Tutuka Continuous Ashing Project

VISUAL IMPACT ASSESSMENT

Final VIA Report

Submitted to Lidwala

10 July 2014

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VISUAL IMPACT ASSESSMENT – FINAL VIA REPORT

Table of Contents

List of Figures

List of Tables

Tutuka Continuous Ashing Project
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Compiled by Dawie J/van Vuuren (MetroGIS) for Lidwala Consulting Engineers.

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1. Introduction.

Tutuka Power Station envisages the continuation of dry ash disposal to continue its power generation activities. An Environmental Impact Assessment (EIA) is currently under way to obtain the required environmental authorisation for the continued ashing activities.

Subsequent to a Scoping Report that was submitted to DEA, three alternative sites have been identified to be assessed as part of the EIA process. These are located in close proximity of the existing ash disposal facility, as indicated on the map in **Figure 1**.

MetroGIS was appointed by Lidwala Consulting to undertake a visual impact assessment (VIA) as part of the EIA. This document serves as a final VIA report, describing the receiving environment and visual impact of the ash disposal facility, ranks the alternative sites in order of preference, and proposes the preferred site from a visual impact point of view.

The qualifications and experience of the author, assumptions and limitations associated with the project, and the level of confidence in this study are described as follows:

Qualifications and Experience of the VIA Practitioner:

Dawie Jansen van Vuuren, director and founder of MetroGIS, is the practitioner who acts as principal for this assessment. He is a registered Geographical Information Science Practitioner and holds post-graduate degrees in Geography and Town & Regional Planning. He has undertaken numerous visual impact studies since 2006, including power generation facilities, power lines, open cast coal mines and various others. He has been involved in the application of Geographical Information Systems (GIS) in Environmental Management and Development Management since 1989 and has a broad understanding of development and associated environmental impacts, specifically social and visual impacts.

In the absence of regulating guidelines for visual impact studies, Mr. Jansen van Vuuren has undertaken wide research, studying literature on VIA methodologies as well as several case studies. He has studied a wide range of local and international publications, reports and guidelines and developed a scientifically based VIA methodology which has been accepted by a wide range of clients.

Neither the author, nor MetroGIS, will benefit from the outcome of the project decision-making.

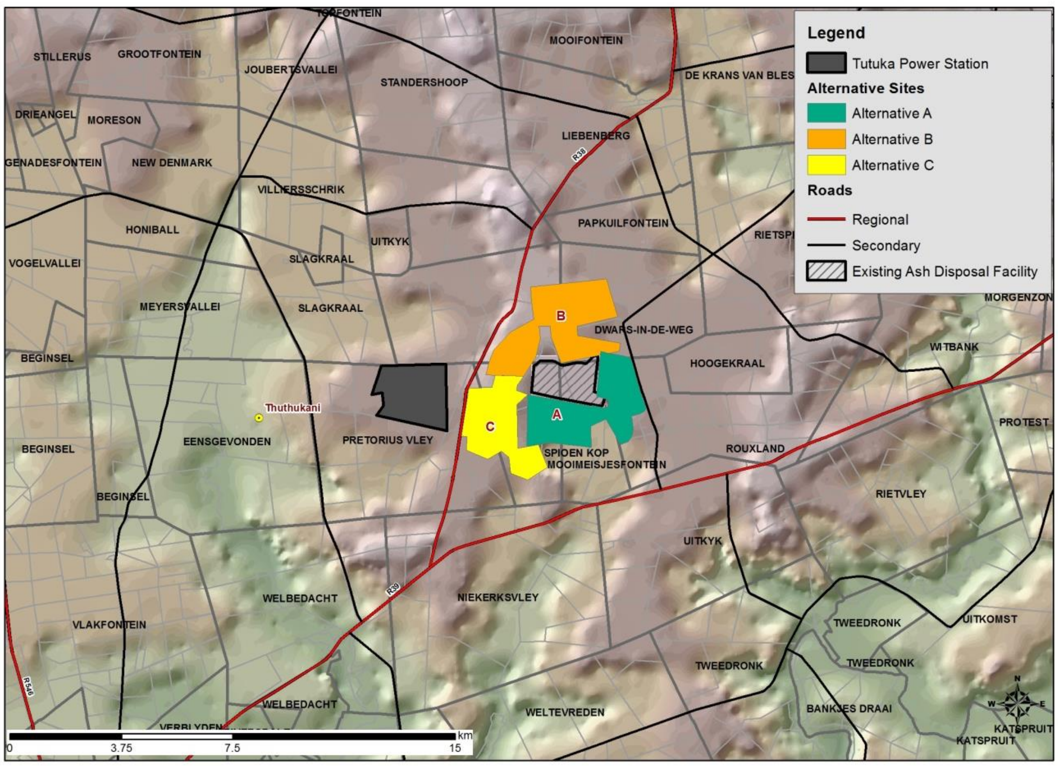

Figure 1: Locality of 3 alternative sites for the proposed ash disposal facility.

Assumptions and Limitations

This study was undertaken during the planning stage of the project and is based on information available at that time. Visual impact assessment is an iterative process of data processing and analysis. Being spatially orientated, Geographical Information Systems (GIS) technology is used extensively to model visual impact parameters and to quantify various elements of visual impact. This process relies on the availability of information with regard to the design of the project, as well as the availability of GIS data to simulate and describe the receiving environment.

The following information was received with regard to the design of the proposed development:

- Polygon data representing the location and extend of the three alternative sites;
- Photographs and GPS point data obtained during a site visit.
- Point data representing the location of possible sensitive receptors.

GIS data that was used to model the receiving environment includes the following:

- Roads, towns, building points and 5m contours, obtained from the Chief Directorate National Geo-Spatial Information.
- Aerial photography from Google EarthÊ .
- The 5m contours were used to generate a digital elevation model (DEM). Reflecting the topography, the DEM is used to undertake a visibility (line of sight) analysis. It must be noted that it does not take cognisance of the effect of vegetation and other structures on the surface, which might obstruct visibility.
- To incorporate the shielding effect of the existing ash disposal facility as well as Tutuka Power Station, these features were included conceptually in a DEM which was merged with the DEM for the study area.

Level of Confidence

The level of confidence[1] is determined as a function of the following:

- The information available, and understanding of the study area by the practitioner:
    - **3**: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible. Two site visits were conducted: one by car, and one by helicopter.
    - **2**: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
    - **1**: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

[1] Adapted from Oberholzer (2005).

- The information available, understanding of the study area and experience of this type of project by the practitioner:
  - **3**: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
  - **2**: A moderate level of information and knowledge is available of the project and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
  - **1**: Limited information and knowledge is available of the project and/or the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

The level of confidence for this assessment is determined to be **9** and indicates that the author's confidence in the accuracy of the findings is high:

- The information available, and understanding of the study area by the practitioner is rated as **3**, and
- The information available, understanding of the study area and experience of this type of project by the practitioner is rated as **3**.
- documents, as listed under References.

