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Flora and Fauna Habitat Assessment

of

MOKOLO AND CROCODILE WATER AUGMENTATION PROJECT (MCWAP): PHASE 1

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EXECUTIVE SUMMARY

1. Introduction:

Galago Environmental CC was appointed to undertake a fauna and flora study for phase 1 of the proposed route for the MCWAP.

The 80km pipeline route is located in several quarter degree grid squares ranging from Steenbokpan in the west to Lephalale in the east and then south to Mokolo dam. It extends from west to east over the Limpopo Sweet Bushveld and Waterberg Mountain Bushveld up to the Central Sandy Bushveld in the south.

The Limpopo Sweet Bushveld extends from the Crocodile and Marico rivers down the Limpopo river valley into the tropics past Tom Burke. The landscape features plains, some areas undulating or irregular with thickets of *Acacia erubescens, Acacia mellifera* and *Dichrostachys cinerea* in disturbed areas. The vegetation unit is considered least threatened. Less than 1% is statutorily conserved and about 5% transformed, mainly by cultivation (Mucina & Rutherford, 2006).

Waterberg Mountain Bushveld is located in the Waterberg Mountains, including the foothills, escarpment and tablelands south of the line between Lephalale and Marken. The landscape consists of rugged mountains with vegetation grading from *Faurea saligna-Protea caffra* bushveld on higher slopes to *Burkea africana-Terminalia sericea savanna* in the lower-lying valleys. The grass layer is moderately developed. The conservation status is regarded least threatened. About 9% is statutorily conserved mainly in the Marakele National Park and Moepel Nature Reserve. More than 3% is transformed by cultivation (Mucina & Rutherford, 2006).

The farm Wolvenfontein on which the Mokolo dam is situated, falls in the Central Sandy Bushveld. The sandy plains support tall *Terminalia sericea* and *Burkea africana* vegetation on deep, sandy soils and *Combretum* woodland on shallow gravely soils. Species of *Acacia, Ziziphus* and *Euclea* are found on low-lying eutrophic sandy soils. The conservation status of this vegetation type is considered vulnerable. While the conservation target is 19%, less than 3% is statutorily conserved and an additional 2% in private reserves such as the Nylsvlei wetlands. About 24% is transformed, including 19% cultivated and 4% urban and built-up areas (Rutherford and Mucina, 2006).

Although the vegetation map of Mucina and Rutherford, 2006 also shows a very small section of Western Sandy Bushveld along the pipeline route, refining the vegetation through detailed surveys could not distinguish between Western Sandy Bushveld and Limpopo Sweet Bushveld and the area was therefore classified as Limpopo Sweet Bushveld.

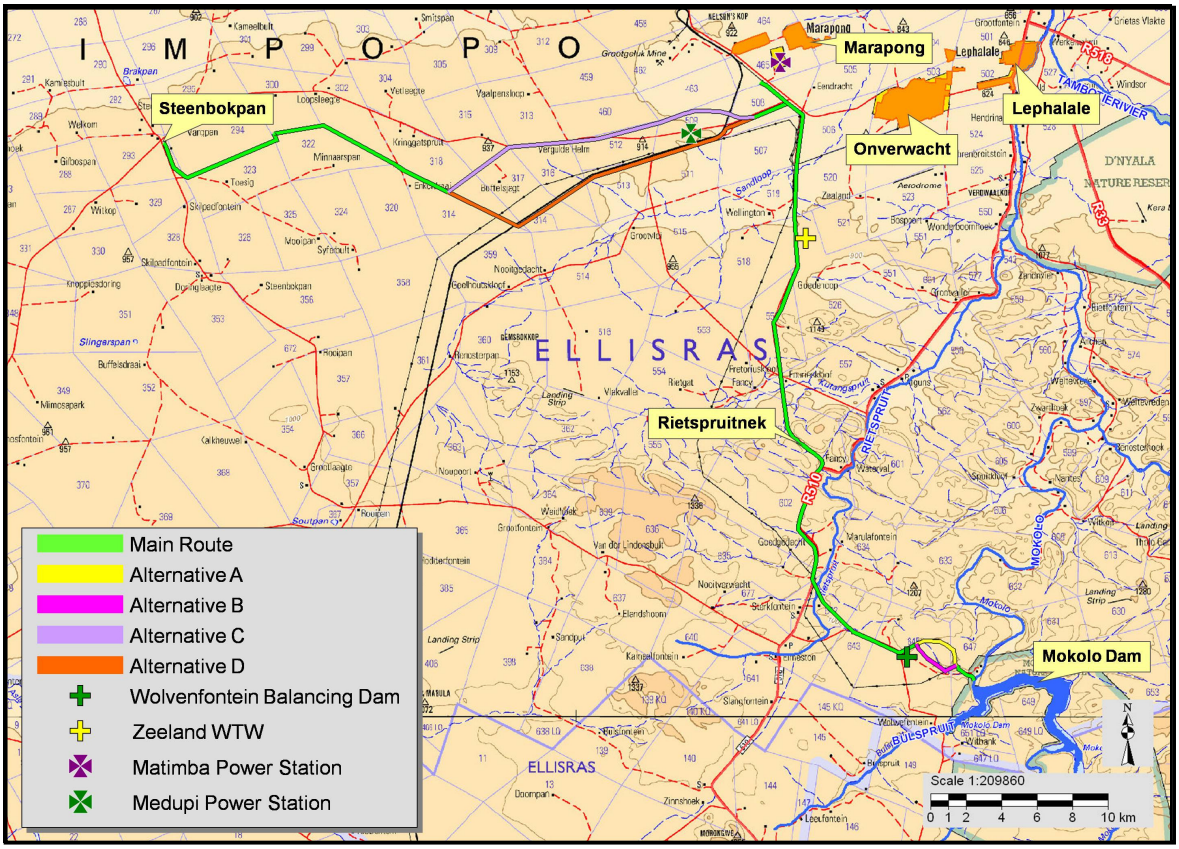

Figure 1: Locality map of the study site.

