Ecological Impact Assessment

Report Prepared for

Gulf Power Ltd.

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1. EXECUTIVE SUMMARY

An ecological impact assessment was carried out for the proposed Medium Speed Diesel Power Plant in Athi River along Mombasa Road. The work involved review of existing literature and carrying out field surveys to establish baseline ecological information. The size of the land for the proposed site is 4 hectares. The ecological impact assessment was undertaken within the site and including a buffer area of approximately 200m around the site. Plants, birds and butterflies were recorded in a checklist and later were run against IUCN to understand their conservation status; no entry was found in the IUCN Red List search engine. Existing activities within the wider environment were also recorded. Geographical features for the site were acquired using a GPS and complemented with Google Earth satellite imagery. This helped in developing a map of the site and its location in GIS software. Ecological impacts were identified and ranked subjectively using an ecological risk matrix. The rating of impacts associated with activities of the proposed project was undertaken using IEEM guidelines (2006). The characteristic of the project activities used in rating included: impact magnitude; spatial extent; duration of the activity; reversibility of impact; timing of activity; frequency of activity. These were rated against specific activities identified from the proposed project. Generally, the ratings of the impacts of the potential activities have low to moderate impacts on environment. After mitigation measures were proposed, residual impact rated were unlikely significant.

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1 Introduction

Due to high population growth rate there has been high demand for basic resources that has caused pressure on existing services. Notably, urbanization of cities in a country results in rapid changes seen in expansion and development of new buildings, roads, settlement, industries, and other social amenities. These developments compete for space and other resources causing destruction on the biotic and abiotic environment. The impacts vary with the type of development projects, processes and the ground scale starting from the construction, operation and decommissioning phase of the project. Despite this, it is important to note that development is imperative for economic growth and therefore, change must take place in the environment. However, environmental sustainability should be emphasized in any project development plan in order to attain effective conservation.

Consideration of environmental issues in socio-economic developments, industrial and urban development should be factored in physical planning. This is due to requirement of sustainability in development activities. In order to ensure this, various management options have been employed. Some of these take into account effects of activities on adjacent ecosystems. Ecosystem approach is a wider approach towards environmental conservation and sustainable use of natural resources. Currently, environmental authorities recognize Environmental Impact Assessment (e.g. the principles of externality) as an excellent planning and decision making tool that can be used throughout the project life cycle. This is a new management strategy that both authorities and project proponents are coping with in the country.

Among other developmental needs and resources, sufficient energy supply plays an important factor in economic development. Due to this, improvement of energy supply has become an important agenda for the national economic development. In order to enhance the supply, investment in power plants is embraced by both government and private investors. In Kenya, generation of electricity is mainly based on the Hydro-Electric Power Plants (HEP) and Geothermal energy. Other sources which are currently increasing their stake in the national grid are Fossil Fuel Power Plants (diesel based). On the other hand, wind and solar energy are increasingly used in homes and schools power supply.

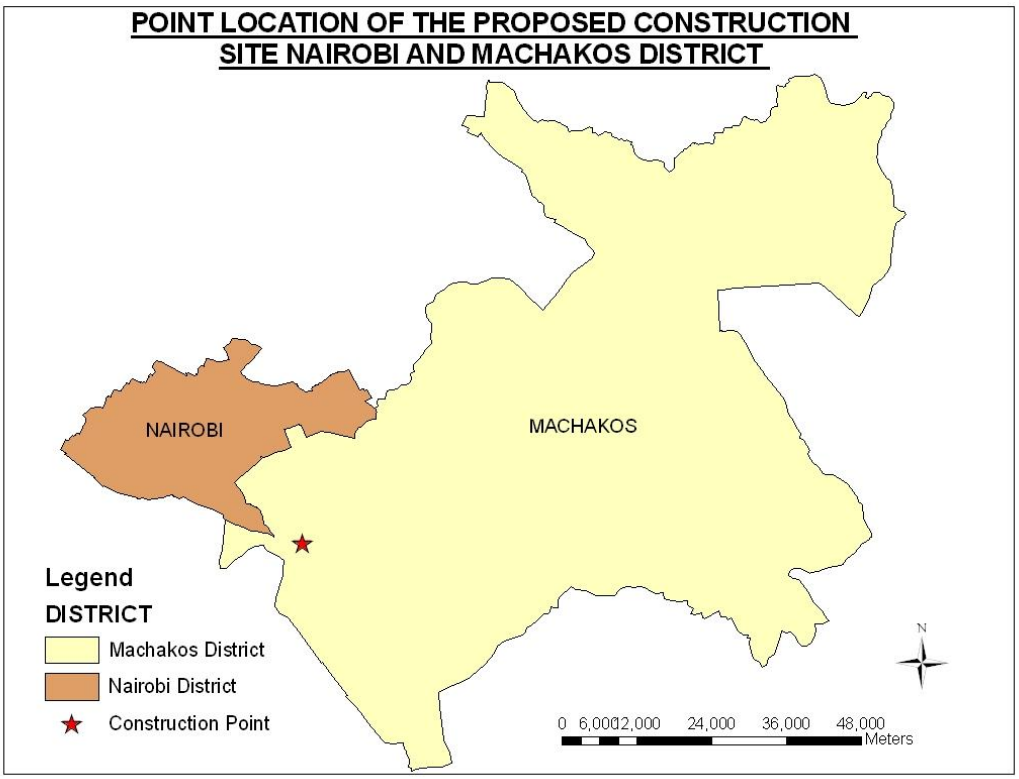
This assessment mainly focused on the Ecological Impact Assessment of the proposed construction of the medium speed diesel (MSD) Power Plant in Athi-River area along Mombasa road by Gulf Power Ltd. Generally, MSD Power Plants are not void of negative impacts on environment. Some of the common impacts are destruction caused by excavation, potential oil spills and drainage of used oil, exhaust fumes (and associated sulphur dioxide and other gases), and noise pollution. Important issues that were covered included:

- Development of biodiversity baseline information for the construction site and adjacent areas;
- Identification of the potential impacts of the project construction and operation, and;
- Scrutiny of management options that will ensure environmental sustainability.