2. Scope of Work & Methodology

The scope of work for this study includes the assessment of the potential visual impacts of the proposed development in terms of nature, extent, duration, magnitude, probability and significance.

Methodology

The methodology includes a qualitative and a quantitative assessment, which are briefly described as follows:

- **Qualitative Assessment – Visual Modification and Visual Sensitivity**
  - Visual Modification ï How does the proposed development contrast with the landscape character of the surrounding landscape?
  - What is the quality of the existing landscape setting?
  - Visual Sensitivity ï How sensitive will viewers be to the proposed development?

- **Quantitative Assessment – Visual Prominence**
  - How much of the proposed development is visible from viewpoints in the receiving environment?

- **Cumulative Assessment**
  - To what degree would the proposed development create visual impacts in addition to the impacts of the existing ash disposal facility?

The methodology is applied by undertaking the following steps:

- **Determine Potential visual exposure**

  The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. Viewshed analyses of the proposed development indicate the potential visibility and the degree of exposure. This is based on a digital elevation model of the study area used in a geographic information system (GIS) to calculate possible visibility and exposure. This allows for assessing the effect of the changed topography brought about by continued ashing operations.

- **Determine Visual Distance/Observer Proximity to the facility**

In order to refine the visual exposure of the stockpile on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence thereof.

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

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

- **Determine Viewer Incidence/Viewer Perception**

  The number of observers and their perception of a structure determine the concept of visual impact. If the visual perception of the ash disposal facility is not favourable to all the observers, then the visual impact would be negative. In this regard, the public participation process should inform this study. Any issues in respect of visual impact raised by interested and affected parties should be communicated to the author.

  It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

- **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. This is analysed by means of a proximity analysis, as described above.

- **Compile a Visual Impact Index**

  The results of the visibility, visual exposure and proximity analyses, as discussed above, are merged in order to determine where the areas of likely visual impact would occur. The process entails a number of data processing activities, as illustrated in see Diagram 1. The combination of these parameters gives a more realistic representation of the spatial extends of possible visual impact, and allows for the quantification of findings which can further be analysed.

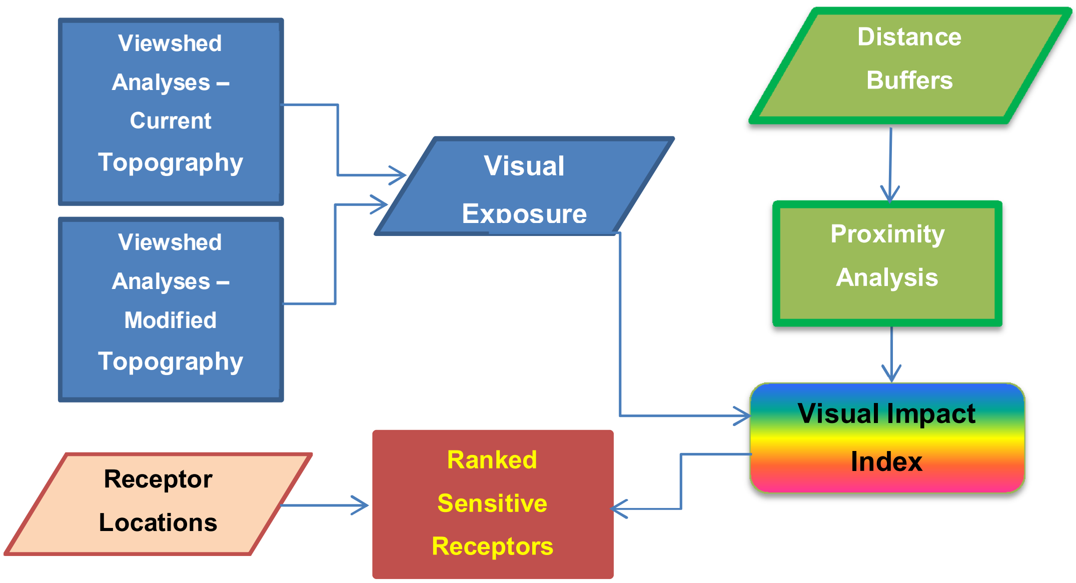

Diagram 1: Preparation process of the Visual Impact Index

A visual impact index was created for each alternative site and was used to identify the preferred site from a minimum visual impact perspective.

- **Determine the significance and acceptability of visual impacts**

  The potential visual impacts identified and described are quantified in their respective geographical locations in order to determine the significance of the anticipated impact. Significance is determined as a function of extent, duration, magnitude and probability.

3. Baseline Setting - Description of the Receiving Environment.

The description of the receiving environment is aimed at the identification of visual resources and how these contribute to particular sense of place of landscapes.

The character of a landscape is shaped by a combination of visual resources, including environmental elements, such as vegetation, topography, water features, and man-made features signifying the way in which human activity has transformed this environment. The visual character of the Tutuka Power Station and its surrounding environment is shaped by a unique combination of the following features:

- Cultivated land;
- An undulating topography with isolated koppies and ridges;
- Perennial and Non-Perennial streams and isolated dams;
- Grassland;
- The Tutuka Power Station (being a visually dominant feature in the area);
- Dispersed farmsteads, and
- Roads, including the R38 to Bethal and the R39 between Morgenzon and Standerton.

Natural grassland, cultivated land and the Tutuka Power Station are the main form giving elements in the landscape, together with farmsteads dispersed through the region. The intrinsic value of these landforms in terms of visual quality varies between **high to low**. Driving through the area creates a pleasant sense of place of the landscape, with views of cultivated land and pastures. In places where facilities such as the power station and the ash disposal facility are partially visible, these have been absorbed as an intricate part of the landscape.

Figure 2: Photographs depicting the landscape character, with the ash disposal facility and the power station dominant in close proximity from the viewer.

However, as one approaches the power station the various components, such as the current ash disposal facility, power lines and other infrastructure become discernable, degrading the visual quality of the landscape in general, as depicted in the photographs in **Figure 2**.

Topography

The topography is an important form giving element of the landscape. On the one hand, it opens up vast panoramic views of the landscape, and on the other hand it creates visual barriers. The topography in the study area has a gentle undulating character with patches of high ground south and east of the existing ash disposal facility. The significance of the topography in terms of visual exposure is illustrated on the maps in **Figures 3 - 5**, which illustrates the level of exposure.

Land Use

Agriculture and power generation represent the primary economic activities in the region. Cultivation (primarily maize), cattle and sheep farming constitute most of the farming activity. The power station is synonymous with different kinds of infrastructure that can be observed, *inter alia* power lines, conveyors, pipelines, and an ash disposal facility.

The position of the observer, and his situational awareness in terms of the landscape as it is observed and experienced, is an important factor in determining any visual impact. This is of particular importance, given the large physical dimensions of an ash disposal facility and the level of exposure thereof.

Nature Reserves and Tourist Areas

There are no nature reserves or tourist attractions within the primary visual catchment area of the ash disposal facility.