2. Requirements:

During the site visit the site was surveyed and assessed for the potential occurrence of Red Data or wetland-associated fauna species such as:

- Juliana's golden mole (*Neamblosomus juliana*)
- Rough-haired golden mole (*Chrysospalax villosus*)
- African marsh rat (*Dasymys incomtus*)
- Angoni vlei rat (*Otomys angoniensis*)
- Vlei rat (*Otomys irroratus*)
- African clawless otter (*Aonyx capensis*)
- Spotted-necked otter (*Lutra maculicollis*)
- Marsh mongoose (*Atilax paludinosus*)
- Forest shrew (*Myosorox varius*)
- White tailed rat (*Mystromys albicaudatus*)
- Highveld golden mole (*Amblysomus septentrionalis*)
- Giant Bullfrogs (*Pyxicephalus adspersus*);
- Cape Vulture (*Gyps coprotheres*)
- Blue Crane (*Anthropoides paradiseus*)
- Lesser Kestrel (*Falco naumanni*)
- African Grass-Owl (*Tyto capensis*)

- African Marsh-Harrier (*Circus ranivorus*)
- White-backed Night-Heron (*Gorsachius leuconotus*)
- White-bellied Korhaan (*Eupodotis senegalensis*)
- Martial Eagle (*Polemaetus bellicosus*)
- African Finfoot (*Podica senegalensis*)
- Lesser Flamingo (*Phoenicopterus minor*)
- Secretarybird (*Sagittarius serpentarius*)
- Black Stork (*Ciconia nigra*)
- Half-collared Kingfisher (*Alcedo semitorquata*)
- Greater Flamingo (*Phoenicopterus ruber*)
- Giant Bullfrog (*Pyxicephalus adspersus*);
- African Bullfrog (*Pyxicephalus edulis*);
- Southern Rock Python (*Python natalensis*);
- Nile Crocodile (*Crocodylus niloticus*).

3. Specialist studies:

This investigation was conducted by the following specialists:

Specialists	Aspect Investigated	Qualifications	Prof. Registration	Date of Field Survey
Rautenbach, I.L.	Mammalogy and zoological review	Ph.D., T.H.E.D.	Pr. Nat. Sci.	25-26 March 2009, 1-2 February 2010
Haacke, W.D.	Herpetology	M.Sc. (Zoology)	Pr. Nat. Sci.	25-26 March 2009, 1-2 February 2010
Geyser, R.	Avifauna		Pending	25-26 March 2009, 1-2 February 2010
Van Greuning, JV	Botany	D.Sc.	Pr. Nat. Sci.	25-26 March 2009, 1-2 February 2010
Kemp, A.C.	Avifauna review	Ph.D.	Pr. Nat. Sci.	
Marais, V.	Environmental Impacts and maps	BL Landscape Architecture		25-26 March 2009, 1-2 February 2010

4. Findings:

Four vegetation units were identified (See Annexure A in the Flora report):

- Limpopo Sweet Bushveld
- Waterberg Mountain Bushveld
- Central Sandy Bushveld
- Disturbed areas and recovering cultivated fields

From the **vegetation** study it was found that the natural vegetation on the pipeline route is considered sensitive and precautions should be taken to inflict as little damage as possible during the construction phase. Development should preferably take place on degraded areas such as at the Medupi site. Care must be taken to minimize or prevent negative impact on vegetation, especially where rare and endangered plants are known to occur. All Category 1 Declared weeds must be eradicated and protected trees should be left intact as far as possible.

It is recommended that the Alternative C pipeline route be situated south of the new road around the Medupi powerstation in the already degraded area rather than disturbing the natural vegetation where *Adansonia digitata* and other protected trees occur. The two Boabab trees that were relocated into that area when the road was built must be avoided. There are also other large Tamboti and Marula trees along the pipeline route that should be avoided where possible.

When blasting is undertaken, rocks must be prevented to roll down slopes and destroy rare plants. It is therefore also recommended that the Alternative B corridor from the Mokolo dam over the farm Wolvenfontein (that falls within the Waterberg Biosphere) be followed so that the two sensitive *Euphorbia* species in the kloofs are not impacted by falling rocks. Care must be taken with the Alternative B route to disturb as little as possible of the vegetation along the route with construction activities, since this section of the route falls within the core conservation area of the Waterberg Biosphere.

The **mammal** study found that from a mammalian view there is no compelling reason why the proposed pipeline route should not be developed. Through most of its length it travels along an existing pipeline and service road and for a distance also along existing roads (being farm, tertiary or secondary roads). The Alternative C route south of the new road is preferred on the Medupi construction site, and the Alternative B Environmental Corridor on the farm Wolvenfontein at the origin of the pipeline. The area at the Rietspruit and R510 should recover adequately given attention to ecological restoration of especially the wetland component.

A large ecological concern is the potential deleterious effect that the volume of water to be extracted as well as sand mining may have on the welfare of the Mokolo River system downstream of the Dam. The river system provides a unique habitat to a plethora of narrowly specialized species, and furthermore acts as a dispersal corridor. The reserve determination (in terms of the National Water Act, No. 36 of 1998) for the Mokolo River has however taken this into consideration and has determined that monitoring of the River will be an important measure to determine the impacts on the health of the river. (See Appendix B for the mammal report).

The **avifauna** study found that three Red Data bird species will be impacted directly by the availability of water downstream from the Mokolo River pump station. These species are the Half-collared Kingfisher, African Finfoot and White-backed Night-Heron. The habitat in the Mokolo River is ideal for these species.

At other places the proposed pipeline route will only have a negative impact during the construction phase where is will cut through the woodland habitat system areas and, in many sections, follow an existing pipeline. After the pipeline is closed and rehabilitated correctly, the bird species will return to the area.

The other Red Data avifauna species are only likely to move through the area and should not be affected by the pipeline, except during the construction phase, provided that large areas with natural woodland areas are not disturbed. (See Appendix C for the avifauna report).

