances. It therefore does not address the rehabilitation of the watercourses from for example a management category D to a C (Kleynhans, 1996 & Kleynhans, 1999). In order to improve the management category, the current impacts due to urbanisation and other anthropogenic impacts should be address and these fall outside the scope of this document.

This wetland rehabilitation plan recognises two phases of rehabilitation:

- Phase 1: Construction associated with installation of the underground cables; and
- Phase 2: Operation, in particular where water movement causes erosion or wetland degradation of any sort as identified during the monitoring phase described below

Table 11 lists the wetland rehabilitation measures that should be undertaken post construction as well as corrective action when monitoring has established that the listed impacts are taking place.

The vegetation rehabilitation aims to ensure the successful re-establishment of first / initial vegetation cover with indigenous plant species that naturally occur within the area. This will reduce the risk of soil degradation and invasion by alien invasive plant species, as well as degradation of the proximate watercourse.

The vegetation rehabilitation comprises three phases:

- Phase 1: Collection / rescue of species within the development footprint that can be utilised for rehabilitation (prior to construction);
- Phase 2: Topsoil management
- Phase 3: Soil preparation
- Phase 4: Establishment of vegetation and prevention of the spread of invasive plant species
- Phase 5: Maintenance

Table 12 list the vegetation rehabilitation measures that are recommended.

Table 11: Wetland rehabilitation plan

Impacts	Rehabilitation	Time frame
Destruction of vegetation Areas where vegetation will be impacted include the area directly impacted on by drill rigs and crew camps	• Access roads must be restricted in wetland areas and buffers. Only use access as designated during the planning phase • Disturb as little of the vegetation as possible. Where vegetation needs to be removed, remove as sods that can be replanted as part of the rehabilitation of disturbed areas • Temporary measures should be taken to prevent topsoil from washing away during rainfall • Where structures are installed in areas that slope towards wetlands, the slops must be re-vegetated by either using removed sods or by seeding with a grass mixture containing species naturally occurring in the area. Sloped areas where vegetation has been removed or destroyed should be replanted immediately after the initial disturbance to reduce the potential of erosion or invasion of the disturbed soils by alien invasive plant species	• Immediately after installation of rehabilitation infrastructure • As and when monitoring indicate degradation of vegetation or failure of the rehabilitation

Erosion
Erosion and sedimentation is likely to occur where vegetation has been cleared and where excavated material is stored in close proximity to a watercourse. Disturbance of steep slopes by the removal of vegetation may result in slope instability and erosion by rain and surface run-off.
	• The contractor shall be responsible for rehabilitating all eroded areas in such a way that the erosion potential is minimised after construction has been completed
	• All slopes that are disturbed during construction should be stabilised immediately to prevent erosion
	• Re-vegetation should be done immediately after construction, especially in sloped areas
	• Disturbances on site should be kept to a minimum to reduce the loss of material by erosion
	• Disturbed areas that require rehabilitation should be mulched to encourage vegetation re-growth.
	• Stockpiled soil should be protected from erosion due to water runoff
	• Near vertical slopes of 1(V):1(H) or 1(V):2(H) must be stabilised using hard structures, preferably with a natural look, and with facilities allowing for plant growth. The EO / ECO will specify a solution in terms of the most appropriate approved method and technology. One or more of the following methods may be required:
	  ○ Retaining walls (loffel or otherwise) (DWAF 2005)
	  ○ Stone pitching.
	  ○ Gabions.
		• During and immediately after any construction phase
		• As and when monitoring indicate erosion is taking place during the operation al phase of the underground cables