4. Issues Related to Possible Visual Impact.

Concerns with regard to visual impact were raised by the owner of the farm Mooimeisjesfontein, particularly with respect to Alternative A which would be as close as 450 from the farm house, at the footprint of maximum utilization of the ash facility. At this distance the ash disposal facility will dominate views, which, together with secondary impacts such as the visibility of dust plumes from operations as well as strong winds, will create extreme adverse visual impacts. Other farmsteads within a radius of 3 km from any of the alternative sites may also be impacted upon, as described in **Section 5: Visual Impact Analysis**.

Other than the above, the biggest concern with regard to the continuation of the ash disposal facility is that of cumulative impacts. This is further discussed under **Section 6: Cumulative Impacts**.

5. Visual Impact Analysis

The visual impact assessment is an iterative process, where different criteria are analysed independent of each other, including the following:

- Visibility and exposure analysis;
- Proximity analysis;
- Visual absorption capacity analysis;
- Cumulative impact assessment

The results are finally integrated and interpreted in a visual impact index to arrive at a conclusive assessment.

The visual impact assessment process is described as follows:

5.1 Visibility and Exposure

Visibility refers to the line of site between the observer and objects in the landscape, being it natural features or man-made structures. **Exposure** refers to the degree of visibility of these features, e.g. can the observer see the complete structure or only part thereof. This is determined by various factors, such as the topography and the appearance of objects in the foreground and around the viewer, such as trees, buildings, etc. In this context, the definition of foreground, middle ground and background plays an important role in visual impact assessment.

The visibility analysis is conceptual, based on the 3-D modelling of the landscape. Land cover is difficult to include in the analysis, since the various objects in the landscape need to be captured and classified and their elevation data (height above ground) provided as well. For the purpose of this study, a conceptual 3D model was created for the existing ash disposal facility. This was merged with the existing Digital Elevation Model (DEM) of the study area, to include the screening effect of the existing structure in the undertaking of the viewshed analysis.

Viewshed analysis is a GIS operation based on the DEM and calculates the number of locations in the landscape that can be connected to points representing the new ash disposal facility by means of a line of sight. For the purpose of this project, the analysis was done for each of the alternative sites.

Exposure is determined by two factors, i.e. the size and extent of the development and the view thereof, partly or in full. As indicated in **Diagram 1**, two viewsheds are undertaken, one of the landscape without an ash disposal facility on a particular site, and one with a fully developed facility. The change in topography can be modelled by calculating the sum of the two viewsheds.

The results of the viewshed analysis for each alternative are shown on the maps in **Figures 3 – 5.** These clearly show how the undulating character of the topography influences the degree of exposure, with full views of the facility possible from high ground mostly to the south and the east.

The viewshed analysis is part of an iterative process, where the results of proximity analyses are integrated with that of the viewsheds. This provides a more realistic representation of possible visual impact, as indicated on the in **Figures 9 – 11**.

