PROPOSED 450MW EMERGENCY RISK MITIGATION POWER PLANT PROJECT, KWAZULU-NATAL PROVINCE

VISUAL ASSESSMENT – INPUT FOR SCOPING REPORT

Produced for:

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Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (SAGC), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

Lourens has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, Environmental Management Frameworks, State of the Environment Reports, Environmental Management Plans, tourism development and environmental awareness projects.

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for *Most Analytical* and *Best Cartographic Maps*, at Annual International ESRI User Conferences. He is a co-author of the ENPAT book and has had several of his maps published in various tourism, educational and environmental publications.

He is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable (i.e. within the KwaZulu-Natal Province).

1. INTRODUCTION

Phinda Power Producers (Pty) Ltd proposes the establishment of a 450 Megawatt (MW) Power Plant within the Alton industrial area located in Richards Bay in the KwaZulu-Natal Province.

Figure 1: Regional locality of the proposed project area.

The 450MW Emergency Risk Mitigation Power Plant (RMPP) involves the construction of a gas-fired power station which will provide mid-merit power supply to the electricity grid. The 450MW RMPP is planned to operate on a mid-merit basis at a minimum annual average dispatch rate of ~50% (i.e. operational between 5:00am and 9:30pm daily and being deployed on average for 50% over the year during this time period) and a maximum annual average dispatch rate of ~72%.

The 450MW RMPP has been designed and developed as a power balance system to manage electricity demand during day time peak periods to provide energy, capacity and ancillary services to promote the stability of the national grid and assist in levelling out the variability in renewables energy electricity supply and meet short term fluctuations in electricity demand. In addition the 450MR RMPP can provide back up support for day time base load generation in the event of unscheduled maintenance on Eskom's base load electricity generation fleet.

The power station will have an installed capacity of up to 450MW, to be operated on either LPG or Naphtha as the initial fuel source and later to be converted from utilising LPG/Naphtha to natural gas. For the initial fuel source, either LPG would be supplied by road from the existing LPG import terminal in Richards Bay or Naphtha would be supplied via pipeline from the import berths at Richards Bay.

Once LNG import and regasification infrastructure is established in Richards Bay in accordance with the Department of Minerals and Energy, Transnet Limited and the IPP Office's planning, natural gas would be supplied to the 450MW RMPP via a natural gas pipeline from this import terminal. The use of either Naphtha or LPG and the associated infrastructure required in respect of each of these alternative fuel sources, will be investigated further within the EIA phase and the preferred fuel source presented.

The LNG terminal and regasification infrastructure and Naphtha supply infrastructure at the port of Richards Bay and the relevant pipelines do not form part of the scope of this assessment, whereas LPG infrastructure does form part of this report.

The main infrastructure associated with the facility includes the following:

- Main Power Island consisting of either gas turbines comprising of air intake, air filter structures and exhaust stack for the generation of electricity through the use of natural gas, Naphtha or LPG; or Gas engines comprising of reciprocating internal combustion engines and exhaust stack utilising LPG or natural gas.

- Generator and Auxiliary transformers.

- Balance of Plant systems.

- Dry Cooling systems.

- Auxiliaries.

- 132kV interconnecting substation and power lines connecting to the grid transmission infrastructure (The power lines to the grid transmission structure will be applied for under a separate environmental approvals process).

- LPG fuel pipe routing between the LPG storage site and the power plant site **or** Naphtha import pipeline from the port of Richards Bay to the onsite storage of Naphtha (the Naphtha pipeline will be applied for under a separate environmental approval process).

- Storm water management ponds.

- LPG storage comprising of up to 15 000m^3 of storage in total, comprising of a number of either bullets or spheres storage tanks in design **or**;

- Naphtha storage on the power plant site of up to 90,000m^3 in total, comprising of a number of tanks.

- Once imported LNG is available in Richards Bay, the 450MP RMPP will be converted from utilising LPG / Naphtha to the use of regasified LNG by means of a new dedicated natural gas pipeline which will replace or supplement the LPG / Naphtha supply to the power plant (The approval for the pipeline will be conducted under a separate process).

- 3 effluent reticulation systems - i.e. 1) sanitary wastewater system; 2) oily water collection system and 3) storm water and rainwater collection system.

- Diesel generator to provide start-up power to the first gas engine / turbine.