Impacts	Rehabilitation	Time frame
	○ Shotcrete. • Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within work areas • Where access cannot be avoided into sensitive areas, the amount of vehicle and personnel traffic should be kept to a minimum and should make use of only one route • Where crossings of watercourses are unavoidable eco-friendly soft options (such as wooden poles) should be placed over the wet area to be driven over • Where all preventative measures have failed and erosion persists soft and hard rehabilitation options, such as eco-logs or weirs, should be considered in conjunction with an engineer and wetland specialist • Erosion control of all banks must take place so as to reduce erosion and sedimentation into river channels or wetland areas.	
Soil Compaction Soil compaction is likely to occur on access roads, and temporary work platforms where heavy vehicles and personnel move around. Soil compaction will decrease permeability of the soil, negatively impact the sub-surface flows and compromise vegetation establishment.	• Areas where soil has been compacted should be ripped to encourage vegetation growth • Ripping shall be done to a depth of 250 mm in two directions at right angles. • Do not rip and / or scarify areas under wet conditions, as the soil will not break up and compaction will be worsened • Do not permit vehicular or pedestrian access into natural areas or into seasonally wet areas during and immediately after rainy periods, until such a time that the soil has dried out (DAWF, 2005) • Rip and / or scarify all disturbed (and other specified) areas of the construction site, including temporary access routes and roads, compacted during the execution of the Works. (DWAF, 2005)	• Immediately after any construction phase • As and when monitoring indicate severe compaction due to maintenance
Mobilisation of pollutants The mobilisation of sediments, excavations, removal and disturbances to vegetation, mobilisation of sulphur,	• In case of emergencies or unforeseen events, the problem must be remediated immediately and any spillage into any watercourses be reported to the Department of Water Affairs. In addition, the soil must be stabilised (import additional topsoil if necessary) and re-vegetated as soon as possible. Re-vegetation should include seeds from the adjacent grassland and any rescued protected plants and/or plants of conservation concern that might have been impacted upon by the emergency /	• Immediately after a construction phase • At any time during operational phase of the underground cables, when maintenance

Impacts	Rehabilitation	Time frame
hydrocarbon and pyrite compounds could have various negative impacts on wetlands and their associated functionality.	unforeseen event. • Remove all project-related material / support equipment immediately on completion of any of the construction phases	activities might have resulted in pollution
Spread of Alien Invasive Species Degradation of natural habitat through habitat transformation and spread of alien invasive plants negatively affects the end land use requirements, particularly for biodiversity	• Appointment of alien plant working group / assign this duty to specific staff • Alien invasive species that were identified within the servitudes should be removed prior to construction related soil disturbances. This will prevent seed spreading into disturbed soils or to downstream areas • All alien seedlings and saplings must be removed as they become evident for the duration of construction • Manual / mechanical removal is preferred to chemical control • If herbicide must be used it should be registered for aquatic use • Acquire the necessary equipment for removal and control • Planned sequence of areas to be cleared of invasive plants • A register of the methods used, dates undertaken, as well as herbicides and dosage used must be kept and available on site. The register must also include incidents of poisoning or spillage • Ensure that contractors can identify the relevant plants and are aware of the removal procedures • All construction vehicles and equipment, as well as construction material should be free of plant material. Equipment and vehicles should be thoroughly cleaned other prior to access on to the construction site.	• During and after construction phases
Sedimentation This is particularly a risk results from cleared areas where vegetation cover can no longer hold, or trap, soils	• Sedimentation should be prevented though sufficient mitigation throughout construction as well as during the operational phase • If structures are used on sensitive sloped areas it is important that sediment does not pass through these structures e.g. gabions should be lined	• During and after construction • During the operational phase of the underground cables as recorded as part of the

Impacts	Rehabilitation	Time frame
during rain events	• Should sedimentation be observed to accumulate and smother vegetation, a wetland specialist should be consulted to find a suitable solution for the specific wetland and its species composition.	monitoring phase

Table 12: Fauna and flora rehabilitation plan

Phase	Rehabilitation	Time frame
Phase 1: Collection of existing plant material	• The Specialist or ECO must identify within the construction footprint any viable plant material that could be used in rehabilitation. *This phase could reduce the need for hydro seeding as well as the risk that natural revegetation does not take place.* • Areas where plants or grass sods will be removed must not be mowed prior to removal • No harvesting should take place outside the area to be disturbed by construction activities • Grass and indigenous vegetation can be removed as sods or runners and stored within transformed vegetation – remove alien invasive vegetation from the sods, prior to removal • Smaller shrubs, trees and bulbs could also be removed and used for rehabilitation. The plants must preferably be removed during the winter months and be replanted by latest springtime. Bulbous plants may be transplanted at any time of the year, although the winter months are preferred. • Do not disturbed large indigenous trees • Grass sods should not be stacked on top of each other. Once construction is completed, these sods should be used to rehabilitate the disturbed areas from where they have been removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 4 weeks • Sods should include at least a 50 mm topsoil layer and the roots shall be minimally disturbed. The soil	• Pre-construction