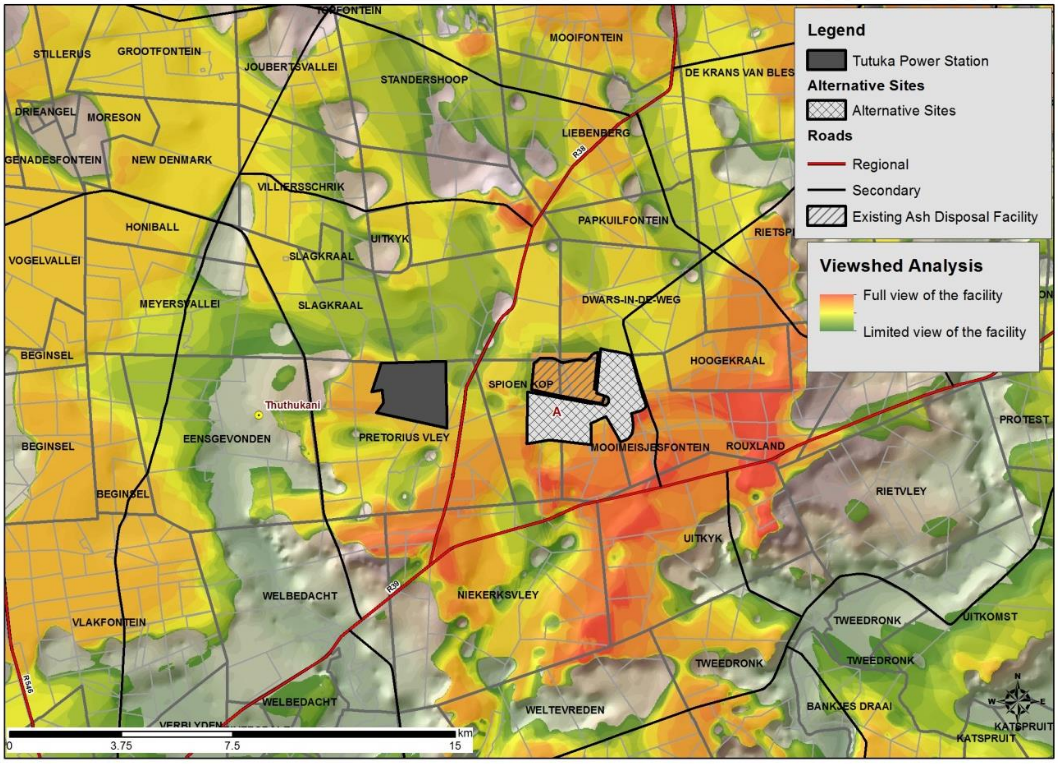

Figure 3: Viewshed analysis - Alternative A

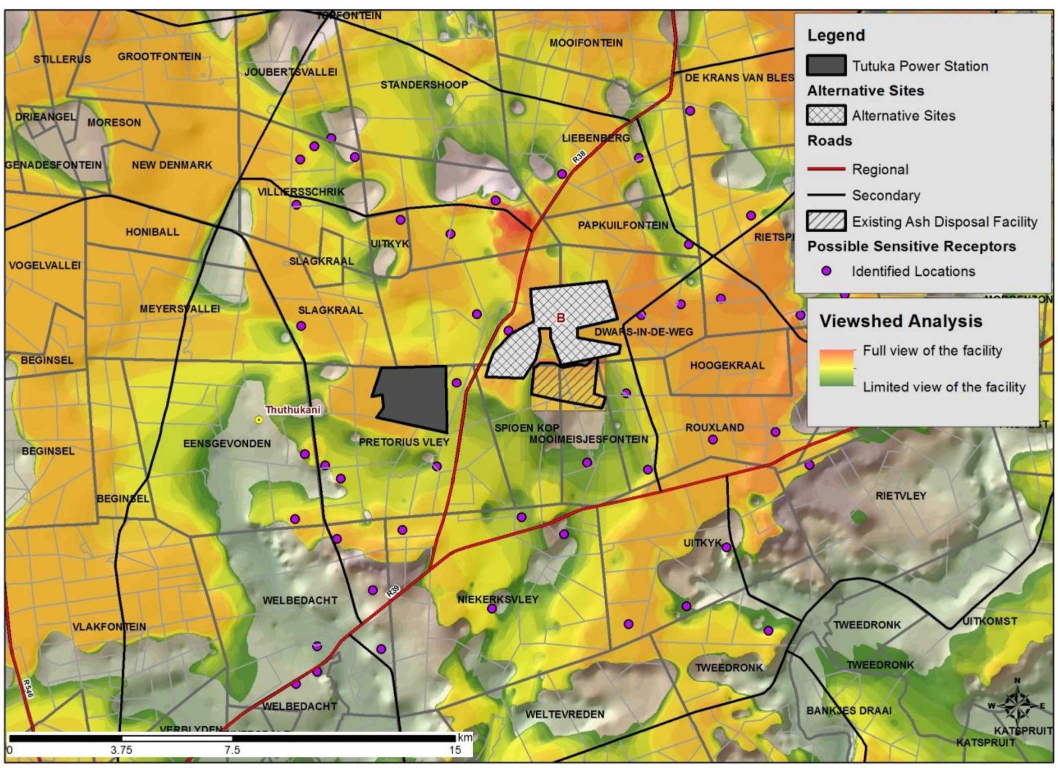

Figure 4: Viewshed analysis - Alternative B

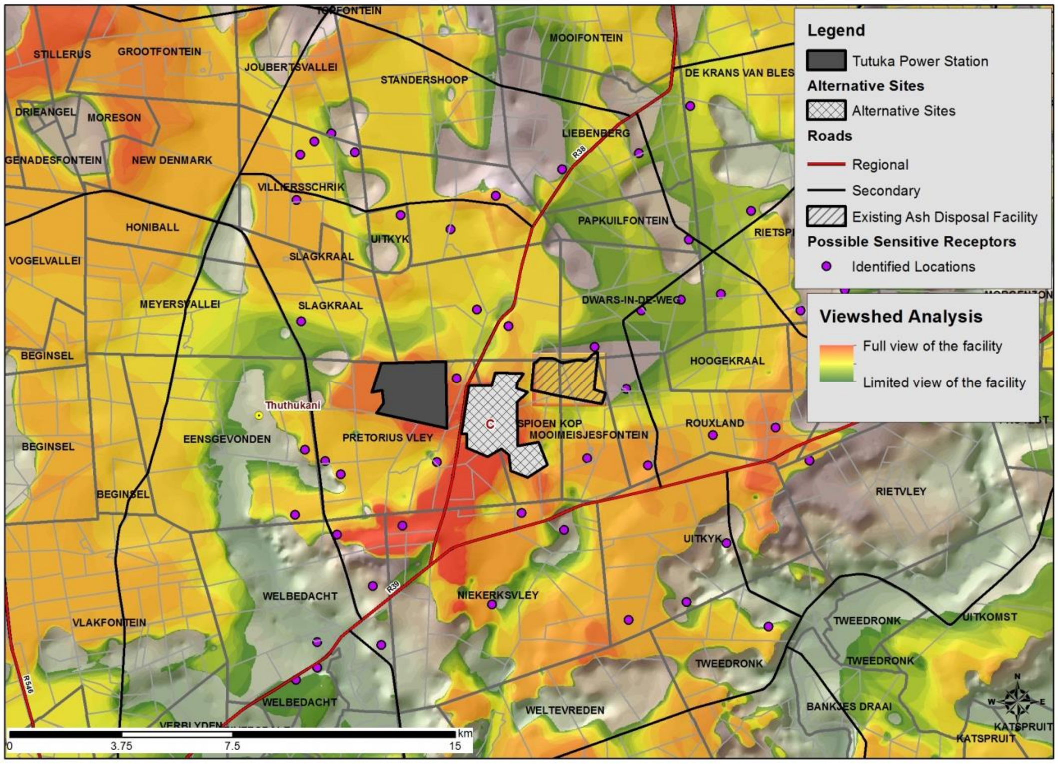

Figure 5: Viewshed analysis - Alternative C

5.2 Proximity

The appearance of an object in a personõs central field of vision, and the way it dominates the field of view, determines the visual impact it might cause. This effect changes with distance from the object. As distance increases, the degree of visibility of an object decreases. Detail of texture, colour and form gradually decay as distance increases. Therefore, a proximity analysis is required to incorporate the effect of reduced visibility over distance. Having a strong geo-spatial association, the proximity analysis is based on radii which are calculated based on the horizontal and vertical dimensions of the proposed development, and the hyperbolic nature of the increased distance effect.

Given the characteristics of an ash disposal facility, the following proximity buffers have been identified for the proposed development:

- 0 ï 1.5 km Very High visual impact.
- 1.5 ï 3 km High visual impact.
- 3 ï 6 km Moderate visual impact.

- 6 ï 12 km		Low visual impact.
- > 12 km		Insignificant.

The buffers were used to create a continuous field of interpolated distance values, as shown on the map in **Figure 6**.

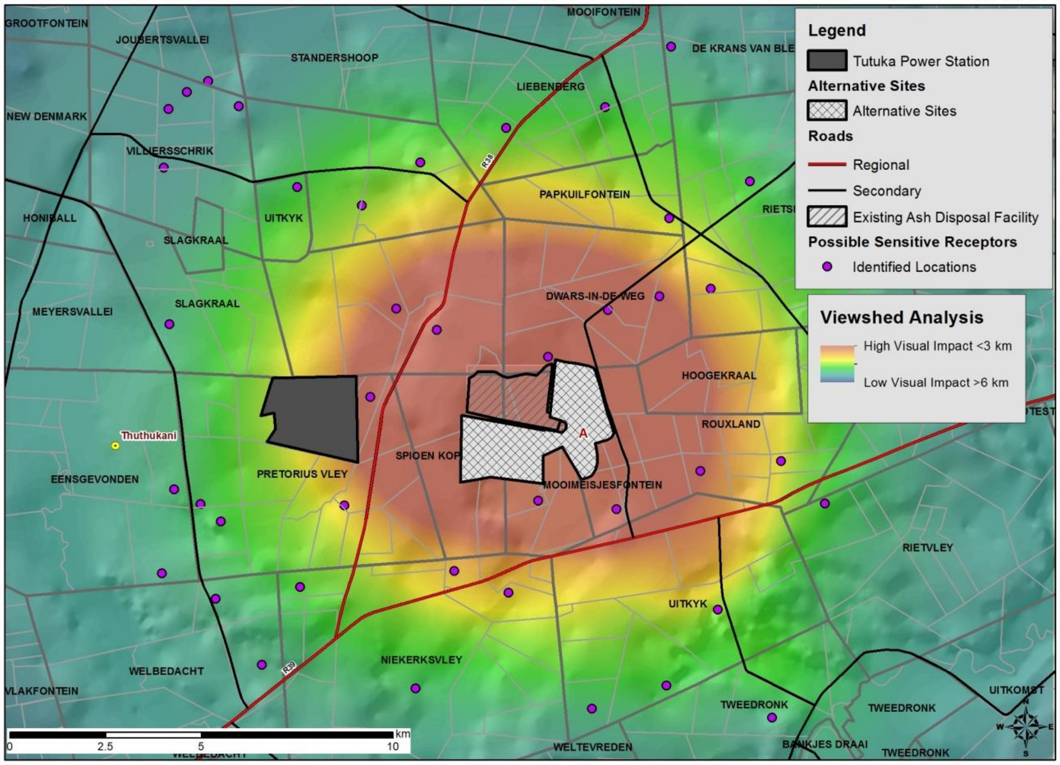

Figure 6: Typical proximity analysis for an ash disposal facility (Alternative A).