1.1 Physical Description

The proposed construction site for the Gulf Energy Power Plant is located approximately 30 km south-east of Nairobi City from the CBD (Fig.1). The site is in Mavoko County Council in Machakos District. Machakos district is situated to the eastern side of Nairobi City with altitude ranges between the lowest range of 600masl at Tsavo in the south end of the district to the highest range of 1600masl in the north-west end at the outskirts of Nairobi.

Figure 1: Location of proposed construction site in Machakos District neighboring Nairobi District

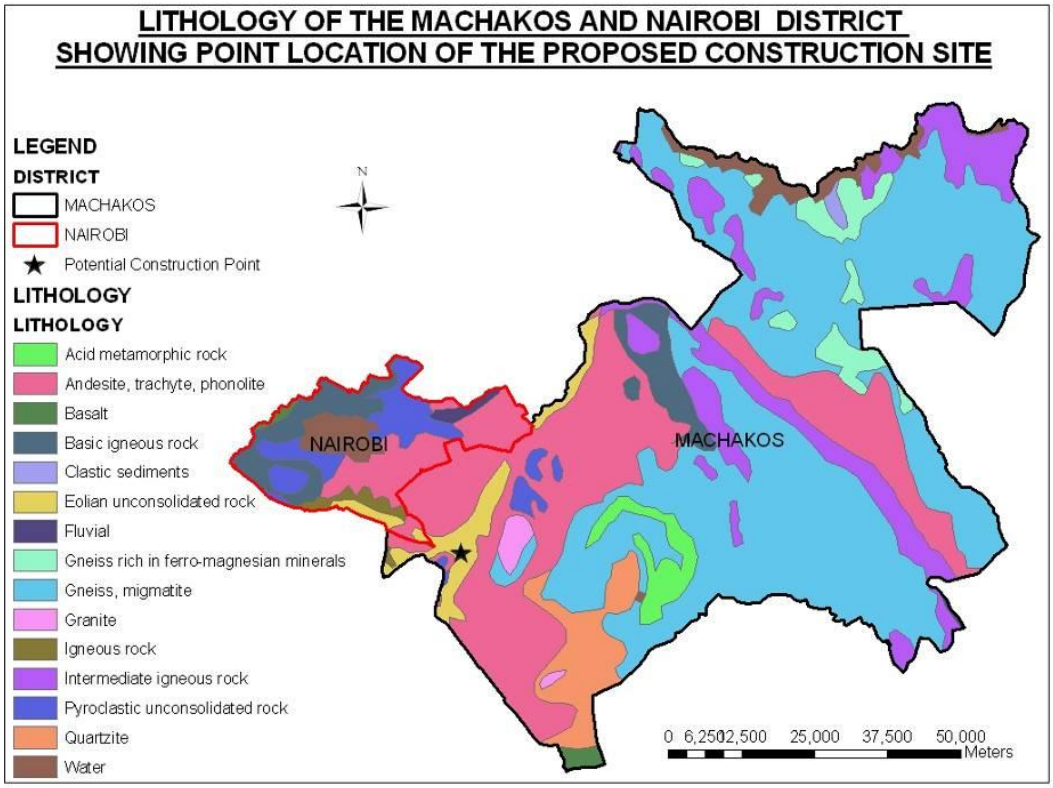


The power plant site is situated in the upper Athi River catchments; it is dry but adjacent to the seasonal Stony Athi River to the south-east. The average annual rainfall in the district ranges from slightly over 1000 mm in some highlands to slightly below 500 mm in low lying south and south east parts of the district. The rainfall in the area has a bimodal pattern with two rainy seasons occurring from March to May and November to December. A small portion of the district has potential for agriculture. Athi River town and the greater Mavoko County Council fall under the agro-climatic zone V-4. This zone is characterized as semi-arid with average rainfall amounting to 450 – 900mm annually. The vegetation cover is described a bushland with the potential plant growth being medium to low.

1.2 Soil Lithology

Major soil types in the district consist of Ultisols (32 %), Entisols (10%), Inceptisols (13%), Alfisols (14%), Vertisols (11%), Oxisols (14%), Andosols and lava (6%). The proposed project site lies mostly in the vertisol soil, while adjacent areas are in entisols soil type. Vertisol soils consist of 30 % clay rich, rich in swelling clays, characterized by deep cracks when dry and high in nutrients (black cotton soil). The entisol soils are developed from recent sediment and often are coarse textured (Machakos District Development Plan, Republic of Kenya). Generally, the underlying rock stratum consists of the eolian unconsolidated rock as shown in Figure 2.

Figure 2: Lithology of Machakos District and Nairobi District showing the location of the proposed construction site



1.3 Ecology description

The main habitats within the Athi-Kapiti ecosystem are the Grass plain dominated by *Cynodon, Themeda, Cypress,* and *Digitaria* species; Dry forest, *Olea africana*, *Croton dichogamus*, *Brachylaena hutchinsii*, and *Calodendrum*; Riverine forest/valley forest, *Acacia xanthophloea*, *Euphorbia candelabrum*, *Apodytes dimidiata*, *Canthium schimperiana*, *Elaeodendron buchananii*, *Ficus eriocarpa*, *Aspilia mossambicensis*, *Rhus natalensis*, and *Newtonia* species.