Phase	Rehabilitation	Time frame
	shall be compatible with that removed from the area to be revegetated and shall not have been compacted by heavy machinery • Indigenous grass seed from the site can be harvested (take care not to include alien invasive plant species). Harvested seed should be dried under cool airy conditions and kept pest free	
Phase 2: Topsoil management	• Where trenches or drilling or pipe jacking entry location will remove soils, the topsoil must always be removed and stored separately from subsoil (up to 30 cm of the upper soils) • Topsoils should be removed (and stored) under dry conditions to avoid excessive compaction • Topsoil handling should be limited to stripping, piling (once), and re-application, within the shortest time frame possible. • Any movement of heavy machinery or vehicles over stored topsoils must be strictly prohibited	• Pre-construction, during site clearing
Phase 3: Soil preparation	Prior to re-vegetation the soil should be stabilised and optimised for establishment of vegetation • Do not disturb soil or vegetation in watercourses unnecessary during rehabilitation activities • Once construction is complete, break the surface crust and prevent erosion • Before replacing the topsoil, remove any foreign objects such as concrete or construction materials introduced to the site during the construction • Shape the subsoil to blend in with the surrounding landscape and rip compacted soils to about 20cm • Soil should be stabilised with effective measures, particularly where the construction activities took place upslope from the watercourse • Apply topsoil evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed to follow the natural contours of the land (in general, topsoil should be reapplied to a depth equal to slightly greater than the topsoil horizon of a pre-selected undisturbed reference site -the minimum depth of topsoil needed for revegetation to be successful is approximately 20 cm) • If the amount of topsoil available is limited, a strategy must be worked to out to optimise revegetation efforts with the topsoil available	• Post construction

Phase	Rehabilitation	Time frame
	• Prevent compaction of the topsoil • Boulders and rocks removed from the construction footprint should be replaced as part of rehabilitation to help create micro-habitats • Protect all areas susceptible to erosion • Prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas • Erosion channels that may develop must be back-filled and restored to a proper condition • Do not allow erosion to develop on a large scale before taking action • Apply mulch, preferably by hand, to achieve a layer of uniform thickness. Mulch made on site should be used or commercial mulch, depending on the experience and recommendation of the contractor. Ensure that the mulch is weed free • Alternatively, suitable geotextiles or organic erosion mats can be used as necessary, depending on the vegetation used and the experience and expertise of the contractor • Continued monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation • Re-applied topsoils need to be re-vegetated as soon as possible	
Phase 4: Re-vegetation	• After construction the disturbed footprint as well as stockpiled topsoil must be cleared of alien invasive plant species • If filling material is to be used, this should be sourced from areas free of invasive species. • Progressive rehabilitation or a phased approach is recommended whereby rehabilitation takes place continuously as the construction in a specific area is complete and should be implemented where feasible • Revegetation could take place as follows below. It is recommended that at least a combination of the existing seedbank and replanting of vegetation removed prior to construction be implemented.	• Post construction or progressively as construction on a certain area is complete

Phase	Rehabilitation	Time frame
	• **Existing seed bank** • Revegetation of the prepared area could occur spontaneously to some degree where topsoils could be re-applied within 6 months. Seeds present in the topsoil will germinate over time, however, this will not include a diversity of species and assumes that the seeds are still viable. In addition, the majority of water crossings included alien invasive plant species which seeds will likely also be present in the seedbank • **Replanting of rescued species and collected seeds** • Replant rescued plant species and sods in similar soil conditions and to the same depth as in their original position • Replanting specifications depend on the species involved • Geophytic plants shall be planted in groups or as features in selected areas • During transplanting care shall be taken to limit or prevent damage to roots • Sods shall be protected against drying out and be kept moist from the time of harvesting until they are finally placed • Plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots • No plants or plants with exposed roots shall be subjected to prolonged exposure to drying winds and sun, or subjected to water logging • Replanting and reseeding should ideally coincide with the start of the rainy season, else irrigation will be required • Planting around wetland areas and watercourses should take place during late winter or early spring after the first rains, avoid compaction of the moist soils • A horticulturist or suitably qualified person should supervise and inform planting • **Hydroseeding (planting process that use water-based slurry to establish grass on large areas)** • Re-seeding should coincide with the first rains in the area, otherwise irrigation will be necessary	