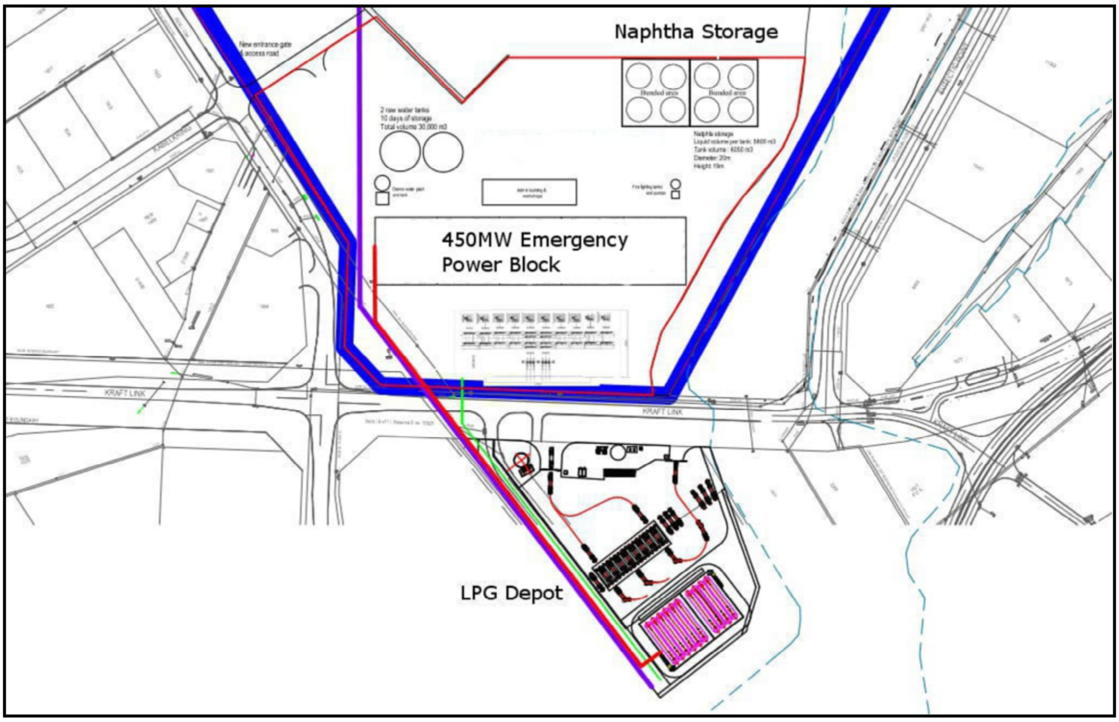


Figure 2: Proposed (preliminary) infrastructure layout.

Figure 3: Aerial view of the proposed project site.

2. SCOPE OF WORK

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact.

The study area for the visual assessment encompasses a geographical area of 171km² (the extent of the full page maps displayed in this report) and includes a minimum 6km buffer zone (area of potential visual influence) from the development footprint. The study area includes the Alton industrial area, a section of the Richards Bay harbour, the central business district (CBD) and a number of residential areas.

3. METHODOLOGY

The study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from topographical data provided by NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

The methodology utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model of the potentially affected environment.

- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.

- The identification of sensitive environments upon which the proposed facility could have a potential impact.

- The creation of viewshed analyses from the proposed project site in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures and activities.

This report (scoping report) sets out to identify the possible visual impacts related to the following proposed infrastructure (which forms part of the Phinda Gas to Power Project) from a desktop level:

- 450MW Power Plant;
- LPG storage depot; and
- Naphtha storage tanks.

4. THE AFFECTED ENVIRONMENT

The proposed project is located within the uMhlathuze Local Municipality, in the King Cetshwayo District Municipality of the KwaZulu-Natal Province. The project site falls within the Richards Bay city limits, approximately 4km south-west of the CBD and 3.2km north-west of the harbour. It does not form part of the Richards Bay Industrial Development Zone (IDZ), but is located centrally within the Alton industrial area. Even though Alton is a predominantly light industrial area, there are a large number of major industries within the area, namely; the Hillside and Bayside aluminium smelters, the Mondi paper plant, the Foskor plant and a large number of industrial structures related to coal storage and transportation at the Port of Richards Bay. The site is zoned general industry.

Topography, vegetation and hydrology

The proposed project site is located at approximately 30m above sea level. The topography of the study area is described as *plains* of the eastern coastal foreland. The region has an even slope with elevation ranging from sea level at the Indian Ocean to approximately 130m above sea level to the north-west.