5.3 Viewer Incidence & Perception

The sensitivity of visual receptors and views will be dependent on the location and context of the viewpoint, the expectations and activity of the receptor, and the importance of the landscape in terms of its historical development and attractiveness. In terms of the latter, the assessment of the landscape indicates that there are no attractive visual resources in the area which might be influenced by visual exposure of the ash disposal facility. Visual receptors in the study area are mainly farm residents and workers in the area. Traffic volumes on the surrounding regional roads are fairly high, whereas access roads to farms experience low traffic volumes.

A number of farmsteads have been identified as possible sensitive receptors. The farm Mooimeisjesfontein has been identified as a particular sensitive viewer location. Sections of roads, where these would have a line of site to the proposed alternative sites, have also been included, specifically the R38 to Bethal and the R39 between Morgenzon and Standerton. These roads carry high traffic volumes with a relatively high incidence of visual receptors. From the roads, however, the visual exposure of the ash disposal facility will be of short duration. No scenic amenities occur in the area that can be effected by views of the ash disposal facility.

In general the number of possible sensitive visual receptors is low, and limited to farm residents in the area and travellers on roads around the power station. Given the visual impact that has already been established by Tutuka Power Station and the existing ash disposal facility, it is assumed that residents would be sensitive to cumulative visual impacts, especially those in close proximity to the facility.

The map in **Figure 7** shows the location and distribution of identified possible sensitive receptors, representing locations of farmsteads and points on roads.

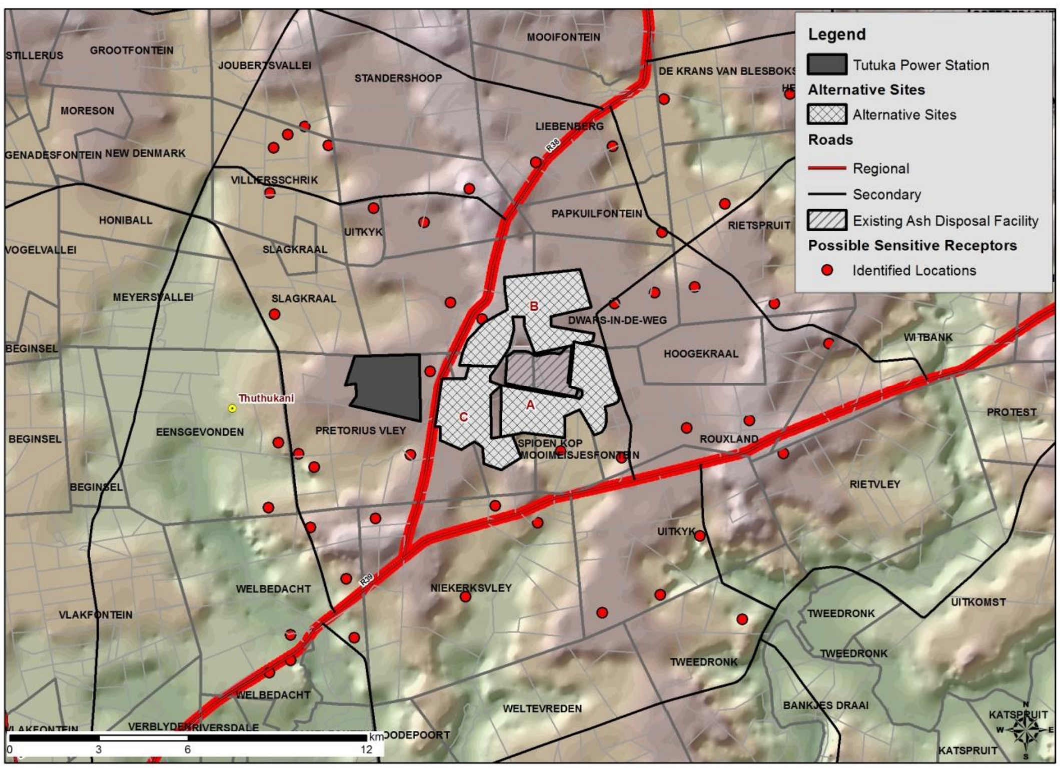

Figure 7: Possible sensitive receptors

5.4 Visual Absorption Capacity

Visual quality relates directly to the intrinsic qualities of a landscape that make it distinct and memorable. Visual absorption capacity (VAC) is an indication of the relative ability of the landscape to assimilate the changes brought about by the new development, thereby getting absorbed into or contrasted with the visual quality of the landscape. It also indicates the ability of natural features, such as trees or high ground, to screen or hide an object where it would have been visible otherwise.

The landscape of the study area, as it was historically known, has been transformed by the establishment of Tutuka Power Station and an ash disposal facility, by virtue of which a new landscape setting has been created. The proposed development is seen as a continuation or an extension of the current operations, since it is relatively close to the existing ash disposal facility, thereby benefitting from the existing developments to create visual absorption capacity.

Mitigation measures, such as covering the side slopes of the ash disposal facility with grass and planting trees in the foreground are also effective of creating visual absorption capacity, as illustrated on the photograph in **Figure 8**, where an older section of the existing facility has been vegetated, allowing it to ôblendô in with the colour and texture of the surrounding environment.

Figure 8: Rehabilitation of the ash disposal facility by vegetating slopes increase the visual absorption capacity of the feature – noticeable on the right section of the photograph.

5.5 Visual Impact Index

The Visual Impact Index is the product of the **visual exposure** and the **proximity** analyses for each alternative and is further outlined as follows:

- **Visual exposure** indicates the number of points visible for each alternative site, compared to the visibility of the current landscape.
- **Proximity** values are assigned to a field of distance buffers which decreases as distance from the site increases.
- The **visual impact index** is the result of multiplying these parameters, represented in a geo-spatial database, which returns a spectrum of values starting from 0 (with 0 indicating no visibility). The concept of the index, and how the values are calculated, is illustrated in **Table 1**.

	Values in Raster Grid							
Visual Exposure*	9	6	0	10	4	1	0	7
Proximity	2	4	6	8	10	12	14	16
Visual Impact Index**	18	24	0	80	40	12	0	112

* Visual Exposure = Visibility of current landscape + modified landscape.