Phase	Rehabilitation	Time frame
	• Species that are well adapted to local climatic and soil conditions should be used according to the supplier's instructions. It is recommended that the grass mix used contain grass species that were present at the crossings as *Cynodon dactylon, Eragrostis curvula, E capensis, Hetropogon contortus Melinis repens* and*, Hyparrhenia hirta.* • The ratio of the seed mix used for re-vegetation is usually specified by the supplier and based on site conditions • Perennial species should form the basis of the grass mix, while at least one species used must provide rapid and dense ground cover during the establishment season. This is likely to include annual, fast growing species • Protected plant species not re-planted in suitable habitat prior to construction (e.g. due to seasonality issues or rainfall) should be replanted during this phase	
Phase 5: Maintenance and monitoring	• No traffic should be allowed in re-vegetated areas • Designated tracks shall be created for pedestrian of vehicle traffic where necessary • Areas where plants have not established successfully for two growing seasons after the first planting will be replanted • In the absence of regular / weekly rainfall post revegetation, all re-vegetated areas should be irrigated regularly at specified intervals. Irrigation methods should be specified by the contractor and not lead to compaction or erosion of rehabilitated areas • The contractor shall be responsible for maintaining the desired level of moisture necessary to maintain vigorous and healthy growth, while avoiding erosion • The contractor must control all alien/ invasive species and that these species are removed as per an Alien Invasive Management Plan or similar document • During the establishment period, all alien plants will be removed by hand once a month during the first growing season. • Re-vegetated areas must be monitored as per the monitoring plan (Section 7)	• Post re-vegetation

7 MONITORING PLAN

The monitoring programme propose to include:

- Establishing a baseline through the taking of photographs of identified environmental aspects and potential impacts on the watercourse prior to construction
- Bi-weekly monitoring during the first month where after monthly audits will be conducted by the Environmental Control Officer to ensure compliance to the EMP conditions, and where necessary make recommendations for corrective action. These audits can be conducted randomly and do not require prior arrangement with the Project Manager.
- Compilation of an audit report with a rating of compliance with the EMP. The ECO shall keep a photographic record of any damage to areas outside the demarcated site area. The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held liable. All claims for compensation emanating from damage should be directed to the ECO for appraisal.
- The Contractor shall be held liable for all unnecessary damage to the environment. A register shall be kept of all complaints from the Landowners or community. All complaints / claims shall be handled immediately to ensure timeous rectification / payment by the responsible part

The above monitoring should also integrate wetland fauna and flora monitoring as set out here. Monitoring refers to the repetitive and continued observation, measurement and evaluation of environmental criteria to follow changes over a period of time and to assess the efficiency of control measures. The monitoring plan aims to establish whether rehabilitation was successful, whether maintenance or related activities have impacts and whether the constructed infrastructure have detrimental impacts on the watercourses after construction (Table 13).

Once-off Monitoring:

1. On completion of construction activities, monitoring should be done in order to record compliance with the targets set out in the EMP and to highlight any areas where further action is required in terms of rehabilitation or routine monitoring

Routine Monitoring:

2. Seasonal monitoring: rehabilitation success, as well as signs of erosion, sedimentation and the presence of alien vegetation should be monitored twice during the summer months: once at the start and once at the end of the rainy season. This should be continued for at least three years after construction of the rehabilitation structures was completed.

3. Rapid monitoring: For the first two years, monitoring should take place immediately after heavy rainfall to ensure that rehabilitated areas are intact and that no erosion and subsequent sedimentation took place.

4. Annual monitoring: after three years, provided that all rehabilitation where found to be successful and no additional problems arose, monitoring can take place once a year after the first seasonal rainfall.

Problems such as failed re-vegetation and erosion should be remediated as soon as it is recorded in the monitoring process. Corrective action should be taken and can include the re-initiation of rehabilitation in

severe cases or by correction of the problem. If problems arise due to the cable infrastructure that was not pre-empted in this plan, an engineer, wetland and vegetation specialist should be consulted as soon as possible.