The **herpetological** study found that the proposed pipeline of Phase 1 either runs on or along servitudes of tar roads, railway lines, power lines or the existing pipeline. The general habitat type surrounding the proposed route consists of open to very dense

bushveld, with limited available habitat for diurnally active and sit-and-wait predators, such as terrestrial skinks, lacertids and other reptiles. Arboreal species are the more prominent components of the local herpetofauna. Typical examples are the Tree Agama, Chameleon, Boomslang, Black Mamba, Spotted Bush Snake and others. Pythons have very suitable habitat, in particular in the mountainous areas, depending on the availability of warm-blooded prey. A limited selection of terrestrial reptiles may be expected to occur on the proposed pipeline route.

Although Bullfrogs are known from the general area, neither of the two species have been confirmed from the quarter degree grid cells involved in Phase 1 of this project but they could occur here.

In general, the habitat types through which the proposed pipelines are to be constructed are very suitable for a relatively high species diversity. The herpetofauna mainly consists of widespread, common Bushveld species with slight variation due to the presence of sandy substrate, stony to rocky terrain, water, bush and trees. However, since these lines are proposed to run parallel to existing power and pipelines, or road servitudes along which the natural vegetation and fauna has been altered, the potential damage to the current herpetofauna is considered to be relatively low. As these strips are narrow, re-colonisation by suitable species will take place in the altered habitat.

Staff of the Sable Hills Game Ranch reported the presence of crocodiles in the Mokolo Dam as well as the river below the dam wall. Each larger pool is reported to have a large, resident, territorial individual. Crocodiles are a protected species and the abstraction of water from the dam and river must therefore ensure that enough water is released for the ecological reserve to ensure the continued existence of the crocodiles. Should sand mining in these river systems be allowed to continue, then the reduction of breeding areas for crocodiles could result in a negative population trend despite the implementation of appropriate reserve releases. (See Appendix D for the herpetofauna report).

5. Impact Assessment:

Two distinct biological systems are under consideration in discussing the ecological impacts of the proposed development, i.e. the Mokolo River downstream from the pump station at the Mokolo Dam, and the route of the pipeline through the savannas of the region.

The banks of the Mokolo River close to the pump station, the Rietspruit as well as seepage lines in the Waterberg are deemed sensitive and should be expeditiously repaired after the pipeline has been laid.

A large ecological concern is the potential deleterious effect that the volume of water to be extracted may have on the welfare of the Mokolo River system downstream of the Dam. The river system provides a unique habitat to a plethora of narrowly specialized species, and furthermore acts as a dispersal corridor. Even a temporary and partial natural desiccation exacerbated by water extracted for the development during a drought will have far-reaching ecological consequences. The welfare of the river system should therefore ideally supersede that of economic interests. The fact that the Mokolo River runs through the D'Nyala Provincial Nature Reserve may be a consideration, although

the terms of this assignment disallowed investigating the reliance of the Reserve on this river. Should sand mining in these river systems also be allowed to continue, then the reduction of breeding areas for crocodiles could result in a negative population trend despite the implementation of appropriate reserve releases.

The reserve determination (in terms of the National Water Act, No. 36 of 1998) for the Mokolo River should take this into consideration and has determined that monitoring of the River will be an important measure to determine the impacts on the health of the river. Monitoring in the future must therefore take the following terrestrial features into account:

- Riverine and riverbank deterioration
- Water quality deterioration
- Decreasing biodiversity within the River that could cause a decrease in food that would have a negative impact on mammal species.

5.1. IMPACT ASSESSMENT (MOKOLO RIVER SYSTEM)

The intention of the proposed development is to provide bulk water piped from the Mokolo Dam in the Mokolo River to Lephalale, Matimbi and Medupi Power Stations, Grootgeluk Coal Mine at Lephalale (Ellisras), and from there westwards to a future development site north-west of the Village of Steenbokpan.

Galago Environmental has not been provided with data pertaining to the predicted water requirements of the communities mentioned above, neither of the water provision capacity of the Mokolo River and Dam.

The concern is that the extraction of water in bulk from the dam and the river will impact on the ecology of the river system as a result of desiccation (including aquatic, floral and faunal components, particularly in conservation areas cf. D'Nyala Provincial Nature Reserve). It is assumed that during prolonged droughts the water needs of the rural communities reliant on the water extracted from the dam and river will supersede that of the river system below the pump station, which will exacerbate the natural effects of a drought on the river system.

The impact ratings presented below are specific to the river system below the pumping station. It does not allow for inflow of water from catchment areas further downstream of the pumping station.

5.1.1 Potential Impacts

- *Loss of exotic species, declared weeds and invader plants*

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Decrease of exotic plants and weeds	River system	Medium-term	Probable	Low	Low

From a conservation perspective, reducing the alien trees and plants will be advantageous, especially in an area with a high nature conservation profile. However, it should be kept in mind that alien invaders are robust plants with variable habitat requirements, and it is quite likely that some aliens will strengthen their hold on the system (viz. lantana), unless they are high consumers of water (viz. wattles) faced with lower water levels.

- *Loss of ecological sensitive and important vegetation units*

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Riparian zone	River system	Long term	High	High	High

Artificially induced lower water levels and particular seasonal cessation of water flow superimposed on natural rhythms will result in severe damage to the ecosystems within the riparian zone, as such deleteriously affecting species richness and diversity, food chains and breeding success / cycles. Should sand mining (destroying riverine vegetation) in these river systems be allowed to continue, then the reduction of breeding areas for crocodiles could result in a negative population trend despite the implementation of appropriate reserve releases.

- Loss of ecosystem function (e.g. reduction in water quality, soil pollution)

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Damage to ecosystem function	River system	Long-term	High	High	High

Predicting the effect on desiccation of the river system is largely speculative, and will require a more comprehensive overview. However, the desiccation of the rivers in the Kruger National Park serve as an excellent example, where a qualitative and quantitative decrease in floods caused by storm water fail to regularly scour river beds from an over-abundance of elements such as weed beds and invaders such as hyacinths. A lower volume of water carrying the same chemical pollutants as before will result in higher concentrations, which in turn negatively impacts on ecological health.

