Proposed Expansion of the Ash Disposal Facility at Kriel Power Station, Mpumalanga

Visual Impact Assessment Report – EIA Phase

Eskom

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Visual character

The visual character of the area is determined by a combination of topography as well as the existing surrounding land use patterns. The general area surrounding Kriel Power Station is visually characterised by mining activities, including mine dumps and open cast mines. Grazing, maize cultivation, heavy industrial activities such as various power stations and rural and peri-urban land, forms the predominant land uses within the study area. Agricultural activities have transformed the landscape through the removal of natural vegetation to maize fields and grazing pastures. The Rietspruit dam, located north of the site, offers boating and other related recreational activities. The broader study area can be described as being rural with a sense of industrialisation. Large industrial infrastructure already plays a significant role in the visual character of the area.

Visual quality

Visual quality is based on human perceptions and expectations in the context of the existing environment. Visual quality is rated according to the existing type of land cover as well as the landscape's intrinsic physical properties. As a result of the visual dominance, the close proximity, scale and extensiveness of the existing ash dams and the power stations situated north-west and west of the site; the visual quality for the site will be low.

Visibility

The visibility of the project is the geographic area from which the project will be visible or view catchment area. Visibility is also dependent on visual exposure, degree of visual intrusion and visual sensitivity of the area. The site will have medium visibility. The areas lying north and west of the site will have partially obscured views as a result of the natural topography and industrial infrastructure. However, minimal obstructions such as buildings and trees ensure extensive views from Kriel's western periphery.

Viewer incidence and perception of the study area

Viewer incidence and perception is determined by the number of viewers, their proximity and how likely they are to be impacted upon. Viewer incidence for the site is rated as low due to the likelihood of familiarity with the current landscape and the positioning of the ash dam within the existing mining and industrial context.

Visual absorption capacity

Visual absorption capacity is an indication of the relative ability of the landscape to accept physical changes without transforming its visual character and quality. The site has a high VAC as an additional ash dam facility would essentially be anchored in the existing mining and industrial context.

Lighting

The lights at night for the site have already been established and the additional lighting will have low to medium significance in the existing context.

Terms and definitions

Alternatives: A possible course of action, in place of another, that would meet the same purpose and need defined by the development proposal. Alternatives considered in the EIA process can include location and/or routing alternatives, layout alternatives, process and/or design alternatives, scheduling alternatives or input alternatives. [3]

Category 5 Development: High township density / residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll routes, large scale infrastructure generally. Large scale development of agricultural land and commercial tree plantations. Quarrying and mining activities with related processing plants. [3]

Degree of visual intrusion: The level of compatibility or congruence of the project with the particular qualities of the area, or its "sense of place". This is related to the idea of context and maintaining the integrity of the landscape or townscape. [3]

Duration: The predicted life-span of the visual impact [3]

Environmental impact assessment: A public process that is used to identify, predict and assess the potential positive and negative social, economic and biophysical impacts of a proposed development. EIA includes an evaluation of alternatives appropriate management actions and monitoring programmes. [3]

Environmental management programme: A document that provides a description of the methods and procedures for mitigation and monitoring impacts. The EMP also contains environmental objectives and targets which the project proponent or developer needs to achieve in order to reduce or eliminate negative impacts. [7]

Extent: The spatial or geographic area of influence of the visual impact. [3]

Impact (visual): A description of the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space. [3]

Intensity: The magnitude of the impact on views, scenic or cultural resources. [3]

Issue (visual): A context-specific question that asks "what will the impact of some activity / aspect of the development be on some element of the visual, aesthetic or scenic environment. [5]

Level 4 assessment: Identification of issues raised during the scoping phase, site visit; description of the receiving environment and the proposed project; establishment of view catchment area, view corridors, viewpoints and receptors; indication of potential visual impacts using established criteria; description of alternatives, mitigation measures and monitoring programmes; 3D modelling and simulations, with and without mitigation. [3]

Management actions: Actions that enhance benefits of a proposed development, or avoid, mitigate, restore or compensate for negative impacts. [3]

Mitigation measures: See *management actions*. [3]

Nature of the impact: An appraisal of the visual effect the activity would have on the receiving environment. This description should include visual and scenic resources that are affected, and the manner in which they are affected, (both positive and negative effects). [3]

Observer proximity: The visual distance an observer would be located from the proposed impact.

Probability: "The degree of possibility of the visual impact occurring."[3]

Perception: Perception is the process whereby sensory stimulations are translated into organised experience.