1.4 Project Description

The Proponent's power plant will be constructed on a 4 hectare piece of land along Mombasa Road. The project is designed to generate electricity using engines that run on diesel or heavy fuel oil. It will supply power to the current national grid. The plant will be constructed with a proposed stack height of 37m which will emit fumes high off ground level. Oil tankers that will be offloading fuel to the site will park in front of the plant compound.

2 METHODOLOGY

2.1 Data Acquisition

2.1.1 Secondary Data

Secondary data was acquired by various means. These included visiting libraries at the National Museums of Kenya (NMK), the Kenya National Bureau of Statistic (KNBS), the internet and online spatial database. The information was used for literature review, updating existing maps and visualization of the potential project site with various adjacent ground features. Data comprised of reports, books and digital thematic maps.

2.1.2 Field Survey

The field survey was carried out on February 16th 2010 between 9.00 am to 12.00 noon. The main activities involved were:

- Examining plant community structures and species composition, and faunal composition in the potential project site and in a 200 meter buffer zone around the boundary. Identification of the species was done using practical experience complemented with a field guide book;
- Undertaking an avifauna survey;
- acquiring GPS points, tracks for showing representative species, delineation of vegetation cover stratification; and
- On-going activities and status of the environment at the site and adjacent areas.

2.1.3 GPS coverage

Point data for representative species and tracks for roads were acquired using GPS Garmin 12 XL. The GPS was set to the map coordinate system WGS 1984 (decimal degree). The GPS data was then loaded into a DNR Garmin software using a cable from the GPS to the computer. With this connection, the data was saved in both an ESRI shape file and Google Earth Kml file.

2.2 Spatial data management, analysis and visualization

The ESRI shape file was loaded into ArcView 3.2 software application. Polygon features were acquired by digitizing (drawing) the boundary of the features in Google Earth in a highly stable internet service. A Google image is recommended for spatial data acquisition and can be comparable with aerial photos in terms of high spatial resolution which ranges from 2 cm to about 15 m. Google image became handy especially in cloudless cover over the area. The default projection system of Google image is WGS 1984, therefore, the data was loaded into DNR Garmin software to convert into ESRI shape file. Thereafter, a base map was developed for the potential construction site.

3 Baseline Ecological Information

3.1 Spatial Information

The proposed project site has a frontage to Mombasa Road. On the way to Mombasa from Nairobi, the site is situated on the right hand side close to the road. Towards the south west of the site, there exists a soil bank approximately 2.5 m high and extending further is an area that was used as a quarry and is currently derelict. Over 30% of the potential project site is covered by waste soil dump from the construction of the dual carriage highway as shown in Figure 3.

3.2 Biodiversity

3.2.1 Plants Diversity (Appendix I)

3.2.1.1 Distribution of Important species

Plant species were observed both within the project site and outside of it. A buffer zone of 200 meters around the tentative project boundary was examined for important species. Most of the tree species recorded is within the buffer-zone of the construction. The construction site comprises of *Cynodon dactylon, Cymbopogon sp.* and other annual/seasonal weed species. Other species are scantly distributed which include the Acacia species and Aloe as shown in Figure 3.

3.2.1.2 Reproduction and dispersal of important species

Most of the important tree species observed in the area reproduce sexually. Therefore, seeds are transported and dispersed by either animals that feed on them, by wind and further by runoffs during rainy seasons. Ecologically, the seed dispersal patterns will not be affected as the species are distributed in the areas around the site.