- Loss of faunal habitat

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Loss of faunal habitat	River system	Long-term	High	High	High

A reduction in water flow / cessation of water flow will inevitably result in a quantitative and qualitative reduction in the life-support systems (habitats) of animals. It is predicted that a reduction in water flow, quantity and quality will have a cumulative effect on faunal diversity and richness.

- Loss/displacement of threatened or protected fauna

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Loss of species	River system	Long-term	High	High	High

Given a significant reduction in flow as well as the quantity and quality of water, a decrease of population densities can be expected as result of concomitant decreasing life-support systems. If decreased natural availability of water are prolonged, the possibility of species loss must be entertained, and following that more unacceptable effects such as a cumulative loss of inter-reliant species.

5.1.2 Impact Assessment Summation

	High	Medium	Low
Extent / Spatial Scale of Impacts	X		
Intensity / Severity of Impacts	X		
Duration of Impacts	X		
Magnitude and Significance of Impacts	X		

5.1.3 Defined Sensitive Area(s):

The river system is categorized as sensitive.

Mammals, birds, reptiles, amphibians, invertebrates and vegetation reliant on either water as a habitat medium (viz. otters, **crocodiles**, crabs, **Half-collared Kingfishers, African Finfoot, White-backed Night-Heron** and the larval stages of a plethora of invertebrates), or on moist conditions such as in wetlands (viz. vlei rats, shrews, frogs, dragon flies) will all be adversely affected by both a constant reduction in water and reliability of this sensitive resource. A best scenario is a drop in population numbers, and a worst case scenario an incremental loss of species (including red listed species) and biodiversity.

5.2. IMPACT ASSESSMENT (PIPELINE *per se*)

A secondary consideration of provisioning bulk water from the Mokolo Dam in the Mokolo River is the impact of the pipeline along its proposed route.

The impact ratings presented below are thus specific to the pipeline from the pumping station to the various destinations at (or near) Lephalale and Steenbokpan:

5.2.1 Potential Impacts

- *Loss of exotic species, declared weeds and invader plants*

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Decrease of exotic plants and weeds	The entire length of the pipeline through savannah	Long-term	Probable	Low	Low

From a conservation perspective, reducing the alien trees and plants will be advantageous, especially in an area with a high nature conservation profile. However, considering the near-pristine condition of the region through which the pipeline will travel, very little alien plants can be expected. It can confidently be predicted that indigenous invaders such as sicklebush will thrive as result of the disturbance.

- *Loss of ecological sensitive and important vegetation units*

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Loss of woodland biome flora	The entire length of the pipeline through woodland biome	Long term	High	Low	Low

The new subterranean pipeline directly along the existing line will result in a limited loss of important vegetation units in the long but narrow combined servitude for the new and existing line for the entire length of the route. But relative to the extensive mass of adjoining land and the pristine condition of its indigenous plant assemblages, this loss is rated as insignificant.

- Loss of ecosystem function (e.g. reduction in water quality, soil pollution)

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Damage to ecosystem function	The entire length of the pipeline through woodland biome	Long-term	Low	Low	Low

No noticeable loss of ecosystem function is anticipated. There may be a low incidence of erosion along the servitude unless due care is taken during restoration.

- Loss of faunal habitat

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Loss of faunal habitat	The entire length of the pipeline through woodland biome	Long-term	Low	Low	Low

A displacement of indigenous vegetation by more vigorous pioneer flora will not have a noticeable effect on vertebrates. Vertebrates rely on vegetative cover for nourishment and refuge, and are not concerned about specific plant species compositions. Animals are further more mobile to find more suitable micro-habitats. It is not expected that there will be a loss of rupiculous habitat in mountainous areas of the route.

- Loss/displacement of threatened or protected fauna

Nature of Impact	Extent	Duration	Probability	Intensity	Significance
Loss of faunal species	The entire length of the pipeline through woodland biome	Long-term	Low	Low	Low

The pipeline will not cause a loss of protected fauna and should furthermore not have a significant effect on small vertebrate populations, especially if the Mitigation Measures are accepted and the restoration of filled-in trenches are conducted so as to not form barriers.

5.2.2 Impact Assessment Summation

	High	Medium	Low
Extent / Spatial Scale of Impacts			X
Intensity / Severity of Impacts			X
Duration of Impacts		X	
Magnitude and Significance of Impacts			X

5.2.3 Defined Sensitive Area(s):

Seepage lines in the mountainous areas through which the pipeline travels can be deemed marginally sensitive, since the isolated nature of these minor wetlands precludes the immigration of most threatened / sensitive vertebrates. Many of these seepage lines may also be seasonal. The proposed pipeline should, however, not impact on the seepage lines and associated flora and fauna. Hence the sensitivity rating assigned to these seepage lines is 'minor'.

5.3. Confidence Levels of Impact Assessments

The confidence levels of the impact assessments presented above are rated as "Moderate", which is deemed conservative rather than optimistic. Opinions are based on observations, *pace* data garnered within the framework of a focused experimental design requiring extensive field work over more time than allotted to this project. However, the estimations expressed are based on extensive field experience of all specialists, allowing a 'close-to-accurate' intuitive judgement.

5.4. Risk Assessment

The risk of ecological damage caused by the development is rated as 'high', unless measures are taken to maintain a situation of as close as possible natural flow of water in the Mokolo River, and prevent the formation of barriers for small terrestrial vertebrates when filling the trenches along the pipeline route.