Receptors: Individuals, groups or communities who are subject to the visual influence of a particular project. Also referred to as viewers, or viewer group. [3]

Sense of place: The unique quality or character of a place, whether natural, rural or urban. Relates to uniqueness, distinctiveness or strong identity. Sometimes referred to as *genius loci* meaning 'spirit of the place'. [3]

Scenic preference model: A model which predicts psychological responses to landscapes with objective measurements of quantitative and qualitative landscape variables. [6]

Scoping: The process of determining the key issues and the space and time boundaries to be addressed in an environmental assessment. [3]

Significance: The significance of impacts can be determined through a synthesis of the aspects produced in terms of their nature, duration, intensity, extent and probability. [3]

View catchment area: A geographic area, usually defined by the topography, within which a particular project or other feature would generally be visible. Sometimes called the visual envelope. [3]

View corridor: A linear geographic area, usually along movement routes, that is visible to users of the route. [3]

Viewpoint: A selected point in the landscape from which views of a particular project or other feature can be obtained. [3]

Viewshed: The outer boundary defining a view catchment area, usually along crests and ridgelines. [3]

Visibility of the project: The geographic area from which the project will be visible. [3]

Visual absorption capacity: The ability of an area to visually absorb development as a result of screening topography, vegetation or structures in the landscape. [3]

Visual exposure: The relative visibility of a project or feature in the landscape. [3]

Visual impact assessment: A visual impact assessment simulates and predicts the significance and magnitude of the visual effects on the landscape. [3]

Visual intrusion: The level of compatibility or congruence of the project with the particular qualities of the area, or its sense of place. This is related to context and maintaining the integrity of the landscape or townscape. [3]

Visual sensitivity: The inherent visibility of the landscape, usually determined by a combination of topography, landform, vegetation cover and settlement pattern. [3]

Abbreviations

AWR	Ash Water Return
CBD	Central Business District
CEMP	Construction Environmental Management Program
DEA&DP	Department of Environmental Affairs and Development Planning of the Western Cape
DTM	Digital terrain model
EIA	Environmental Impact Assessment
EMP	Environmental Management Program
GIS	Geographic Information System
Ha	Hectares
I&AP	Interested and affected party
Km	Kilometre
NEMA	National Environmental Management Act, 107 of 1998
TOR	Terms of reference
VAC	Visual absorption capacity
VIA	Visual impact assessment

Content of Specialist Report as per Appendix six of the NEMA EIA Regulations of 2014

(1) A specialist report prepared in terms of these Regulations must contain	Section
(a) details of- (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page 10
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 11
(c) an indication of the scope of, and the purpose for which, the report was prepared;	1.5
(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	1.3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	2.2
(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	3.1
(g) an identification of any areas to be avoided, including buffers;	N/A
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	3.1,3.2,3.3
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	2.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	4
(k) any mitigation measures for inclusion in the EMPr;	7
(l) any conditions for inclusion in the environmental authorisation;	N/A
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A
(n) a reasoned opinion- (i) as to whether the proposed activity or portions thereof should be authorised; and (ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	N/A
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) any other information requested by the competent authority.	N/A

Details of specialist, including relevant experience

The VIA report was undertaken by Elmie Weideman and Mr Goosen of Aurecon. Both Mr Goosen and Mrs Weideman are qualified as Landscape Architects and registered with the South African Council for the Landscape Architectural Profession (SACLAP). All GIS mapping and spatial analysis was compiled by Stephen Townshed of Aurecon.

Mrs Weideman has completed the following VIA's over the past five years:

- A 150-km transmission line for Eskom between Pietermaritzburg and Empangeni, Kwazulu Natal;
- A 280km transmission line in North West
- A wind farm for Just Energy near St. Helena Bay;
- A crude oil storage farm near Saldanha Bay;
- A solar farm near Westonaria
- A transmission line in Kwazulu Natal
- Mining infrastructure in Limpopo
- Upington Solar Farm, near Upington in the Northern Cape province; and
- Various reservoirs located within the Olifants River catchment located in the Northern Province and Mpumalanga

Declaration of independence

I, Elmie Weideman declare that

I act as the independent specialist in this application

I will perform the work relating to the application in an objective manner, even if it results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may comprise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;

I will comply with the Act, Regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interest in the undertaking of this activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing -any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

EWeideman

Signature of the specialist:

Name of company: Aurecon South Africa

Date: Jun 2017

1 Introduction

1.1 Project description and background

Project description

The construction of Kriel Power Station (owned by Eskom Holdings SOC Limited, Eskom) was completed in 1979 and was considered to be the largest coal-fired power station in the southern hemisphere at the time (see **Figure 1**). The 38 year old power station, with an installed capacity of 3 000 MW (Eskom, 2010), is located approximately 7 km west of the small town of Kriel (also known as Ga-nala) in the Mpumalanga Province. Through the process of electricity generation, coarse and fine ash is produced by burning coal. At full capacity, each of the six boilers can produce up to 740 000 tonnes/year of coarse ash/ boiler bottom ash (approximately 20% of total ash produced) ash and 2 960 000 tonnes/year of fly ash/ precipitator fly ash (approximately 80% of total ash produced).