It is recommended that fixed point photography is used to monitor vegetation and soil stability. This involves taking pictures of the areas monitored from the same point during each monitoring event. The images can be compared and serves as a record of the success of rehabilitation or the failure thereof.

Table 13: Monitoring plan

Variables	Methods	Monitoring Frequency	Indicator	Corrective Action
Integrity of structures located in the wetlands	• On-site inspection • Fixed point photography.	• After construction • Seasonal for the first three years and rapidly after heavy rainfall • Thereafter annually	• No erosion evident	• Structures should be fixed where possible or new structures should be implemented
Vegetation cover	• On-site inspection • Assess landscape functionality • Monitor species cover abundance and ensure that natural species cover increase (compare to vegetation study results prior to construction) • Fixed point photography	• After construction • Seasonal for the first three years and rapidly after heavy rainfall or drought spells • Thereafter annually	• Spreading and distribution of dominant plant species in specified zones • Wetland re-vegetation shall be considered successful if the cover of herbaceous and/or woody species is at least 80 percent of the type, density, and distribution of the vegetation in adjacent wetland areas that were not disturbed by construction • No bare soils • Acceptable grass cover will include about 60% of the area seeded shall be covered with acceptable plants and that bare patches are not greater than 650 mm in dimension	• If natural re-vegetation does not occur replanting of indigenous plants should be done at sites of concern • Prevent pedestrian traffic from entering rehabilitated areas • Where necessary, reseeding or replanting will have to be done if no protective plant cover has been created within the first growing season • If re-vegetation is not successful at the end of 3 years, develop and implement (in consultation with a relevant specialist) a remedial re-vegetation plan to actively re-vegetate the failed areas. Continue re-vegetation efforts until re-vegetation is successful • If vegetation rehabilitation is successful at the end of 3 years, report on the status of the vegetation (e.g. using photographic record) and only monitor annually or if maintenance activities might have disturbed the area again

Variables	Methods	Monitoring Frequency	Indicator	Corrective Action
Plant species composition	• Fixed transect to determine the species composition	• Fortnightly inspections of the site by ECO post revegetation • Rapid inspection in the event of heavy rainfall or drought spells within the first three years post revegetation • Seasonal inspections and monitoring until 80% of the desired plant species have become established • Thereafter annually	• Presence/absence of desired species • Natural configuration of habitats as part of ecosystems is recreated, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist • Indigenous biodiversity continually improves to an end state comparable to or better than the original vegetation descriptions • This end state, if healthy, will be dynamic and able to recover by itself after occasional natural disturbances without returning to a degraded state • Ecosystem function of natural landscapes and their associated vegetation is improved or maintained	• If natural re-vegetation does not occur replanting of indigenous plants should be done at sites of concern. • If exotic plants have colonised the area the exotic plants should be removed.
Erosion	• On-site inspection • Fixed point photography • Compare to adjacent land	• After construction • Seasonal for the first three years and rapidly after heavy rainfall • Thereafter annually.	• Areas where vegetation cover is limited or nil and where soil has started to erode • Bare soil patches or ditches	• Should erosion occur, soft options such as hay bales, eco-logs and replanting should be considered, if erosion is too great a rehabilitation method should be discussed with an engineer and wetland specialist
Sedimentation	• As determined by ECO • Visual observations and site inspections • Fixed point photography	• After construction • Seasonal for the first three years and rapidly after heavy rainfall	• Excess sediment in wetlands and rivers • Bare soil upslope from wetland areas	• Cause of sedimentation should be identified and dealt with appropriately • Should sedimentation be observed to accumulate and smother vegetation, a wetland specialist should be consulted to