* Visual Impact Index = Visual Exposure X Proximity

Table 1: Calculation of a visual impact index (values for illustration purposes only).

The spatial representation of the visual impact index for each of the assessed alternative sites is given on maps in **Figures 9 – 11**.

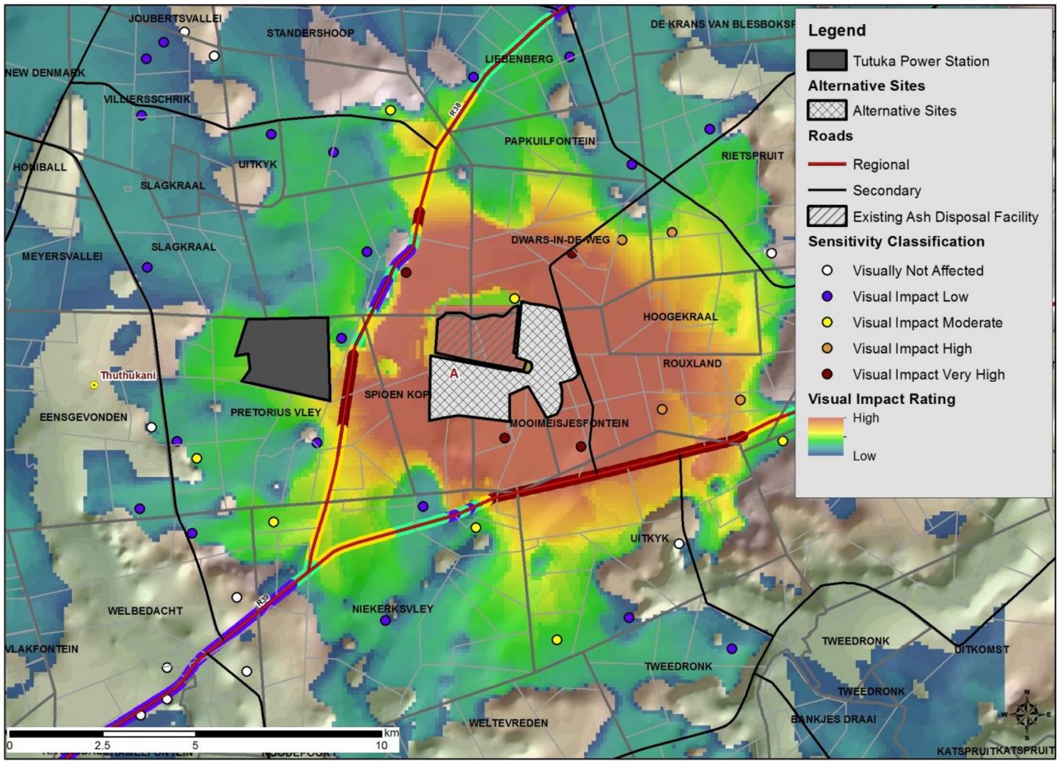

Figure 9: Visual impact index for Alternative A.

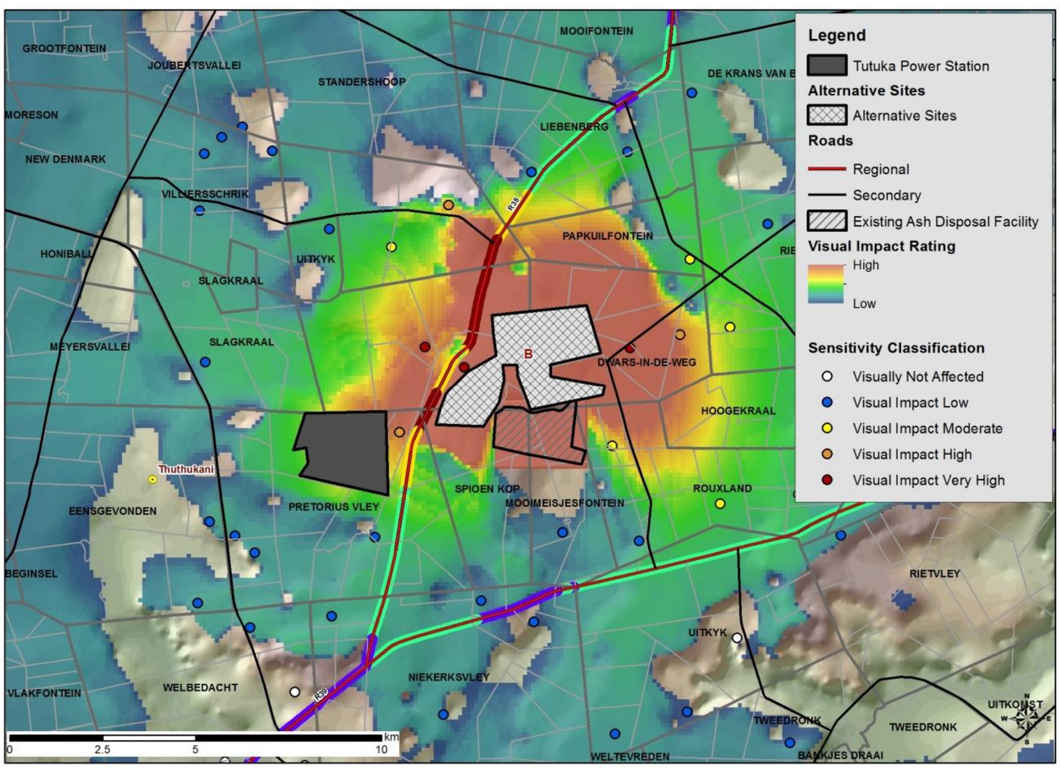

Figure 10: Visual impact index for Alternative B.