Figure 1 | Location of the Kriel Power Station and current ash dam complex

Kriel Power Station makes use of a wet ashing process to dispose of its ash. Coarse ash is transferred with a small volume of fine ash (fly ash, to limit pipeline wear) from the Power Station to sumps, from where it is pumped as a slurry mixture to the Wet Ash Disposal Facilities (WADF)[1] (ash dams). The fine ash is transported separately to the existing ash dam complex, via two conveyors that are located south-east of Kriel Power Station. As mentioned above, Kriel uses wet ashing system, which involves conditioning fly ash and coarse ash with water for pneumatic transportation to the ash dams through conveyor belts and ash lines, respectively.

Upon reaching the ash dams, conditioning water, from ash, sluices into the designed lowest point of ash dam wherein it gets drained through penstocks. All the water collected from Kriel ash dams through the penstocks is stored in Ash Water Return (AWR) dams. From the AWR dams the ash water gravitates to a manifold and is then pumped back to a High Level AWR dam. From the High Level AWR dam the water gravitates to the pollution control dams known

[1] Wet Ash Disposal Facility is also referred to as an Ash Dam

as the Borrow Pits and Swartpan. The Borrow Pits contain mainly excess ash water from High Level AWR dam while Swartpan contains mainly excess overflow ash water from the Borrow Pits. Both Swartpan and the Borrow Pits dams are part of ash water cycle and are used as emergency containment dams. This water is then pumped from Swartpan for re-use by the Power Station for ashing purposes (Kriel Power Station, 2016).

The three existing ash dams will reach their capacity by end July 2021. Eskom is, thus, proposing to expand its existing ash disposal facility by constructing and commission an additional ash disposal facility footprint before the existing ash dams reach their capacity in 2021.

The complete proposed expansion with new ash dams (AD4.1, AD4.2 and AD4.3) (**see Figure 2**) would fulfil the ash disposal requirements for the Power Station's extended - operational life, whereby decommissioning of the six generating units is planned to commence in 2039. AD4.3 is however located on a previously mined and backfilled area, which needs to be tested first for stability. The expansion project is, therefore, divided into two phases, namely Phase 1, which covers construction of AD4.1 and AD4.2 (the subject of this application) (see Figure 3) and Phase 2 which covers AD4.3. A Monitored Test Embarkment is underway for AD4.3 and therefore this EIA only deals with Phase 1. Once the stability of AD4.3 has been confirmed, depending on the results, an additional EIA may be undertaken for AD4.3 or an alternative capacity. To smoothen the decommissioning process, a five year contingency has been allowed for, thus it is assumed that the Power Station will be operated for an additional five years, thereby allowing for the power station decommissioning from 2041 to 2045.