The flat topography is dominated by wetlands and water bodies (e.g. the Nsezi and Mzingazi lakes, the harbour bay and its numerous channels) while the

Mhlatuze River meanders to the south of the study area. The project site falls within the Mhlatuze River quaternary catchment and the Nseleni River floodplain (a tributary of the Mhlatuze) is prominent to the west of the study area.

The larger part of the study area falls within the *Indian Ocean Coastal Belt* bioregion comprising of *Maputaland Wooded Grassland*, interspersed with *Subtropical Alluvial Vegetation, Swamp Forests, Subtropical Freshwater Wetlands* and *Freshwater Lakes*. It must be noted though, that large parts of the study area, especially to the north, have been transformed by forestry (exotic plantations) and sugar cane cultivation, and industrial development. The dominant land cover types, where intact, are described as *Thicket* and *Dense Bushland* and *Grassland*.

Refer to **Maps 1** and **2** for the topography and land cover maps of the study area.

Land use and settlement patterns

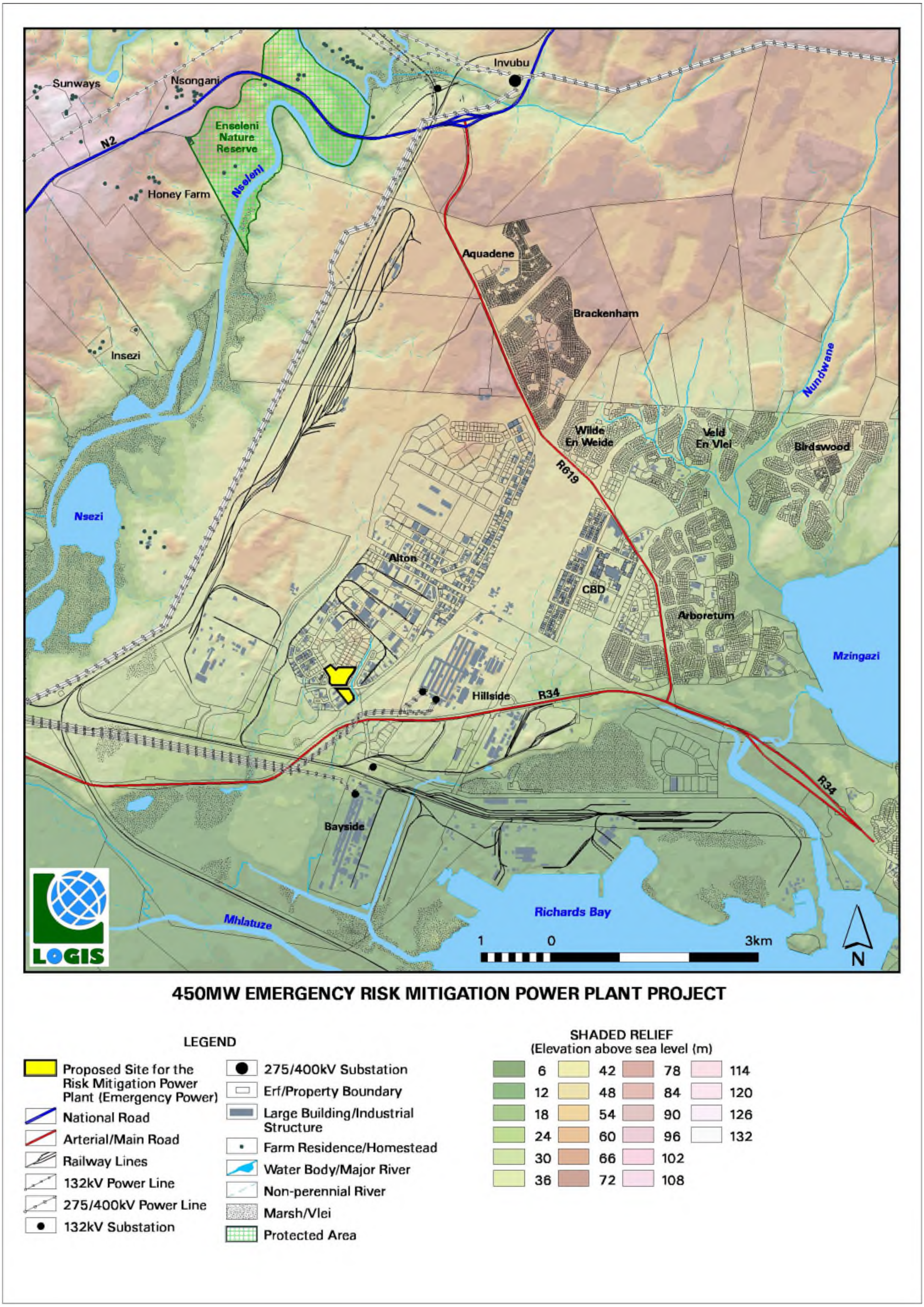
The industrial activities, the Richards Bay IDZ and the transportation infrastructure related to the port, as mentioned earlier, are the primary land use activities within the study area. This and the intensive forestry and sugar cane production to the north (and south) account for the largest economical drivers within the region. There is a well-established railway network and a large number of electricity distribution and transmission power lines traversing the study area.