Variables	Methods	Monitoring Frequency	Indicator	Corrective Action
		• Thereafter annually		find a suitable solution for the specific wetland and its plant species composition.
Alien Invasive Plant Species	• Monitor the emergence of alien invasive plant species in or around rehabilitated areas and the servitude in general • On-site inspection • Fixed point photography	• After construction • Seasonal for the first three years and rapidly after heavy rainfall • Thereafter annually	• Establishment of alien invasive plant species in rehabilitated areas or in watercourses • Visible reduction of number and cover of alien invasive plants within the project area. • No establishment of additional alien invasive species.	• Remove emergent invasive vegetation from the servitudes as well as rehabilitated footprint as soon as it becomes apparent • Manual labour is preferred above chemical or manual removal. • Do not use herbicides or pesticides in or within 200 meters of wetland areas
IF Protected plant species were recorded and relocated	• Site visit & Photographic evidence • Count of individuals and comparison to coordinates and number of species originally removed and relocated	• Initial monitoring after relocation should be undertaken at least three timed during the first two growing seasons • Seasonally thereafter for another three years	• Health • Die back is / is not occurring. • Damage or harvesting is evident • Population increase / decline	• Report any decline of numbers, determine cause and take corrective action. • If needed, consult a specialist to write a management plan for individual species.

8 REFERENCES

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APPENDIX C: CV OF EAP

CURRICULUM VITAE

Name:	**KARTHIGESAN GOVENDER**
Name of Firm:	ENVIROLUTION CONSULTING (PTY) LTD (2004 – Present)
Position:	Director and Project Manager
Date of Birth:	12 April 1974
Nationality:	South African
Languages:	English, Afrikaans

EDUCATIONAL QUALIFICATIONS

- B.Sc. – Wits University 1997
- B.Sc. (Honours) –Wits University 1999
- Certificate in Advanced Project Management – Damelin 2003

PROFESSIONAL REGISTRATION

- South African Council for Natural Scientific Professions (**SACNASP**) Reg. No. 400049/12

KEY QUALIFICATIONS and RESPONSIBILITIES

Responsibilities

Management of all projects and screening, client liaison and Financial Management.

Feasibility Studies (2000 to date):

- Ekurhuleni Regional Professional Team- Conducted Environmental feasibility studies for more than 40 proposed sites for housing development on behalf of Gauteng Department of Housing.

Environmental Management Plans (EMPs) (2004 to date):

- Compiled EMPs associated with EIAs for housing developments as well as linear (power lines, pipelines and road infrastructure) construction developments and filling stations
- Developed procedures for conducting EMP related audits
- Conducted auditing of implemented EMPs

Environmental Audits (2006 to date):

- Chrome International South Africa- Tailings dam external audit
- Bakwena Platinum Corridor Concessionaire- Rustenberg bypass
- Various audits for construction projects including linear (power lines, pipelines and road infrastructure), residential and industrial projects.

Environmental Reporting and Policy Development (2000 to 2002):

- City of Johannesburg – Updating of the State of the Environment Report
- Conducted research on sustainable development issues affecting the city of Johannesburg
- Participated in the formulation of environmental strategy and policies, including Local Agenda 21
- Evaluated and commented on EIA's or development applications

- Reported on any environmental legislation insofar as it affected the city of Johannesburg
- Writing of Projects Terms of References for Consultants as well as managing consultants
- Task Team member of World Summit on Sustainable Development (WSSD) 2002 Preparatory Committee
- Task Team member of the Local Government Summit (LGS) coordinating committee for WSSD
- Provided input to the various WSSD sub-committees (WSSD Greening *etc*.)
- Coordinated and participate in the Local Agenda 21 activities of the City of Johannesburg
- Coordinated, participated and provided input into WSSD activities of the City of Johannesburg in conjunction with external stakeholders
- Stakeholder liaison and implementation of environmental policy and legislation
- Provided input into LIDP and Environmental Policy processes
- Assisted ICLEI with WSSD related activity and local government initiatives

Environmental Impact Assessment (2004 to date)

- Exemptions (various applications) - including installation of fuel storage tanks, township and commercial developments
- EIAs for proposed Cemeteries
- EIAs for formalising of township developments
- EIAs for filling station developments
- EIAs for the relocation of Sewer Plants
- EIAs for road upgrades and development
- EIAs for proposed housing developments in Ekurhuleni Metropolitan Municipality on behalf of Gauteng Department of Housing – more than 25
- Scoping studies undertaken and project managed with budgets exceeding 2 million rand, project managed all the EIA related work for the Ekurhuleni Regional Professional Team
- EIAs for Eskom Power Transmission and Distribution Lines
- Managed and participated in various environmental projects & programmes, in conjunction with external partners and stakeholders
- EIA for the Eskom Medupi Landfill
- EIAs Johannesburg Water
    - Sewer treatment Plants
    - Network construction and Upgrades