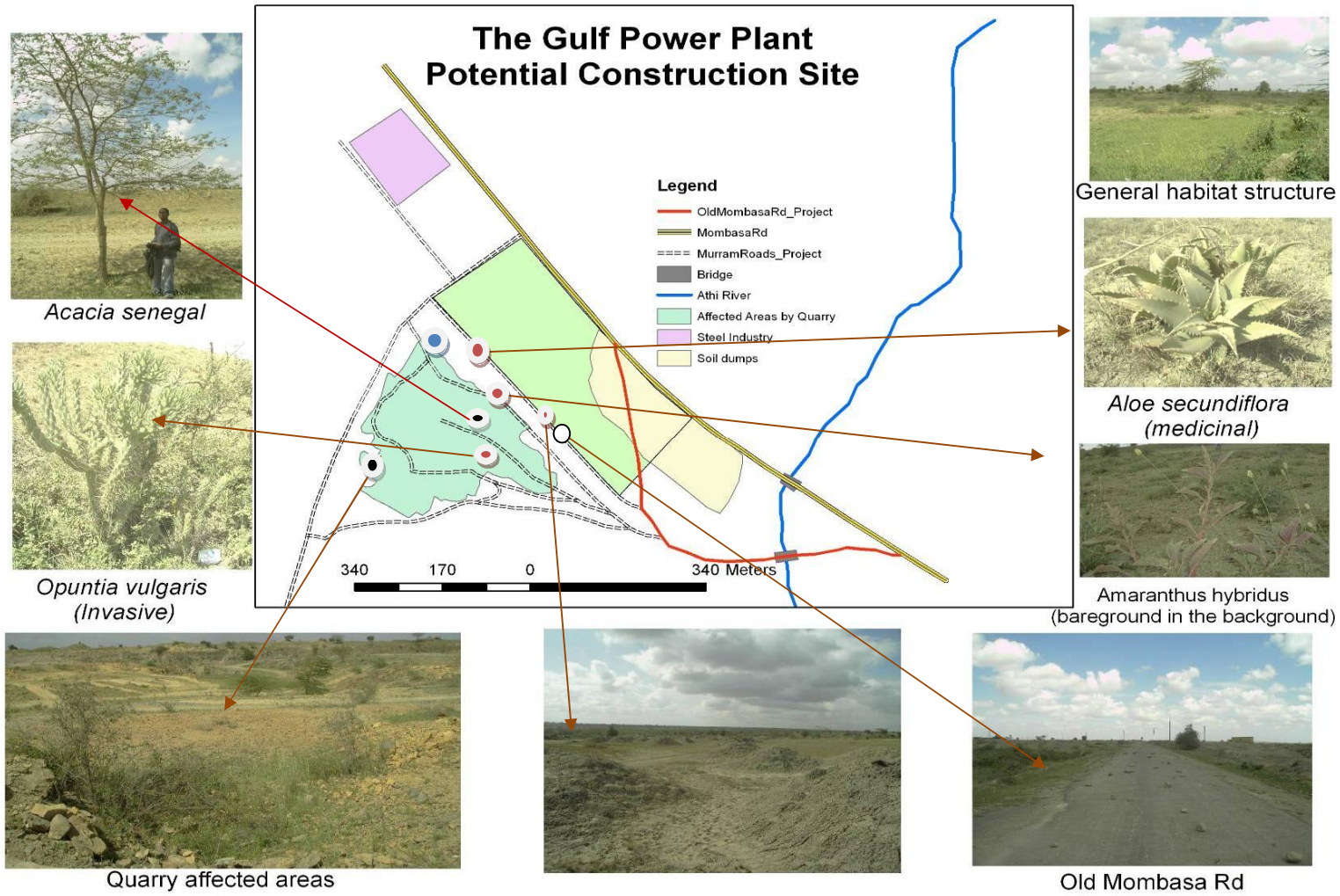


Figure 3: Map of the proposed power plant site with randomized points showing representative species

3.2.1.3 Structural characteristics of the plant communities

The dominant plant community observed were grasses, which are dominated by Star grass, *Cynodon dactylon*, and Couch grass, *Cymbopogon sp.* The grasses are degraded with bare areas forming 1/3 of the area. The average height of the grasses observed was 15 cm. The other community comprises of herbs (annual plant species) which were few and observed occurring in isolation. They range from 10cm to 120cm in height. The tree community was rare as shown in Figure 4. They are sparsely distributed at the lower south-east edge of the project site i.e. starting at the edge, towards the buffer zone up to the riverine (where there is large *Acacia tortilis*. The riverine is situated approximately 0.6km south-east from the site.

Figure 4: Image showing existing vegetation structures and cover at the proposed project site

3.2.1.4 Invasive plant species

Invasive plants that were observed during the rapid field assessment include: *Solanum incanum, Solanum mauritianum*, *Tagetes minuta, Lantana camara* which competes with other vegetation, *Opuntia vulgaris* which competes with native plants and precludes grazing and browsing near it.

3.2.2 Fauna

Generally, the area around the project site does not support diverse fauna species. It is open, dry with very low vegetation cover making it unsuitable for inhabitation. However, few species of birds and butterflies were observed in the wider area (within the site and outside of it).

About 19 species of Avifauna (birds) were recorded in the area. They include Rufous (Naped Lark), Northern Wheatear, Common Bulbul, Rattling Cisticola, Willows Warbler, Variable Sunbird, Rufous Sparrow, Grey-headed Sparrow, Purple Crenadier, Bronze Manikin, African Citril, Little Swift, Black Saw-wing, Superb Starling, Stricky Seed-eater, Bronze Sunbird, Grassland pipit, Fischer's Sparrow-lark, Golden-Breasted Bunting. Most of these birds were observed in-flight.

A few species of butterflies were observed especially when advancing towards the direction of the riverine. Their occurrence was related to the increase of the flowering vegetation covers. The species included *Junonia hierta, Junonia oenone, Papilio demodocus, Colotis cuippe, Dixeia pigea, Dixeia spilleri,* and *Belenois zochalia*

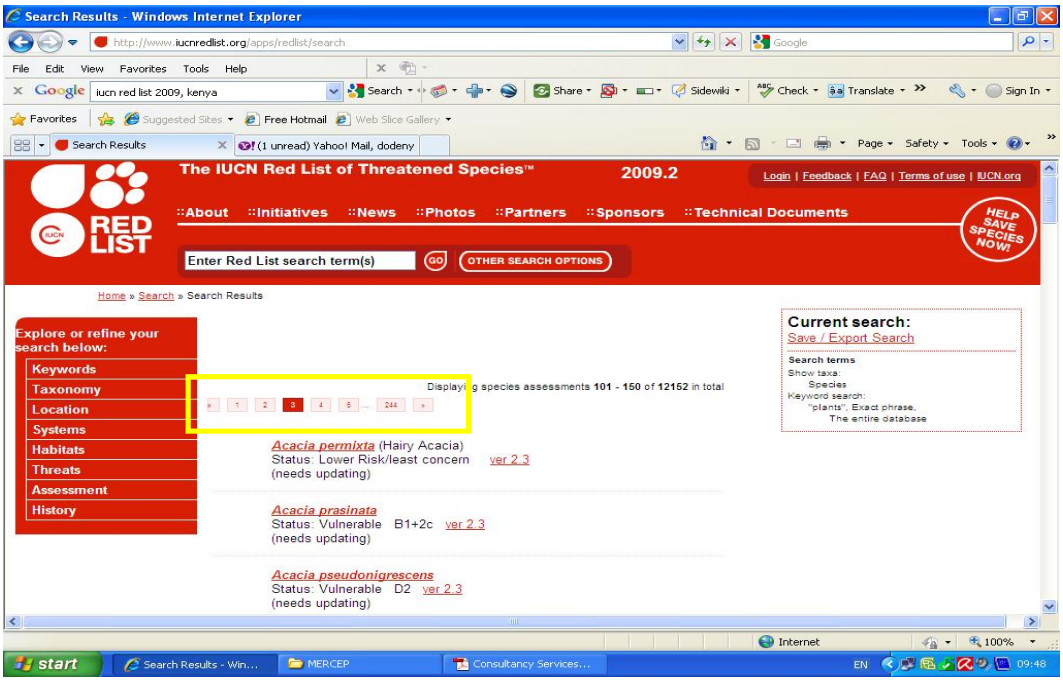
3.3 Ecologically sensitive zones

The proposed project site is open with short grasses existing with very few trees dispersed at the lower edge of the site. The area is already degraded and there is no sensitive habitat.