The N2 national road, the R34 arterial road (John Ross Parkway) and the R619 main road provide motorised access to the region. The John Ross Parkway traverses south of the proposed development site, and is expected to be the quickest access road (via Alugang and Kraft Link Roads) to the site.

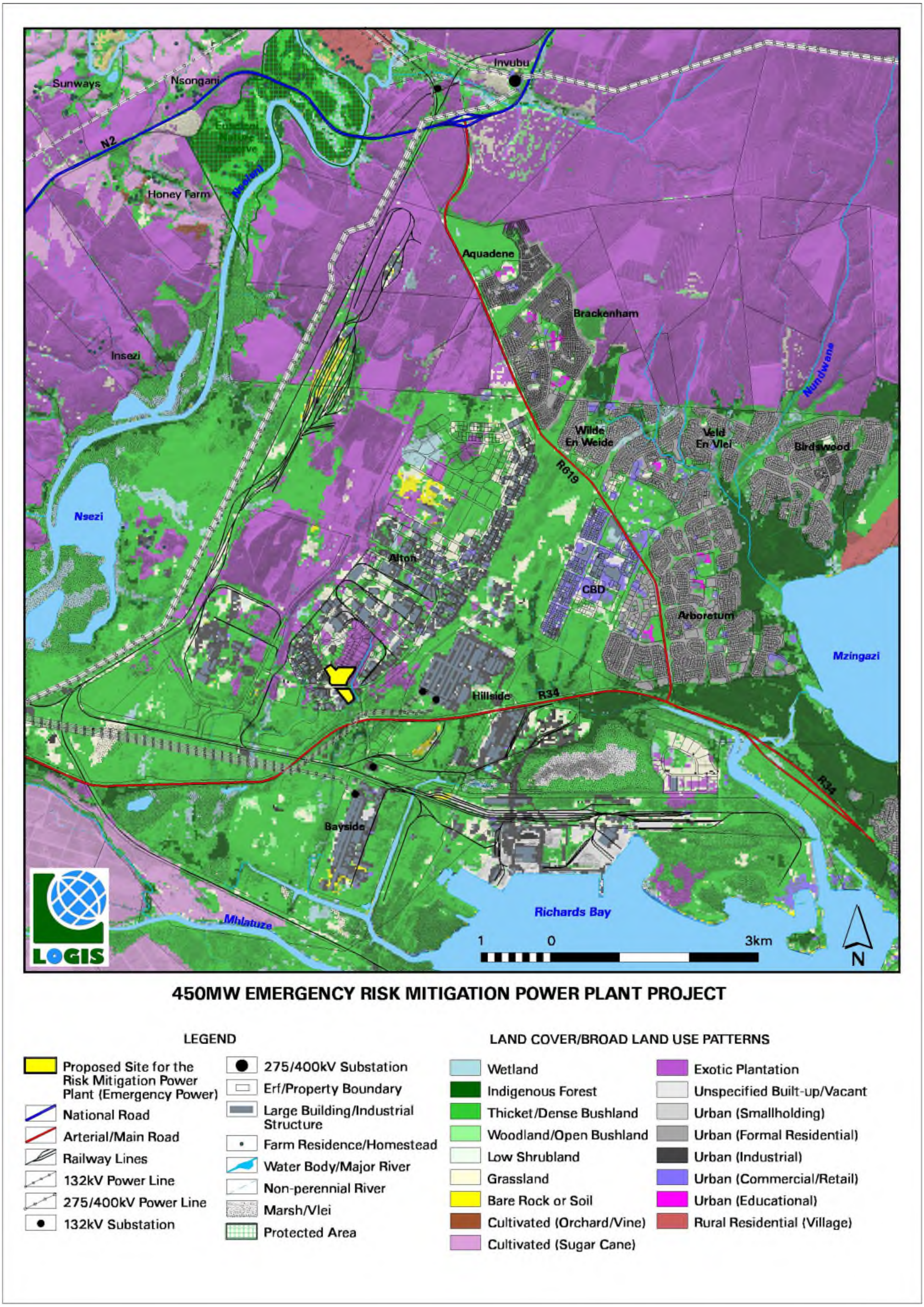
The majority of residential areas within Richards Bay are located north of the city and east of the R619 main road. Residential neighbourhoods include Arboretum, Birdswood, Veld-en-Vlei and Wilde-en-Weide. None of these residential areas are located in close proximity to the proposed development site.