Projects worked on and managed (2000 to 2004):

- Cities State of the Environment Report (CSOER) on the Internet – WSSD Project (Managed its updating)
- ICLEI's Cities for Climate Protection (CCP) Campaign – WSSD Project. (Coordinator for the City of Johannesburg
- Managed pilot projects focused on demand side management of energy resources : Energy efficient retrofitting of street lights as a showcase for WSSD, partnered with the International Institute for Energy Conservation (IIEC) – WSSD Project
- Managing Water for South African Cities with United Nations Center for Human settlements (UNCHS), involving Catchment Management of the Klipriver System and Upgrade
- The Strategy for Sustainable Development (SSD) for the City of Johannesburg WSSD Project
- Housing Projects with DANCED
- Green Procurement Project of the City of Johannesburg

EMPLOYMENT EXPERIENCE

ENVIROLUTION CONSULTING (PTY) LTD

Director (1 September 2004 – present)

EIMS Group
Associate and Environmental Specialist for Environmental Impact Management Services (EIMS) and Director of Tswelopele Environmental (2002- 31 August 2004)

City of Johannesburg (Braamfontein)
Environmental Management Specialist
(2000-2002)

Standard Bank
212 Smith Street, Braamfontein
Position: Bank Teller (Nov. 1996 – May 1998)

Electronic Data Systems (EDS)
Commissioner Street, Johannesburg
Position: Customer Services Consultant (June 1998 – Jan. 1999 & Jan. 2000 – Aug. 2000)
Reason for leaving: Employed by City of Johannesburg

Wits University

- 1999: Teaching assistant for first year Zoology, Botany and Medical Students, and College of Science students at Wits University.
- 1999: Mapping and sampling vegetation at Nylsvlei Nature Reserve in the Northern Transvaal.
- 1999: Tutoring Zoology and Botany to first year and College of Science students at Wits University

CURRICULUM VITAE — CHEDA SHEILA BOLINGO

Position: Environmental Consultant

Name of Firm: Envirolution Consulting

Name of Staff: Cheda Sheila Bolingo

Date of Birth: 12/02/1981

Total Years of Experience: Seven (7)

EDUCATION:

Qualification	Institution	Date obtained
MSc (Environmental Management)	University of Johannesburg	2017
BSc (Hons) (Environmental Management)	University of Johannesburg	2010
B Sc (Geography & Environmental Management)	University of Johannesburg	2008

COUNTRIES OF WORK EXPERIENCE:

South Africa

LANGUAGES:

Language	Reading	Speaking	Writing
English	Excellent	Very Good	Excellent
Zulu/Sotho	Fair	Good	Fair
Afrikaans	Fair	Fair	Fair
French	Very Good	Good	

EMPLOYMENT RECORD:

1. Organisation: **Envirolution Consulting**
Period: May 2016 to date
Position: Environmental Consultant
Reference: Mr Karthigesan Govender – Managing Director
Contact: (T) 0861 444 499

2. Organisation: **Savannah Environmental**
Period: June 2012-December 2015
Position: Environmental and GIS Consultant
Reference: Ms Tebogo Mapinga - Senior Project Manager
Contact: (C) 072 738 3836 (T) 011656 3237

3. Organisation: **Fourth Element Consultant**
Period: Feb 2011 - May 2012
Position: Environmental Consultant and GIS Practitioner
Reference: Mr Tsepo Lepono - Environmental Director
Contact: (T) 011 022 1364; (C) 083 339 9103

PROJECT EXPERIENCE:

Environmental Authorisation Processes: Environmental Impact Assessments (Scoping and EIA Phases; Basic Assessments (BA); Environmental Management Programme Reports; Environmental Feasibility Analysis for the following selected projects:

- Scoping, EIA Report & EMP for the Roodepoort Strengthening 400kV substation & 400kV power lines near Roodepoort, Gauteng
- Scoping, EIA Report & EMP for the proposed construction of the Gourikwa-Narina-Droerivier 400kV Power line and Substation upgrades near George, Western Cape Province
- EIA Report & EMP for the Blackwood Solar Energy Facility near Boshof, Free State Province.
- Scoping, EIA Report & EMP for the Boundary Solar Energy Facility near Boshof, Free State.
- Scoping, EIA Report & EMP for the Bosjesmansberg Solar Energy Facility near Copperton, Northern Cape Province.
- Scoping, EIA Report & EMP for the Kheis Solar Energy Facilties near Grootdrik, Northern Cape
- Basic Assessment Process for the Hillside 132kV substation and power line project near Middelsburg, Mpumalanga Province
- Basic Assessment Process for the Simthabi 132kV substation and power line project near Thabazimbi, Limpopo Province
- Basic Assessment Process for the Avalon Cemetery Extension in Soweto, Gauteng
- Basic Assessment Process for the Dinaledi-Spitskop Deviation 400kV power line project near Mogwase, North West Province
- Basic Assessment Process for the Sannaspos Solar Energy Facility near Bloemfontein, Free State
- Basic Assessment Process for the Machadodorp Solar Energy Facility near Machadodorp, Mpumalanga
- Basic Assessment Process for the proposed stormwater Infrastructure construction and upgrade In Zandspruit & Finetown, Gauteng Province.
- Basic Assessment Process for the Jukskei Rehabilitation, along Observatory Stream, Bezhuidenhout Valley, Gauteng Province
- Basic Assessment Process for the Olifantsfontein Rehabilitation Measures along Kaalspruit, Clayville, Gauteng Province
- Environmental Screening Report for the Bosjesmansberg Solar Energy Facility near Copperton, Northern Cape Province.
- Environmental Screening Report for the Ennerdale Extension 9 project near Ennerdale, Gauteng.
- Basic Assessment Process for the Tembisa Western Outfall Sewer in Tembisa, Ekurhuleni Metropolitan Municipality, Gauteng Province.

Public Participation Process - formed part of the above mentioned Environmental Authorisation Processes. Experience in the Public Participation Process included the following activities:

- Identification of key stakeholders and stakeholder groups;
- Notification of stakeholders;
- Conducting public meetings and/or focus group meetings;
- Compilation of public meeting presentations on MS Power Point format;
- Compiling an Issues and Responses Report from minutes of meetings held with stakeholders;
- Liaison with stakeholders via fax, email and telephone for the duration of the project;
- Establishing and maintaining relationships with key stakeholders;
- Liaison between client/ developer and stakeholders; and
- Correspondence, liaison and site meetings with the relevant authorities handling the environmental applications have also been successfully undertaken.

Environmental Compliance Auditing and ECO: Environmental monitoring for the Dorper Wind Farm near Molteno in Eastern Cape (2014), duties included the followings:

- Monitor of the implementation of the EMPr.
- Liaison with relevant authorities;
- Drafting environmental audit reports to the authorities.
- Compilation of Environmental Log Sheet for record of any impacts
- Suggesting corrective action measures to eliminate the cause of the non-conformance incidents.
- Liaison with contractors regarding overall environmental management onsite;
- Undertaking routine monitoring and appointing a competent person/institution to be responsible for specialist monitoring, if necessary.

SKILLS BASE AND CORE COMPETENCIES

- Strategic and compliance advise for all aspects of environmental assessment and management
- Working knowledge of environmental planning policies, regulatory frameworks and Environmental Auditing and compliance monitoring legislation
- Strategic and regional assessments; pre-feasibility & site selection
- Identification and assessment of potential environmental impacts and benefits
- Development of practical and achievable mitigation measures and management plans and evaluation of risk to project execution
- Environmental compliance advise, monitoring and reporting for construction projects
- Public participation/involvement and stakeholder consultation
- Experienced in assessments for both linear developments and nodal developments
- Key experience in the assessment of impacts associated with renewable energy projects
- Wide range of experience for public and private sector projects
- Research
- Compliance advice for Financial Close

- Drafting of proposals and Tenders
- GIS (ArcGIS)
- Project management and planning (including budgets)

KEY RESPONSIBILITIES

- Providing consulting services to clients for Environmental-related matters.
- Conducting Environmental Impact Assessment (EIA) processes
- Preparation of EIA reports
- Creation of maps for various projects
- Managing multidisciplinary teams
- Conducting various research
- Report writing
- Managing subcontractors
- Client communication
- Proposal preparation