3.4 IUCN Redlist data search for vulnerable species

Species that were observed/recorded were checked with the search engine of the IUCN Redlist data shown in Figure 5. After opening several pages of the list, none of the species observed/recorded were found in the record of vulnerable species.

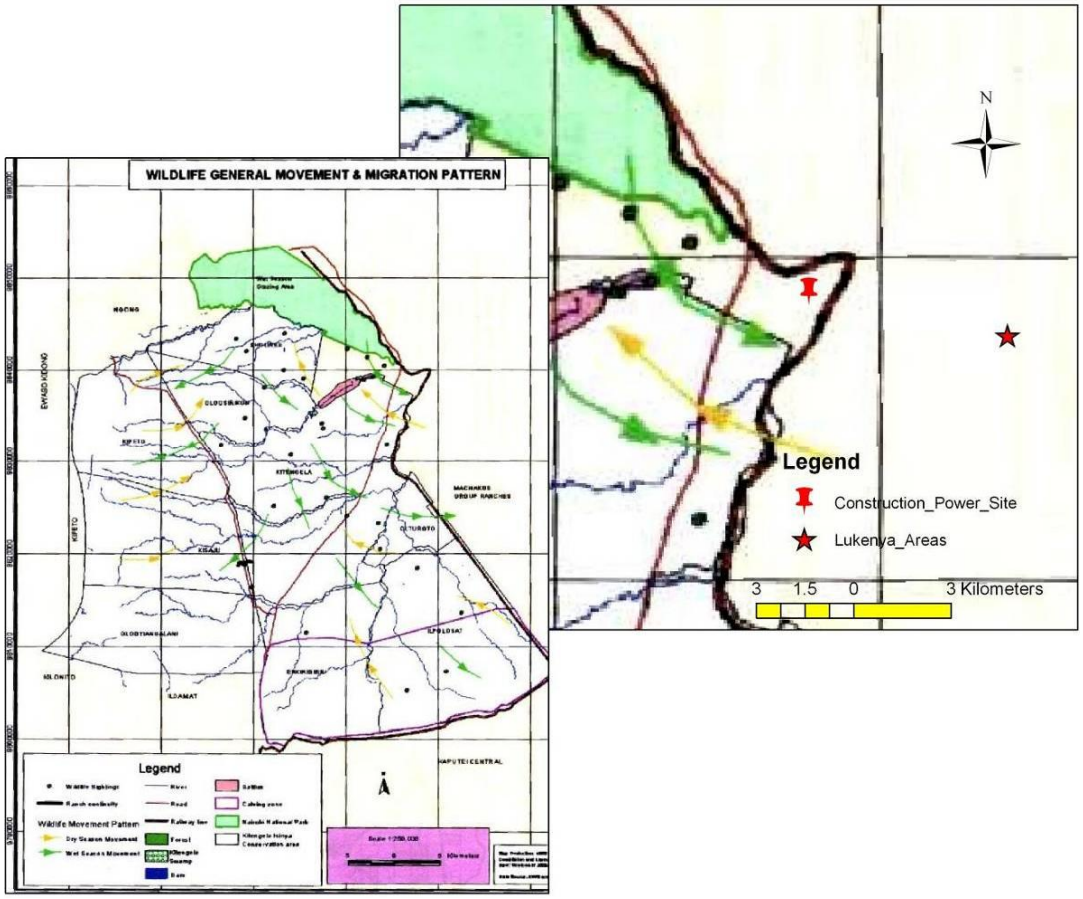
Figure 5: The IUCN search engine for Red List of threatened species of plants and animals



3.5 Animal migratory routes

The proposed project site is situated in the Athi-Kapiti plain ecosystem and lies about 8.5km to the south-east of the Nairobi National Park.

Figure 6: Migratory patterns of herbivores around the Nairobi National Park during wet and dry seasons