There are only two proclaimed terrestrial protected areas within the region, namely; the Enseleni Nature Reserve to the north-west and the Richards Bay Game Reserve south of the study area. Other than these protected areas, and potentially along the Indian seaboard, there are no identified tourist attractions or destinations in closer proximity to the development site.[1]

[1] Sources: DEAT (ENPAT KwaZulu-Natal), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2013-14 (ARC/CSIR) and SAPAD2019-20 (DEA).



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

5. VISUAL EXPOSURE/VISIBILITY

The result of the preliminary viewshed analysis for the proposed power plant is shown on **Map 3**. The initial viewshed analyses were undertaken from a maximum 30m above ground level, in order to simulate the maximum height of the exhaust stacks associated with both the proposed technologies (i.e. both gas engine and gas turbine technology). The viewshed analysis also includes vantage points for the LPG depot at 10m above ground level and the Naphtha storage tanks at 19m above ground level.

The visibility analysis map indicates proximity radii from the footprint of the proposed structures/activities in order to show the viewing distance (scale of observation) of the power plant, LPG depot and Naphtha storage tanks in relation to its surrounds.

Refer to **Figure 4** below. The photo indicates two gas **engine** exhaust stacks with a total generating capacity of 225MW. The 450MW Emergency Risk Mitigation Power Plant would have a total of four exhaust stacks.

Figure 4: South Texas Electric Cooperative's 225MW Red Gate Plant with reciprocating engines. *Photo: South Texas Electric Coop., Inc*.

Refer to **Figure 5** below. The photo indicates an example of a gas **turbine** power plant where the air intake structures and exhaust stacks are clearly noticeable. The 450MW Emergency Risk Mitigation Power Plant would have a total of between 8 and 16 turbines and exhaust stacks, depending on the final choice of gas turbine technology.

Figure 5: Example of a gas turbine power plant. *Photo credit: Unknown*.

The LPG storage facility at the power plant site will consist of 15 tanks of 1,000m^3 each (15,000m^3 in total). Refer to **Figure 6** below.

Figure 6: Example of storage tanks at a LPG depot. *Photo: Engineering News.*

Naphtha storage on the power plant site will be up to 90,000m^3 in total, comprising of an unknown number of tanks. Refer to **Figure 7** below.

Figure 7: Example of Naphtha storage tanks. *Photo: Wikipedia.*

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed power plant, LPG depot and Naphtha tanks, therefore signifying a worst-case scenario. It is however expected that the built structures and industrial buildings, and even the vegetation within the region, may influence the viewshed analysis and ultimately mitigate the visual impact to some degree. It is recommended that these structures and vegetation that make up the visual absorption capacity (VAC) be built into the digital terrain model, in order to accurately determine the visual exposure during the IEA phase of the project.