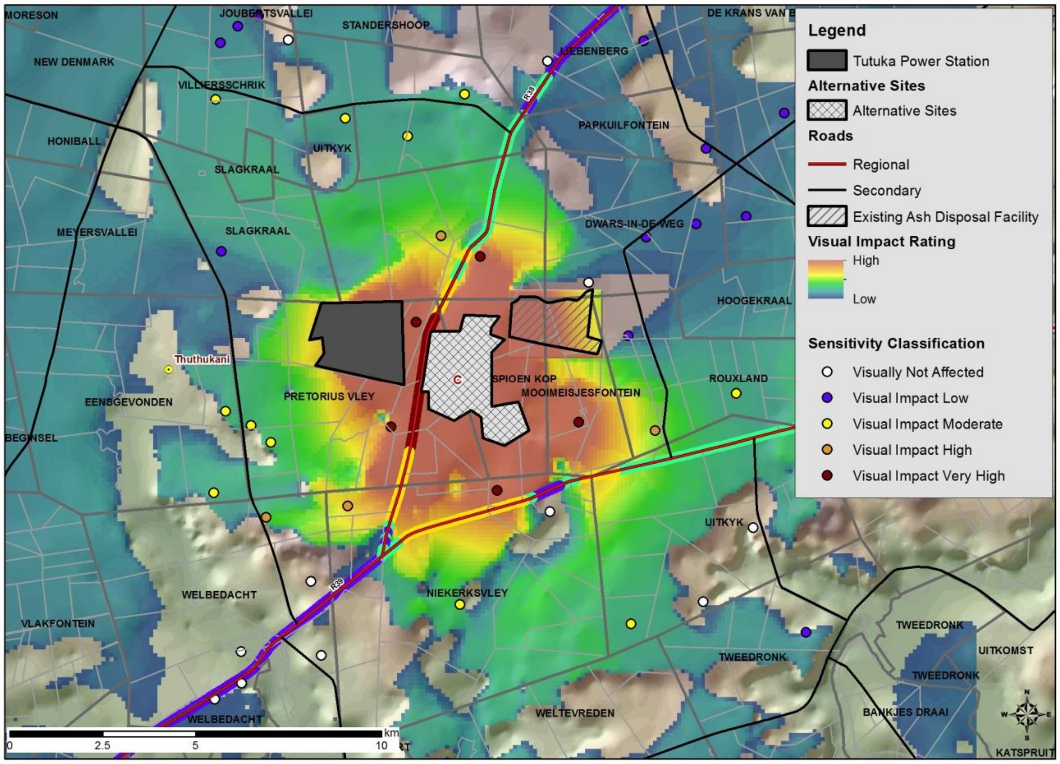

Figure 11: Visual impact index for Alternative C.

Judging by the maximum values of the respective visual impact indexes, Alternative A shows the lowest score, with Alternative B the highest. However, Alternative B shows the lowest impact on sensitive viewer locations. Based on this analysis **Alternative B** would be regarded as the preferred site.

5.5 Rating of Alternative Sites and Identification of Preferred site

The rating of alternative sites is based on the Visual Impact Index and the number of sensitive receptors affected. The values of the Visual Impact Index are extracted to points representing sensitive viewer locations. The quantification of these parameters makes it possible to rate and compare the three alternatives, as summarised in **Tables 2 & 3**.

Visual Impact Index				
	Max Value*	Mean Value	Rating	
Alt A	185.763	13.72	1	Preferred
Alt B	305.703	19.47	3	Not preferred
Alt C	301.457	17.8	2	Not preferred

* The number of locations in the visual catchment with the highest exposure value.

Table 2: Rating of alternatives according to the maximum index value.

Sensitive receptors highly affected				
	Farmsteads *	Roads	Rating	
Alt A	18.00%	R 39	3	Not preferred
Alt B	14.00%		1	Preferred
Alt C	18.00%		2	Not preferred

* The percentage of farmsteads that fall within the High – Very High spectrum of the visual impact index

Table 3: Rating of alternatives according to the number of sensitive receptors affected.

Although **Alternative B** has the highest score in terms of the visual impact index, the number of sensitive receptor locations in the high to very high category is the lowest. This corresponds with the information as shown on the maps in **Figures 9 – 11**, thereby confirming this location as the **preferred site**.

6. Cumulative Impacts

Cumulative visual effects can arise in three reasonably distinct ways.

First there is the effect of the extension of an existing development, or the positioning of a new development such that it would give rise to an **extended** and/or **intensified** impression of pre-existing ash disposal facility in the landscape, as seen from fixed or transitory locations. This type of cumulative effect is categorised as ‘*static combined/simultaneous*’, and is relevant in the case where the proposed development would be viewed as an extension of the existing ash disposal facility.

Secondly, cumulative impacts can arise through an **increase in the perceptions** of sensitive receptors where ash disposal facilities are observed from locations from which more than one facility would now be seen in different parts of the landscape. This distinction becomes relevant when the observer faces or visualises one ash disposal facility with another in the opposite direction behind her/his back.

Third, an increase in the incidence of sequential perceptions of different power stations with associated infrastructure can occur through the **recurrence of images** and impressions arising from power stations at various points in the landscape and which are continuously encountered when moving through it. Since the proposed development is an extension of an existing facility, this effect is unlikely to happen.

Alternatives A, B & C fall under the first category. With each alternative being located adjacent to the existing ash disposal facility, the positioning thereof would give rise to an **extended** and **intensified** impression of pre-existing an ash disposal facility in the landscape

The significance of cumulative impacts is difficult to assess. On the one hand it can be reasoned that the *static combined/simultaneous* effect takes place where pre-existing ash disposal facilities have already established a visual impact and that these have become an integral part of the landscape. The argument is therefor that the significance of visual impact would be low.

On the other hand, there should be recognition of the limits of the environment to accept further development without noteable harm (adverse visual impact). Cumulative impact assessment therefor seeks to ascertain if the introduction of new ash disposal facilities is likely to reach or exceed that limit. Given the close proximity of sensitive receptors, such as Mooimeisjesfontein, these are likely to reach that limit, since they are already affected by views of the ash disposal facility, which would be exacerbated with the new facility being even closer.

7. Mitigation

Given the large vertical and horizontal dimensions of an ash disposal facility, mitigation possibilities are few and limited to the following:

- Minimizing the height and footprint of the facility;

- Rehabilitate the facility by actively vegetating the slopes with grass, shrubs and trees similar to what is found in the surrounding area, as shown on the photograph in **Figure 8**.

As mentioned above, the impact will be further mitigated by its absorption into the landscape of a power station with existing ash disposal operations.

8. Visual Impact Significance Rating

The methodology for rating the significance of potential visual impacts states the **nature, extent, duration, magnitude** and **probability of occurrence** in respect of each development phase of the project. This involves the description and quantification of these criteria in the following way.

- The **nature**, describes what causes the effect, what will be affected and how it will be affected;

- The physical **extent**, wherein it is indicated whether:
  - 1 - the impact will be limited to the site;
  - 2 - the impact will be limited to the local area;
  - 3 - the impact will be limited to the region;
  - 4 - the impact will be national; or
  - 5 - the impact will be international;

- The **duration**, wherein it is indicated whether the lifetime of the impact will be:
  - 1 - of a very short duration (0ï 1 years);
  - 2 - of a short duration (2-5 years);
  - 3 - medium-term (5ï 15 years);
  - 4 - long term (> 15 years); or
  - 5 - permanent;

- The **magnitude of impact on ecological processes**, quantified on a scale from 0-10, where a score is assigned. This value is informed by the Visual Impact Index. Where more than one value is applicable, the higher of the two will be used to allow for a worst case scenario:
  - 0 - small and will have no effect on the receiving environment;
  - 2 - minor and will virtually have no effect on the receiving environment;

* 4 - low and will cause a slight impact on sensitive viewers;
* 6 - moderate and will result in prominent modifications of the landscape;
* 8 - high with the development dominating views of the landscape;
* 10 - very high and results in total loss of existing views.

- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:
  * 1 - very improbable (probably will not happen;
  * 2 - improbable (some possibility, but low likelihood);
  * 3 - probable (distinct possibility);
  * 4 - highly probable (most likely); or
  * 5 - definite (impact will occur regardless of any prevention measures);

- the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- the **status**, which is described as either positive, negative or neutral;
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the *degree* to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

S = (E+D+M)*P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- **31-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

Tables 1 – 5 summarise the above criteria for each of the following:

- Construction Phase

- Operation Phase;
- Decommissioning Phase
- Cumulative impacts;
- No-go alternative

Table 4: Construction Phase

Construction Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Transformation of the visual quality of the landscape	**Nature of impact:**	A new ash disposal facility will be developed on the selected site as an extension of the existing facility. This will be introduced as new features into the landscape, with moderate adverse visual impacts. No visual impacts are expected during construction of the facility.							
	with	2	2	2	5	**30**	**Low**	-	High
	without	2	2	2	5	**30**	**Low**	-	High
	degree to which impact can be reversed:	The impact during construction cannot be reversed.							
	degree of impact on irreplaceable resources:	N/A							

Table 5: : Operational Phase

Operational Phase										
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Visual exposure of the newly introduced ash disposal facility	**Nature of impact:**	Visual exposure of the newly introduced ash disposal facility is expected to create additional visual impacts by adding a new feature to the landscape that is large in spatial dimensions.							
	with	2	4	4	5	**50**	**Medium**	-	High
	without	2	4	6	5	**60**	**Medium**	-	High
	degree to which impact can be reversed:	Views of the ash disposal facility are expected to be absorbed visually into the mass and scale of the existing features, particularly as the appearance of the power station at large. By vegetating the side slopes of ash disposal facility, the visual impact can further be reduced.							
	degree of impact on irreplaceable resources:	N/A							
Transforming the visual quality and sense of place of the landscape	**Nature of impact:**	The historical visual quality of the area as an agricultural landscape has been transformed by the development of Tutuka Power Station. It is expected that the proposed new development would add to cumulative impacts, but would not further degrade the visual quality and sense of place of the landscape.							
	with	2	4	4	3	**30**	**Low**	-	Medium
	without	2	4	6	5	**60**	**Medium**	-	High
	degree to which impact can be reversed:	The visual appearance of ash disposal facility, consisting of topsoil, subsoil and overburden, can be changed by planting grass, shrubs and trees on the slopes that are visually exposed to the surrounding area. This will increase the possibility of visual absorption into the landscape in terms of texture and colour.							

Table 6: Decommissioning Phase

Decommissioning Phase									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Permanent transformation of the landscape	**Nature of impact:**	Stockpile highly visible in the horizon are visible as man-made structures. Should these remain as permanent features, the visual impact will remain permanently							
	with	2	4	4	3	30	Low		Medium
	without	3	5	6	5	70	High		Medium
	degree to which impact can be reversed:	The impact can be reversed by removal of the ash and restoring the vegetation to its original state.							
	degree of impact on irreplaceable resources:								

Table 7: Cumulative Impacts

Cumulative Impacts									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Incremental cumulative impact with the addition of an ash disposal facility in the visual landscape where and existing facility is already visible and not regarded as part of the natural environment.	**Nature of impact:**	Cumulative impacts are likely to occur, but are not regarded as sufficient enough to fundamentally change the landscape character.							
	with								
	without	2	4	4	3	**30**	**Low**	-	High
	degree to which impact can be reversed:	The impact cannot be reversed							

Table 8: No-Go Alternative

No-Go Alternative									
Potential Impact	**Mitigation**	**Extent (E)**	**Duration (D)**	**Magnitude (M)**	**Probability (P)**	**Significance (S=(E+D+M)*P)**		**Status (+ve or -ve)**	**Confidence**
Transformation of the visual quality of the landscape	**Nature of impact:**	Should the ash disposal facility not be developed, the visual landscape and sense of place around the power station will remain the same as it is currently being experienced.							
	with								
	without	1	4	0	5	**25**	**Low**	+	High

	degree to which impact can be reversed:	The impact cannot be reversed	

9. Acceptability of visual impacts

Visual impacts of the proposed development is expected to vary from low to moderate and will mostly be determined by the location of the observer in terms of distance from the ash disposal facility and the appearance of the scenery, brought about by landscape features around the observer. The acceptability of visual impacts are considered by answering specific questions as suggested by (NRC 2007: 374)[2]. These questions are:

i. Is the project located within an area of identified scenic or cultural significance?
   No.

ii. Would the project significantly degrade views or scenic resources of regional or national significance?
   No.

iii. Is the project on or close to a natural or cultural landscape feature that is a regional focal point?
   No.

iv. Is the project in a landscape area that is visually distinct and rare or unique?
   No.

v. Is the project unreasonably close to many residences that would be severely affected, especially as a result of noise and visual impact, or by being completely surrounded?
   No.

vi. Will the project occupy an area valued for its wildness and remoteness? If these values have been specifically documented, then consideration of the appropriateness of the project becomes even more important.
   No.

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[2] NRC (National Research Council). 2007. Environmental Impacts of Wind-Energy Projects. Committee on Environmental Impacts of Wind Energy Projects, National Research Council. Washington, DC: The National Academies Press. Available: http://www.nap.edu/catalog/11935.

vii. Would the projectôs scale in terms of height and length overwhelm the landscape in which it occurs?

Yes, but this is confined to the ash disposal facility site and close proximity of < 1.5km.

viii. Will the project result in unreasonable visual clutter due to its combination with existing built features that already degrade landscape features? This is an issue of cumulative impacts.

No. Although cumulative impacts are expected, the proposed development will be assimilated by the features of the existing ash disposal facility.

ix. Has the applicant used reasonable and available mitigating techniques that would reduce the projectôs impacts?

Yes. The slopes of the existing ash disposal facility have been vegetated, thereby increasing the visual absorption capacity of the feature into the landscape.

x. Does the project violate a clear, written community standard intended to protect the aesthetics or scenic beauty of the area? Such a standard ideally will be legally adopted by a community or government institution, and provide clear guidance to developers and be based on sound principles of aesthetic resource assessment.

No.

In conclusion, 10% of the above questions provide negative answers. This is indicative of a low probability of visual impacts.

10. Conclusion

The proposed extension of an ash disposal facility for Tutuka Power Station is required to continue power generation at the plant.

The visual quality of the receiving environment has already been modified by views of the power station and associated infrastructure, which includes the ash disposal facility south of the power station. The power station dominates views in the foreground and middle ground, with the ash disposal facility less visible and largely integrated into the topography of the area.

The severity of impact is influenced by the perception of viewers, which is assumed to be neutral. The visual absorption capacity of the environment is assessed to be sufficient to integrate the facility into the existing landscape, provided the preferred site is chosen and proposed mitigation measures are carried out.

The visual impact assessment and rating of alternative sites indicate Alternative B as the preferred site (Also see Table 3).

It is concluded that the visual impact of the proposed development is high in places, but can be mitigated by selecting the option with the least effect on sensitive receptors and implementing the proposed mitigation measures.

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