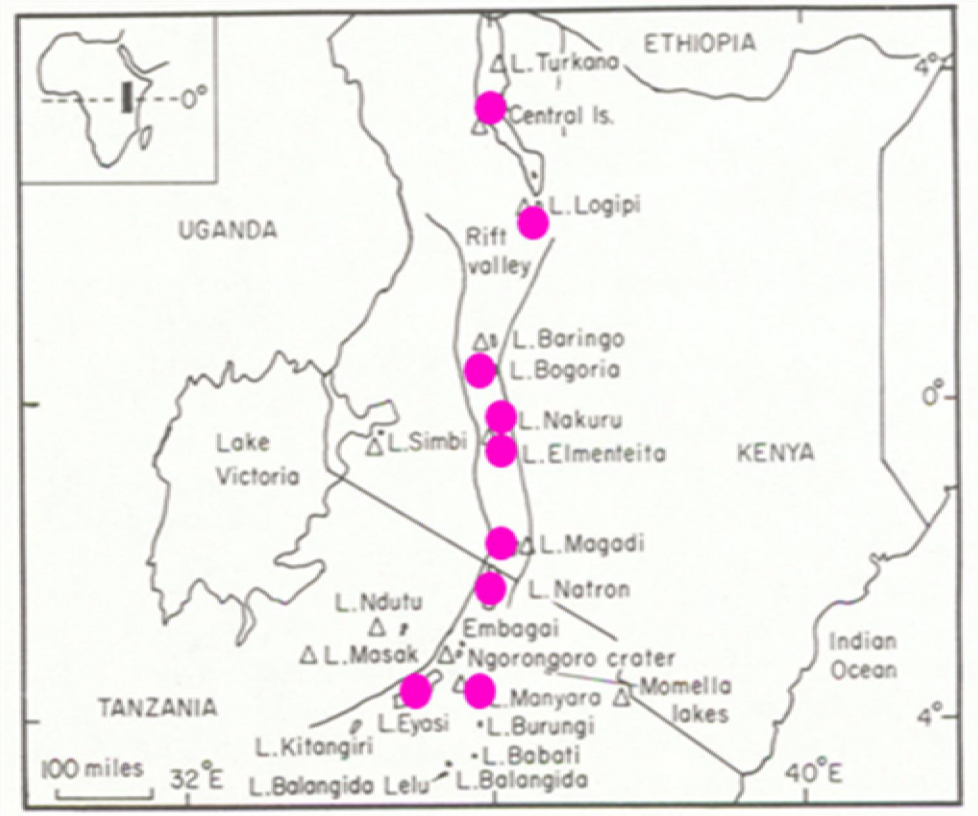


The green arrows show movements during wet season, while yellow arrow shows dry season movement.

The Nairobi National Park comprises less than 10% of the Athi-Kapiti ecosystem with the northern, eastern and western boundaries fenced with an electric fence. The southern boundary is marked by the Mbagathi River; it is not fenced and is open to the Kitengela Conservation Area. This is the side where there is considerable movement of large ungulate species across it. The herbivores (wildebeest and zebra) use Kitengela Conservation Area and migratory corridor to the south of the Park to reach the Athi-Kapiti Plains. The migratory routes for the animals lie in the south of the proposed site. The wet season (green arrow) and dry season (yellow arrow) movement lies about 2 and 4 km respectively from the potential power plant construction site as shown in Figure 6.

Avifauna migratory route: The main flyways and stop-overs for the migratory birds (Palearctic birds) are within the Rift Valley (Ollorgessailie, Kariandusi, L. Turkana) and Lake Victoria as shown in Figure 7. The proposed project site does not lie close to the bird migratory routes and therefore is not expected to have significant impacts.

Figure 7: General migratory route for Palearctic migrant birds within the Rift Valley



3.6 Environmental degradation

The area neighboring the proposed project site is highly evolving in terms of economic development. This is seen in the form of dominant industries such as a neighboring steel manufacturing plant to the north-west. The area is open degraded area with low cover of grasses and seasonal plants. There is eminent soil dumping that is increasingly altering vegetation cover. This covers more than 30% of the proposed site. There is a growing solid waste dump in the south east of the site. These are illegal activities that potentially affect the ecological role of a habitat and value of an economic development.

Figure 8: Soil dumping in the proposed project site

Figure 9: Solid waste dumps in the background at the south-east end of the proposed project site

4 Impact Identification and Assessment

4.1 Methodology

Baseline information generated through literature review and field observations formed the basis on which impacts of the proposed project were assessed and identified. Impacts were identified based on possible effects of activities and certain operational processes on habitats, species (plants and animals) and ecological processes.

Subsequently the Consultant used the Institute of Ecological and Environmental Management (IEEM) Guidelines to assess the ecological impacts arising from the proposed project. These guidelines were produced for the U.K. environment and customized for the proposed project.

4.2 Potentially affected biophysical features

4.2.1 Soils

The soil at the proposed project site is black cotton soil. The earthworks involving excavation will cause disturbance resulting in loosening and compaction of the indigenous soils. Potential oil and lubricant spills from vehicle maintenance and other machinery may cause soil pollution.

4.2.2 Air Quality

The exhaust fumes generated by vehicles transporting materials and supplies to the site could potentially pollute the ambient air quality. The proposed power plant will produce Sulphur dioxide and aerosols which are air pollutants.

4.2.3 Noise Quality

There will be noise from the vehicles transporting materials and supply fuel to the power plant. Additionally the power plant will cause noise pollution. This has potential of interfering with bird calls as they pass over the proposed power plant site during the construction and operational phase of the project.

4.2.4 Landscapes

Site clearance, fencing, infrastructure construction and parked large vehicles reduce land cover and visibility. To some extent the proposed project may result in slight modification of the landscape and aesthetic features of the site.

4.2.5 Water Quality/Quantity

Use of machines during construction and operation of the power plant may cause oil spillage. This may be carried away into the drainage system by runoffs and/or routine drainages that could potentially affect flora and fauna.

4.2.6 Flora

Vegetation losses particularly for species with small populations are likely to be lost during the site clearance and excavation for foundations. Improper dumping of excavated soil and other debris may smother plant covers and soil seed bank especially of the ephemeral status such as herbs and grasses. Introduction of obnoxious weeds and invasive plant species may occur during the operation phase. Dust/aerosols and sulphur dioxide generation may occur

during the operation phase. These have potential interference with plant photosynthesis and pollination. Also, upcoming structures and access roads may create barriers for seed dispersal between habitats.

4.2.7 Fauna

Habitat fragmentation due construction of access roads, and plant structures may reduce connectivity between different habitats for animals like mammals, bird, herpetofauna and invertebrates. The expansive species habitats and migration routes may be affected for migrant herbivore species and birds.

4.2.8 Hydrology

Construction of the power plant may increase runoff accumulation and waste waters within the site. The eventual discharge of the water to the low-lying riparian zones may potentially cause or increase soil erosion and siltation down-stream. This may also affect water quality and pollution to the natural drainage system.