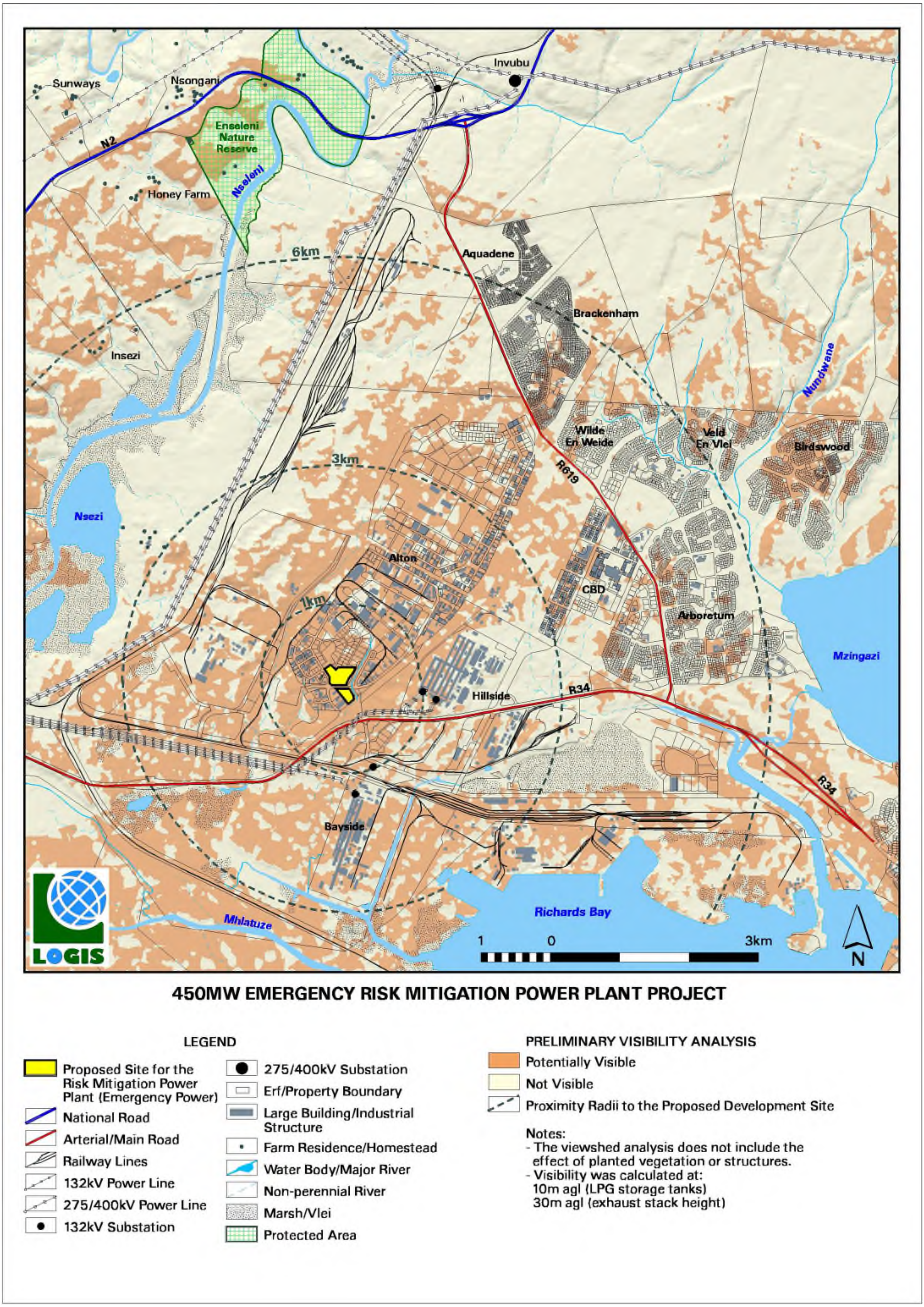
Results

It is clear that the power plant, LPG depot and Naphtha tanks may have a fairly large area of potential visual exposure, not considering the VAC of built structures and vegetation. The power plant buildings, exhaust stacks and storage tanks would theoretically be visible from large parts of the study area, especially within a 1 - 3km radius of the structures. These exposed areas include sections of the R34 arterial road and may contain additional potential sensitive visual receptors.

The visual exposure will however not be in isolation, but rather in the context of the existing structures and buildings present at this location and within the region. The visual exposure, and ultimately the visual impact, would therefore be combined or cumulative, rather than an individual visual impact. It should therefore be determined if the cumulative visual impact is expected to be excessively high, or whether the existing structures absorb the potential visual impact i.e. consolidate the existing visual impact.

Conclusion

Even if the existing structures successfully absorb the visual impact, or if the VAC of the site visually conceals the structures, the power plant and substation (where visible within shorter distances e.g. within a 1 – 3km radius), may constitute a high visual prominence, potentially resulting in a visual impact. This may become evident should potential sensitive visual receptors be identified within this zone during the EIA phase of the project. Alternatively, if there are no sensitive visual receptors, or if it is determined that the perception of the placement of the infrastructure within an existing industrial area is acceptable to all, the visual impact may be low.