6. Mitigation:

Recommended mitigation measures proposed by the specialists:

- The topsoil must be kept separate during excavation, and correctly replaced when filling the ditch.
- Reasonable care must be taken to limit erosion, inter alia by sowing indigenous grass species.
- It is recommended that the developer appoint a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) to advice on the seeding of indigenous grasses.
- No plants not indigenous to the area, or exotic plant species, especially grasses such as Kikuyu and other ground-covering plants, should be introduced in the rehabilitation of the line, as they might spread into the areas of natural vegetation.
- Where possible work should be restricted to one area at a time. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- Prior to construction, fences (*game fences*) should be erected in such a manner to prevent access and damage to any sensitive areas identified.
- The contractor must ensure that no fauna species are 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.
- Where the pipeline will cross the Rietspruit and other drainage lines, the pipeline should be build over these wetland systems high enough to allow free movement of birds underneath the pipeline. If it is build underneath the river, then care must also be taken not to restrict the free movement of birds moving along the river.
- Measures should be taken to prevent erosion in areas where the pipeline will cross hilly areas.
- **No vehicles must be allowed to move in or across the wet areas or drainage lines and possibly get stuck.** This leaves visible scars and destroys habitat. It is important to conserve areas where there are tall reeds or grass and areas were there are short grass and mud.
- It is suggested that where work is to be done close to the drainage lines, these areas **be fenced off during construction** to prevent heavy machines and trucks from trampling the plants, compacting the soil and dumping in the system.
- During the construction phase noise must be kept to a minimum to reduce the impact of the development on the fauna residing on the site.
- Alien and invasive plants must be removed during the construction and operation phase of the project.
- It is recommended that, while trenches are open during the construction phase, a sloping section of the side-wall is made available for the escape of any trapped animals. Tortoises and pythons, if encountered during construction, should be removed and placed into suitable habitat away from the construction area. Due to the probable presence of low densities of relatively common species on the existing servitudes and the narrow width of the proposed servitudes, no further mitigating measures are being proposed as the expected effect on the local herpetofauna is limited.

The following recommended mitigation measures were developed in conjunction with the Gauteng Department of Agriculture and Rural Development (GDARD), 2009 but are also applicable to the Limpopo province:

- An Ecological Management Plan (to be included in the Environmental Management Plan (EMP) must be developed for the construction and operational phase of the development and should:
    - include an ongoing monitoring and eradication programme for all non-indigenous species, with specific emphasis on invasive and weedy species
    - ensure the persistence of all Red and Orange List species
    - minimize artificial edge effects (e.g. water runoff from developed areas and application of chemicals)
    - result in a report back to the Directorate of Nature Conservation on an annual basis.

- Where possible, trees naturally growing on the pipeline route should be retained as part of the landscaping, with specific emphasis on the following species: *Acacia erioloba*, *Boscia albitrunca*, *Combretum imberbe*, *Sclerocarya birrea* subsp. *caffra*. Measures to ensure that these trees survive the physical disturbance from the development should be implemented. A tree surgeon should be consulted in this regard. A qualified botanist must mark trees when the route is pegged and permits obtained from DWAF before any protected trees are removed.
- The crossing of natural drainage systems should be minimized and only constructed at the shortest possible route, perpendicular to the natural drainage system. Where possible, bridge crossings should span the entire stretch of the buffer zone.

Pipelines

- The appropriate agency should implement an ongoing monitoring and eradication program for all invasive and weedy plant species growing within the servitude.
- Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.
- Any post-development re-vegetation should use species indigenous to South Africa. Plant species locally indigenous to the area are preferred. As far as possible, indigenous plants naturally growing along the route, but would otherwise be destroyed during construction, should be used for re-vegetation.
- Where a pipeline is to traverse a wetland, measures are required to ensure that the pipeline has minimal effect on the flow of water through the wetland, e.g. by using a high level clear span bridge or box culverts rather than pipes.
- Disturbance to any wetlands during construction should be minimized. A plan for the immediate rehabilitation of damage caused to wetlands should be compiled by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science. This rehabilitation plan should form part of the EMP and a record book should be maintained on site to monitor and report on the implementation of the plan.

7. Environmental Sensitivity and Conclusion:

From the surveys it was determined that the proposed pipeline routes of Phase 1 either runs on or along servitudes of tar roads, railway lines, power lines or the existing pipeline. Although the vegetation in the vicinity of the proposed pipeline route is sensitive, most of the areas directly linked to these servitudes are disturbed to a certain degree. It was therefore found that the proposed pipeline will not have a significant impact on the fauna and flora in the area, given that the servitude width be kept to a minimum and that the mitigation measures proposed above be implemented.

With two exceptions the proposed pipeline route will traverse along an existing pipeline in the savanna and is not anticipated to directly result in a significant loss of ecological sensitive and important habitat units, ecosystem function (e.g. reduction in water quality, soil pollution), loss of faunal habitat, nor of loss/displacement of threatened or protected fauna. Planning calls for the new route to run adjacent to the existing route in an additional narrow strip of pristine veld. This approach will convert a narrow strip of pristine veld in barren terrain eventually supporting pioneer vegetation; but this is preferable to an independent route through pristine veld.

With regard to Alternatives B and C, the following comparative assessment is applicable:

Rising Main - Mokolo Dam to Wolvenfontein Balancing Dams

		Advantages	Disadvantages
	Alternative A	✓ The route goes along a road and road construction has already disturbed small sections along the route.	× The steep gradient of the surrounding area is host to sensitive plants and fauna habitats. × The sides of this route are very steep and extra cutting for the pipeline could cause rocks to roll down the slope and destroy red listed plants or sensitive fauna habitats.
	Alternative B	✓ Most of the route runs along the mountain summit and not through drainage lines. ✓ This route will have minimal ampacts on sensitive flora or fauna habitat. ✓ There is a possibility to put the pipe above ground, minimizing the impact of construction associated with blasting.	× Blasting and cutting to put the pipeline underground could impact on sensitive flora and fauna within the Waterberg Biosphere (a conservation area) during the construction phase. × Boulders and materials taken from the trenches could form barriers for movement of fauna if left in the natural veld areas.