4.3 Criteria for Ranking and Rating impacts

The methods used for ranking impacts were based on subjective judgments that have been used in Environmental Impact Assessment (EIA). The matrix method was used for ranking impacts of activities as indicated in Table 1. In the matrix, activities were listed running horizontally and vertically. Magnitudes of impacts were compared and if the vertical activity attributes had higher impact then, it was ticked (see table below).

Table 1: Environmental impacts identified ranked in a matrix and checked against each to compare one that has more impact on environment that the other.

	Landscape alteration	Soil dumping	Noise pollution	Water pollution	Obstruction	Soil erosion	Siltation	Air pollution	Loss of aesthetic value	Ranks
Landscape alteration	×	√	×	×	√	√	√	×	×	4
Soil dumping	×	×	×	×	×	√	√	×	√	3
Noise pollution	√	√	×	×	√	√	√	×	√	6
Water pollution	√	√	√	×	√	√	√	×	√	7
obstruction	√	√	×	×	×	√	√	×	×	5
Soil erosion	×	×	×	×	×	×	×	×	√	1
Siltation	×	√	×	×	×	√	×	×	×	2
Air pollution	√	√	√	√	√	√	√	×	√	8
Loss of aesthetic	×	×	×	×	×	×	×	×	×	0

Note: 8 = Highest impact and 0 = lowest impact

The guideline for IEEM guidelines (2006) was used for rating impacts of the development activities on the biophysical features. The characteristic of the project activities; impact magnitude, spatial extent, duration of the activity, reversibility of impact, timing of activity, activity frequency were rated against specific identified project activities in their respective phases in the following ways (Table 2):

Magnitude: 1 = low, 2 = moderate, 3 = high

Extent: 1 = onsite, 2 = site and buffer, 3 = site, buffer and beyond

Duration: 1 = Few weeks, 2 = several months and 3 = more than 1 year

Reversibility: 1 = reversible, 2 = moderate and 3 = irreversible

Timing: 1 = Not critical (does not coincide with ecological processes) 2 = partially critical (partially affects ecological processes) 3 = critical (activity coincides with ecological processes)

Frequency: 1 = once (in the lifetime of the development), 2 = Occasional (in the lifetime of the development) and 3 = continuous (in the lifetime of the development)

Impact: Positive = (+ve) either or negative = (-ve)

Impacts were assessed on a rating of 1 to 4 in the following way:

1 = near certain impact where probability is estimated at 95% chance or higher,

2 = Probable, where probability is estimated above 50% but below 95%,

3 = Unlikely, where probability is estimated above 5% but less than 50% and

4 = extremely unlikely where probability is estimated at less than 5%.

Table 2: Impact ratings based on the impact project activities potentially has on the environment.

Project Activity	Project Phase	Biophysical Feature affected	Magnitude	Extent	Duration	Reversibility	Timing	Frequency	Score	Positive/Negative	Probability of impact
Site Clearance, excavation	Construction	Soil, Flora, Fauna, Landscapes, Air Quality and Hydrology	2	1	1	2	2	1	1.5	-ve	Probable (above 50% but below 95%)
Soil dumping		Soil, Flora, Fauna, Landscapes and Hydrology	1	1	1	1	2	1	1.2	-ve	Unlikely (5% but less than 50%)
Laying mortar foundation		Air Quality, hydrology, water quality	1	1	1	2	1	1	1.2	-ve	Unlikely (5% but less than 50%)
Fencing	Construction and	Flora Fauna	1	1	1	2	2	1	1.3	-ve	Unlikely (5% but less than 50%)

Project Activity	Project Phase	Biophysical Feature affected	Magnitude	Extent	Duration	Reversibility	Timing	Frequency	Score	Positive/Negative	Probability of impact
Machine works (combustion and exhaustion)		Soil, air quality, water quality, flora, fauna	1	3	3	1	2	3	2.2	-ve	Probable (above 50% but below 95%)
Waste generation and disposal		Soil, water quality, flora, fauna	1	1	3	1	1	2	1.5	-ve	Probable (above 50% but below 95%)
Soil Compaction (on site and by vehicles)		Soil, hydrology,	1	1	3	2	1	1	1.5	-ve	Probable (above 50% but below 95%)
Fueling power plant engines	Operational	Soil, water quality, flora, fauna	2	1	3	1	1	3	1.8	-ve	Probable (above 50% but below 95%)

Table 3: Summary table for impacts and mitigation measures

Proposed Activity	**Characterization of unmitigated impact on the ecological features**	**Significance without mitigation and confidence level**	**Mitigation and Enhancement**	**Residual significance and Confidence level**
Site Clearance, excavation and soil dumping	Clearing of vegetation and excavation of soil and dumping. Movement of heavy earthmovers	Potential reduction of size of habitat, loss of species and alteration of landscapes.	Trees lying outside construction footprint should be preserved (minimum clearance). Avoid soil dumping in areas with unique and mature trees. Translocate unique plant species such as Aloe species to a decoration garden. Excavated top soil should be used for landscaping, controlling erosion and reinforcing drainage channels and fencing. Leave a strip around the power plant for planting trees.	Impact **Probably** not **Significant** impact (above 50% but below 95%).
Fencing	Digging foundation and construction of wall around the proposed project site compound produces dusts and affect soil system.	Potential loss of movement of soil organisms, loss of soil micro-habitat, interference with natural animal dispersal patterns.	If hard stone are dug out then, they can be used for filling floors of the structures. Excavated soil should be dumped in an area with similar environment to enable survival of soil organisms.	Effect in respect to the ecosystem services is **unlikely** (more than 5% but less than 50%) significant.
Laying mortar foundation	Mixing of cement with concrete may produce dust polluting air and soil	Health impacts on workers through potential respiratory complication, potential reduction of rates of photosynthesis, and animal breeding and feeding patterns	Worker use appropriate protective gear. Use dust sieves and screens to contain the dusts.	Impact is **Unlikely** (more than 5% but less than 50%) **significant**.