Map 3: Map indicating the potential (preliminary) visual exposure of the proposed power plant.

6. ANTICIPATED ISSUES RELATED TO THE VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed power plant and ancillary infrastructure includes the following:

- The visibility of the facility from, and potential visual impact on observers travelling along the R34 arterial road or residing within a 1 – 3km radius of the plant.
- Potential cumulative visual impacts (or alternatively, consolidation of visual impacts) with specific reference to the location of the proposed power plant within an existing industrial area.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity to the facility.
- The visual absorption capacity of existing structures, buildings and natural or planted vegetation (if applicable) within the study area.
- The potential to mitigate visual impacts.

It is envisaged that the issues listed above may potentially constitute a visual impact at a local and/or regional scale. These need to be assessed in greater detail during the EIA phase of the project.

Table 1: Impact table summarising the potential primary visual impacts associated with the 450MW Risk Mitigating Power Plant.

<table>
<tr><td colspan="4">Impact

Visual impact of the power plant on observers in close proximity to the proposed infrastructure and activities. Potential sensitive visual receptors may include:

• Observers travelling along the R34 arterial road
• Residents of homesteads and farm dwellings (if present in close proximity to the facility)</td></tr>
<tr><td>Issue</td><td>Nature of Impact</td><td>Extent of Impact</td><td>No-Go Areas</td></tr>
<tr><td>The viewing of the power plant and ancillary infrastructure and activities</td><td>The potential negative experience of viewing the power plant and ancillary infrastructure and activities</td><td>Primarily observers situated within a 1-3km radius of the power plant</td><td>N.A.</td></tr>
<tr><td colspan="4">Description of expected significance of impact

Extent: Local
Duration: Long term
Magnitude: Moderate
Probability: Probable
Significance: Moderate
Status (positive, neutral or negative): Negative
Reversibility: Recoverable
Irreplaceable loss of resources: No
Can impacts be mitigated: Yes</td></tr>
<tr><td colspan="4">Gaps in knowledge & recommendations for further study</td></tr>
</table>

A finalised layout of the power plant and ancillary infrastructure are required for further analysis. This includes the provision of the dimensions of structures and equipment.

Additional spatial analyses are required in order to create a visual impact index that will include the following criteria:

- Visual exposure (including the effect of existing structures and vegetation)
- Visual distance/observer proximity to the structures/activities
- Viewer incidence/viewer perception (sensitive visual receptors)
- Visual absorption capacity of the environment surrounding the power plant infrastructure and activities

Additional activities:

- Identify potential cumulative visual impacts (or consolidation of visual impacts)
- Undertake a site visit
- Recommend mitigation measures and/or infrastructure placement alternatives

Refer to the Plan of Study for the EIA phase of the project below.

7. CONCLUSION AND RECOMMENDATIONS

The fact that some components (e.g. the exhaust stacks) of the proposed power plant may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 1-3km buffer zone from the power plant need to be identified and the severity of the visual impact assessed within the EIA phase of the project.

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the power plant as well as for the ancillary infrastructure, as these structures (e.g. the substation) may have varying levels of visual impact at a more localised scale. The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

This recommended work must be undertaken during the Environmental Impact Assessment (EIA) Phase of reporting for this proposed project. In this respect, the Plan of Study for the EIA is as follows:

- **Determine potential visual exposure**

The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed power plant and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m SRTM digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

Features such as vegetation, man-made topographical features and other existing structures (that make up the visual absorption capacity of the environment surrounding the proposed development) that might shield the facility are built into the model to ensure that the result of the visibility analysis is as accurate as possible.

- **Determine visual distance/observer proximity to the facility**

In order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for each type of structure.

Proximity radii for the proposed power plant are created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed facility.

- **Determine viewer incidence/viewer perception (sensitive visual receptors)**

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that would be exposed to the project infrastructure.

This is done in order to focus attention on areas were the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this data set, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, national parks, residential areas, etc.), that should be addressed.

- **Determine the visual absorption capacity of the landscape**

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

- **Calculate the visual impact index**

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software will be used to perform the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Determine impact significance**

The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section is displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred layout alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- **Reporting and map display**

All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in the VIA report.

- **Site visit**

Undertake a site visit in order to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

8. REFERENCES/DATA SOURCES

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