The Environmental Corridor of Alternative B is recommended at the origin of the pipeline on the farm Wolvenfontein. Most of the route runs along the mountain summit. This will be preferable to the large quantities of rocks and debris which will roll down the slopes (impacting on sensitive flora species) during excavation with devastating ecological consequences should the route along the public road, the Alternative A – Mokolodam routes or the existing pipeline be followed. The objective of Alternative B is to minimize ecological damage within the Waterberg Biosphere through minimisation of the footprint and controlled blasting with minimal noise effect. If that can not be achieved then it is recommended that the pipeline be placed above ground where possible. Placing the pipeline above ground in the Alternative B section will reduce the noise impact on sensitive fauna species and reduce the area to be disturbed during construction which could impact on sensitive flora species. Vegetated embankments at regular intervals or raising the pipeline at certain points would allow access of large game species and reduce the pipeline barrier effect.

Gravity Line - Matimba Power Station to Steenbokpan

	Advantages	Disadvantages
Alternative C	✓ There are large tracts of land already disturbed by the new road and the construction site of the Medupi Power station. ✓ Most of the route is accessible by the new road and construction site	× There are two Boabab trees that were relocated on this route that the new route will have to avoid, since they can not be relocated again.
Alternative D	✓ The route goes mostly along the railway line and existing pipeline route.	× Most of this route goes through pristine vegetation × The area along the railway line and existing pipeline route is already rehabilitated and the pipeline will disturb new sensitive vegetation. × Construction activities along the route will open up the area, which could cause poaching and other impacts if not controlled.

The Alternative C route around the Medupi construction site is preferable, since it will run through an already and existing disturbed industrialized area. From a fauna perspective the environment at the Rietspruit and R510 is not exceptionally sensitive. The area consists of the Rietspruit, a drainage line and terrestrial, arboreal and rupiculous habitats. The Rietspruit is however sensitive for birds but given inordinate attention to ecological restoration after laying the pipeline, the area will continue to support a full plethora of vertebrates.

The following maps depict the environmental sensitivity of the pipeline route:

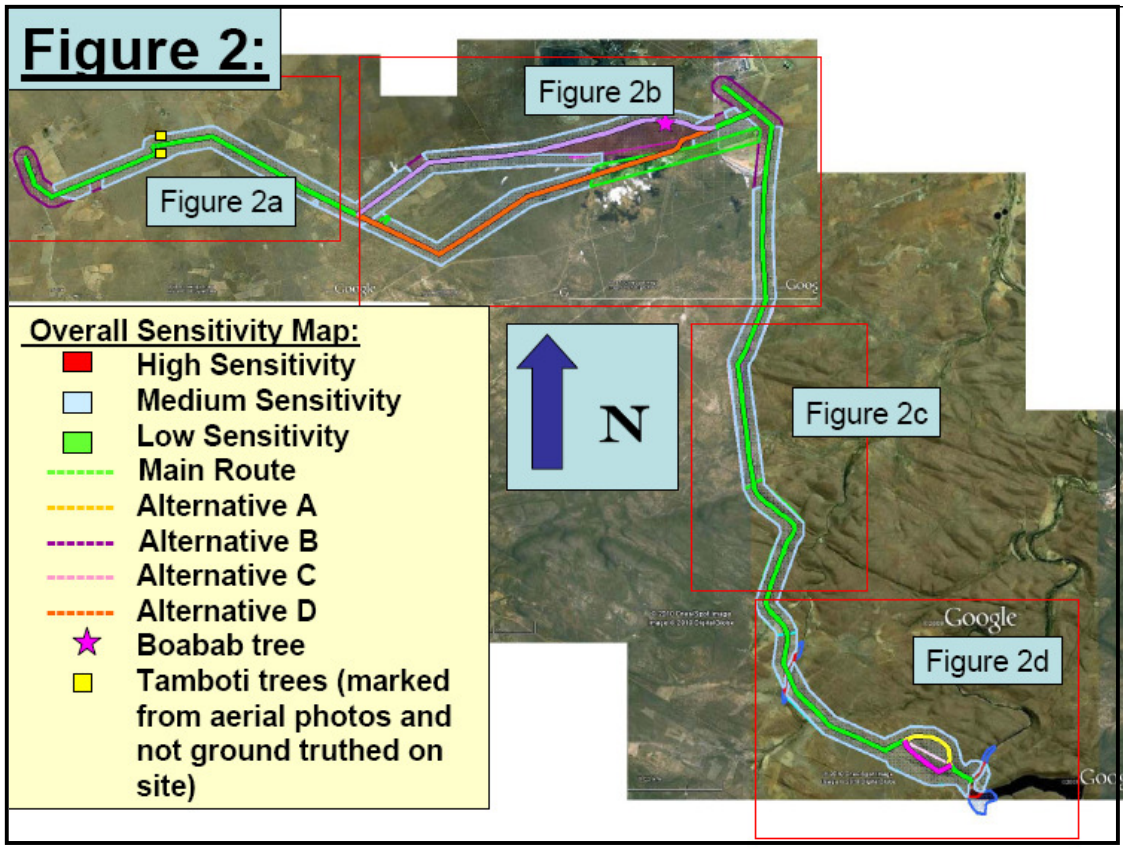

Figure 2: Overall Environmental Sensitivity map – showing areas to be zoomed in.

Sensitivity mapping rules.