Proposed Activity	**Characterization of unmitigated impact on the ecological features**	**Significance without mitigation and confidence level**	**Mitigation and Enhancement**	**Residual significance and Confidence level**
Machine works (combustion and exhaustion)	Potential noise, dust and exhaust fumes	Potential pollution of air, soil, noise pollution, and interference with plant photosynthesis and growth; interference with animal feeding and migration. Emission of gases e.g. sulphur dioxide may cause acid rains which might affect terrestrial plants and aquatic organism	Dust suppression and installation of noise mufflers to the housings of the engines sprinkling of water at the earth trucks especially during the dry season. Installation of efficient combustion engines to reduce dangerous emissions. Maintenance and servicing of machinery and engines.	**Probable**, not negative significant impact. (above 50% but below 95%).
Fueling power plant engines	Transfer of diesel from oil tankers, filling of diesels to the engine tanks.	Accidental spillage of diesel oil on floor, which may be washed by water and drained in the main sewer or drainage channels. This presents potential risk to aquatic plants and animals. On the other hand, fire incidence may occur.	Careful handling of the transfer and filling to avoid spillage. Wipe diesel oil drips and recycle where necessary. Equip the houses with fire extinguishers.	**Unlikely** no negative significant impact
Waste generation and disposal	This involves oil wastes discharged from the engines and developing solid wastes. Dumping of construction material wastes.	Potential smothering of small vegetation if oils not disposed carefully. Solid wastes may affect aesthetic value of landscape if not disposed carefully	Metal and plastic wastes can be recycled or reused. Careful handling and disposal of oil wastes. Establishing a waste management plan/strategy.	**Unlikely** no negative significant impact
Soil Compaction (on site and by vehicles)	Heavy machines compress soil for compaction to stabilize construction soil. Moving vehicles that fuels will create soil compaction in the parking areas.	Potential interference with soil micro-habitat, destruction of vegetation (grasses).	Create parking yard and vehicles should be organized (i.e. lay down time table for fueling).	**Unlikely** no negative significant impact.

5 REFERENCES

- IEEM, 2006. Guidelines for ecological impact assessment in the United Kingdom.
- Republic of Kenya, 1994. District Development Plan: Machakos District. Office of the President and Min. of Planning and National Development.

Website

- http://www.ilri.org/gis/search.asp (Access date February 17, 2010)

Appendix I: Plant Species Observed at Proposed Site

Genus	Species	IUCN Redlist data	Category	Abundance (status)	Occurrence/distribution
Acacia	*drepanolobium*	No entry found	Tree species	Rare on site	At one side of the boundary and adjacent areas
Croton	*dichogamus*	No entry found	Tree species	Rare on site	At the boundary and adjacent areas
Acacia	*Senegal*	No entry found	Tree species	Rare on site	At the boundary and adjacent areas
Balanites	*aegyptiaca*	No entry found	Tree species	Rare on site	Between boundary of construction site and quary
Commelina	*sp.*	No entry found	Herbs	Rare on site	Inside and outside of site
Withania	*somnifera*	No entry found	Herbs	Rare on site	Inside and outside of site
Solanum	*incanum*	No entry found	Herbs	Rare on site	Inside and outside of site
Datura	*stramonium*	No entry found	Herbs	Rare on site	Inside and outside of site
Oxygonum	*nigrum*	No entry found	Herbs	Rare on site	Inside and outside of site
Amaranthus	*hybridus*	No entry found	Herbs	Rare on site	Inside and outside of site
Biden	*pilosa*		Herbs	Rare on site	Inside and outside of site
Achyranthes	*aspera*	No entry found	Herbs	Rare on site	Inside and outside of site
Sphaeranthus	*suaveoleris*	No entry found	Herbs	Rare on site	Inside and outside of site
Crotolaria	*agatiflora*	No entry found	Herbs	Rare on site	Inside and outside of site
Tagetes	*minuta*	No entry found	Herbs	Rare on site	Inside and outside of site
Solanum	*mauritianum*	No entry found	Herbs	Rare on site	Inside and outside of site
Gomphocarpus	*fruticosus*	No entry found	Herbs	Rare on site	Inside and outside of site
Prectrurthur	*sp.*	No entry found	Herbs	Rare on site	Inside and outside of site
Momordica	*foetida*	No entry found	Herbs	Rare on site	Inside and outside of site
Portulaca	*oleracea*	No entry found	Herbs	Rare on site	Inside and outside of site
Leonotis	*nepetifolia*	No entry found	Herbs	Rare on site	Inside and outside of site
Digitaria	*scalarum*	No entry found	Herbs	Rare on site	Inside and outside of site
Abutilon	*mauritianum*	No entry found	Herbs	Rare on site	Inside and outside of site
Acalypha	*volkensii*	No entry found	Herbs	Rare on site	Inside and outside of site
Cucurius	*aculeatus*	No entry found	Herbs	Rare on site	Inside and outside of site
Sonchus	*asper*	No entry found	Herbs	Rare on site	Inside and outside of site
Asperagus		No entry found	Herbs	Rare on site	Inside and outside of site
Lantana	*camara*	No entry found	Shrubs	Rare on site	Outside site
Aloe	*secundiflora*	No entry found	Succulents	Rare on site	Inside and outside of site
Opuntia	*vulgaris*	No entry found	Succulents	Rare	Outside site site
Cynodon	*dactylon*	No entry found	Grasses	abundant	Inside and outside of site
Cymbopogon		No entry found	Grasses	abundant	Inside and outside of site