BIODIVERSITY ELEMENT	SENSITIVITY MAPPING RULE
Flora communities	Sensitive flora communities
Mammal & Herpetofauna habitat	Sensitive fauna habitat
Avifauna habitat	Sensitive Rietspruit and Mokolo River

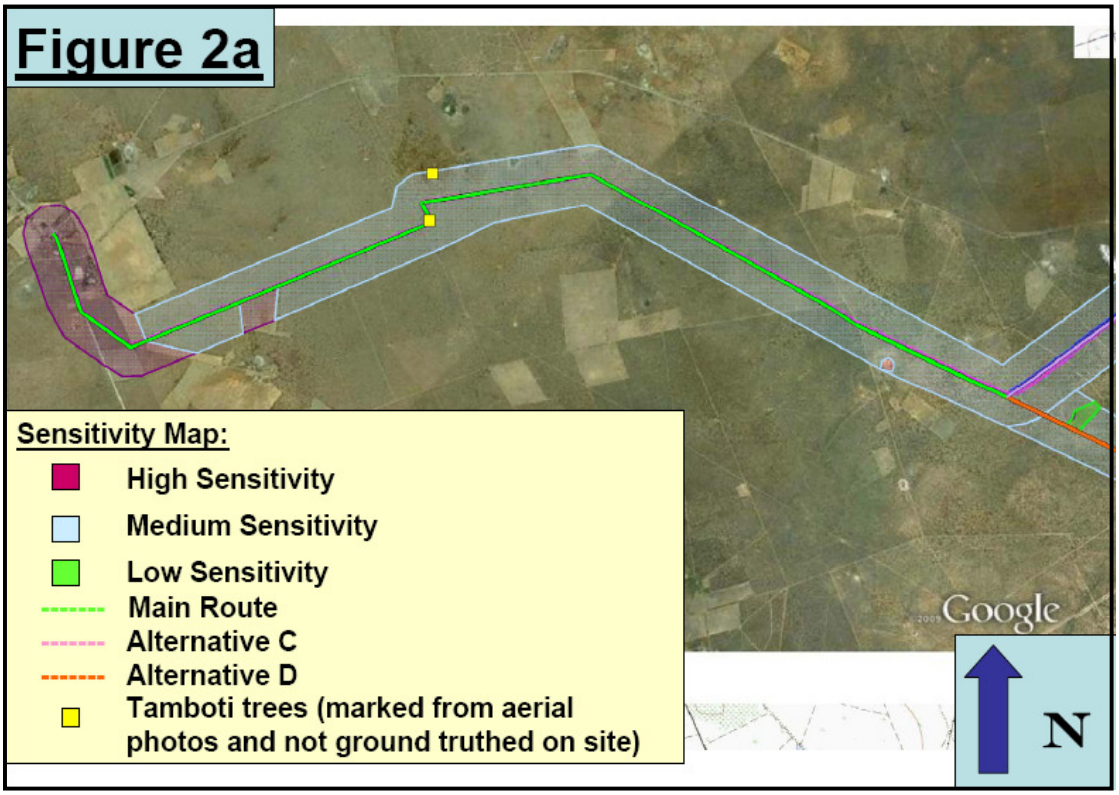
Figure 2a
Sensitivity Map:
High Sensitivity
Medium Sensitivity
Low Sensitivity
Main Route
Alternative C
Alternative D
Tamboti trees (marked from aerial photos and not ground truthed on site)
Google
N

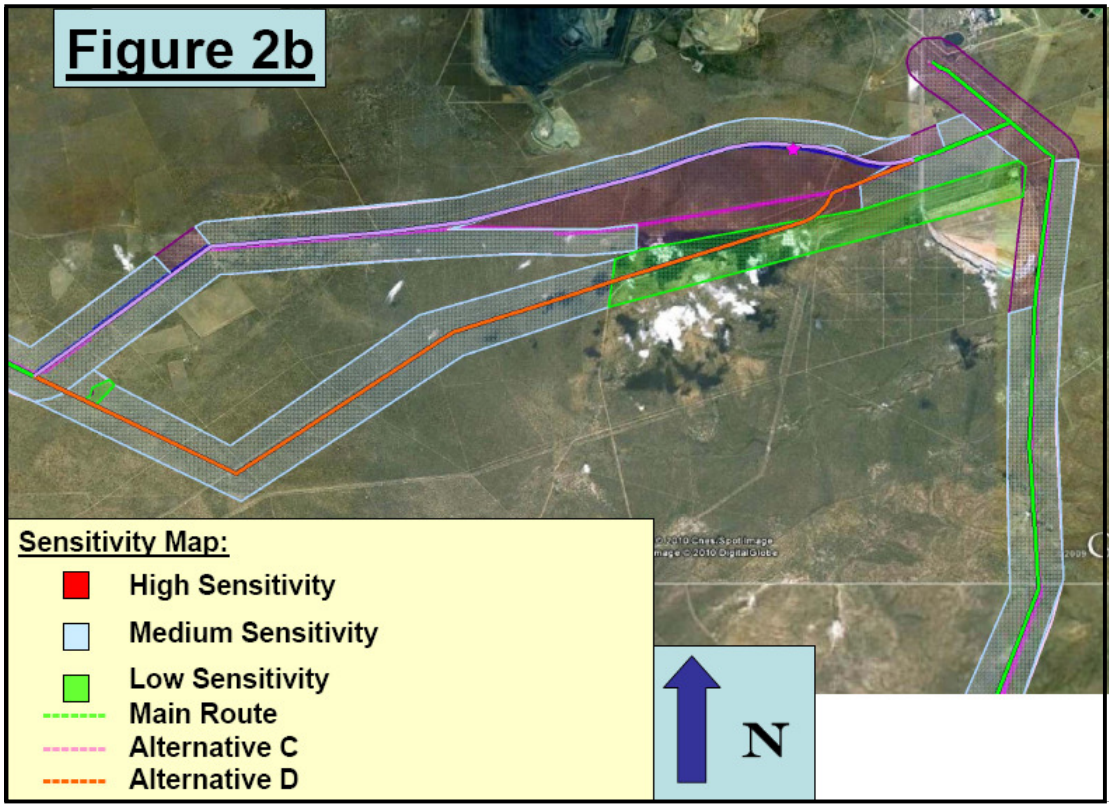
Figure 2b
Sensitivity Map:
High Sensitivity
Medium Sensitivity
Low Sensitivity
Main Route
Alternative C
Alternative D
N

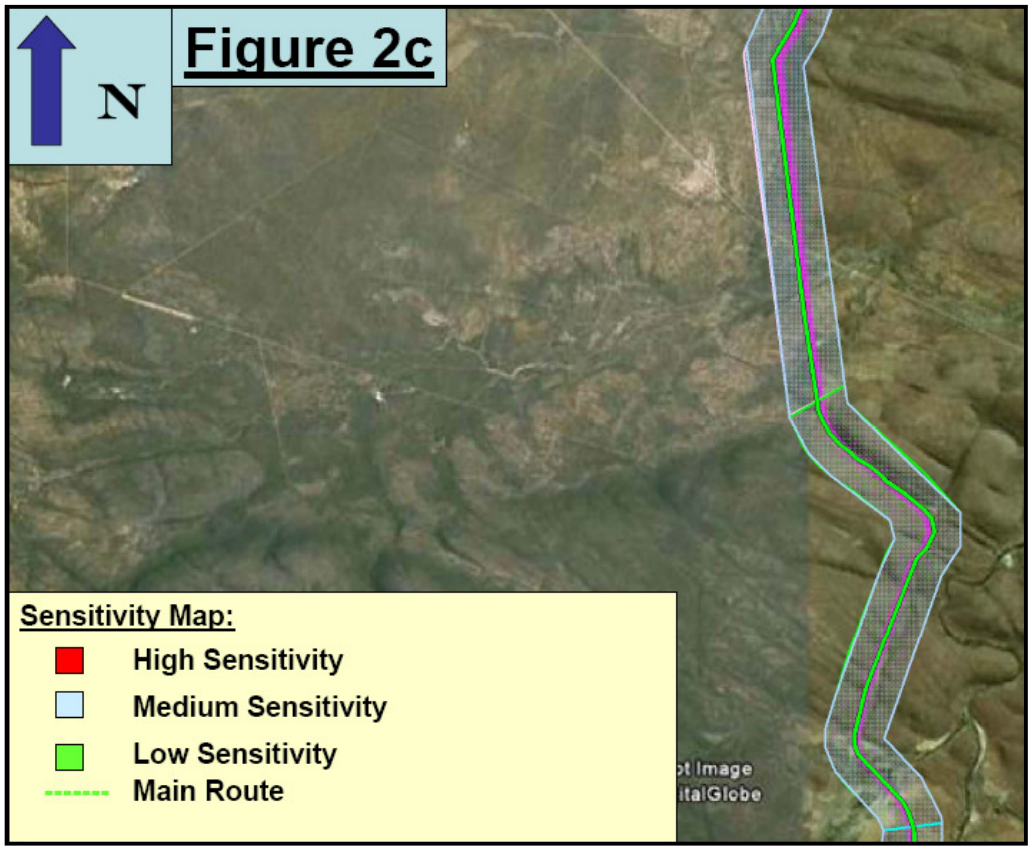
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Figure 2c
Sensitivity Map:
High Sensitivity
Medium Sensitivity
Low Sensitivity
Main Route

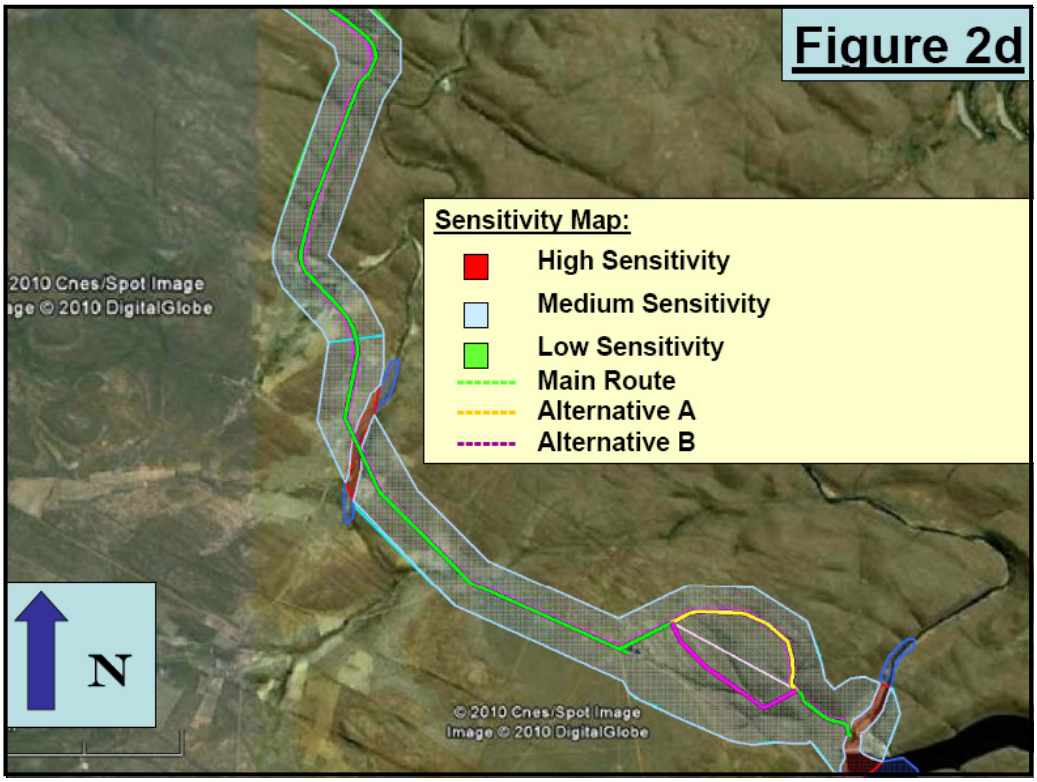
Figure 2d
Sensitivity Map:
High Sensitivity
Medium Sensitivity
Low Sensitivity
Main Route
Alternative A
Alternative B
N
2010 Cnes/Spot Image
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APPENDIX A: Flora Report

APPENDIX B: Mammal Report

APPENDIX C: Avifauna Report

APPENDIX D: Herpetofauna Report