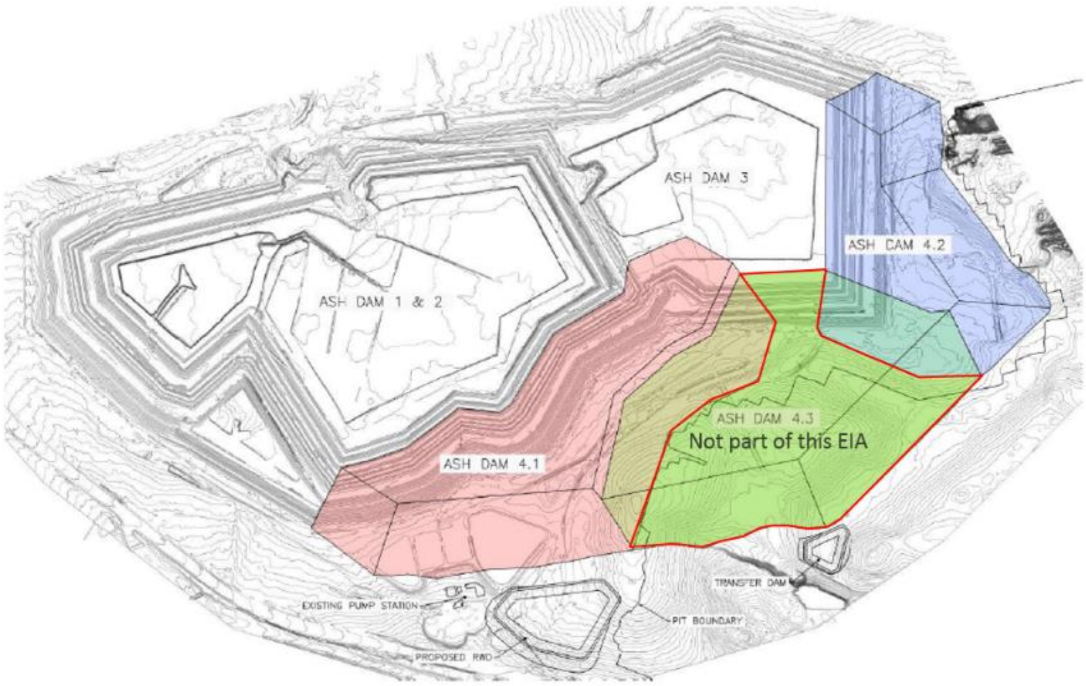


Figure 2 | Ash Dam 4 Concept (Source: JW044/16/E821)

Figure 3 | Phase 1, construction of AD4.1 and AD4.2 (the subject of this application)

The development of ash dam 4 will be sequenced to distribute large immediate capital expenditure cost. Dam 4.2 will be developed first in 2021 and will utilize a ring main system to distribute ash within the ash dam basin. Water generated on the dam will be decanted into solution trenches, running along the toe of the new dams, utilizing penstocks and subsoil drains. Ash water from Dam 4.2 will be gravitated to a transfer dam from where it will be pumped to the AWR dam.

Deposition was split between the existing and new dams in order to reduce the height of the preliminary starter walls, as well as the final height of the new dams. It was assumed that deposition on the existing dams will continue for 4 years after the commissioning of the first phase of AD4 (i.e. until the final phase of AD4 is commissioned). Once AD4.1, AD4.2 *and AD4.3*[2] are operational, the existing dams will be decommissioned, and rehabilitated. A period of two (2) years was allowed for between the construction phases of AD4 in order to defer large immediate capital costs. Thus, after AD4.2 is commissioned in July 2021, AD4.1 will be commissioned in July 2023, *and subsequently AD4.3 or another additional capacity in July 2025*.

From the AWR dam, ash water will be pumped back to the power station and ash dam pump-house to be reused in the placement of ash from the power station.

Site reference

This EIA process covers only AD4.1 and AD4.2 as well as the associated infrastructure that will be developed, including a Transfer Dam. The infrastructure includes pipes and a Transfer Dam that will be located on the mine backfilled area (*just South of the proposed siting for AD4.3*). A Class C liner has been provided for the ash dams (AD4.1 and AD4.2) and the Transfer Dam, which also has an addition of a concrete liner for maintenance purposes. Geotechnical studies will be conducted in the detail design phase and is expected to provide sufficient information to allow for the appropriate design of the transfer dam and infrastructure.

[2] AD4.3 will be implemented if deemed feasible and needed

	Stability of the Transfer Dam (vetted by Designer & Chief Engineering Geotechnical Engineering): The Transfer Dam is not sized or designed to store any water. The Transfer Dam is designed to collect return water from Dam 4.2 and pump to the AWRD. This will be a continuous process and operations must comply as such; The design premise of the Transfer Dam's placement & construction is that the weight of the soil in that position (pre-construction) is heavier than the weight of water; The Transfer Dam position abuts the old Starter Wall of the Pit 2 backfills. Therefore, the Starter Wall would have been compacted and consolidated. The Basin of Transfer Dam is founded on the ash behind the Starter Wall, which would have consolidated after 20 years; It is also assumed that the soil/ash at that position has caused localised consolidation over time, so no loose soils are expecting directly under the Transfer Dam; and Therefore, the Transfer Dam will not add weight to the environment & therefore not induce deep settlements. Going forward in the design, the Transfer Dam will take the detailed geotechnical information into account to design layer works below the Transfer Dam's base. This should ensure that there are no settlements, as any settlement would misalign the pipeworks. *NB. Within the Transfer Dam design the liner is accessible and can be repaired if compromised.*
Site layout	The attached map (Figure 3) is based on the latest layout received from Eskom. Note that the layout of AD4.1 and AD4.2 has not changed – only the associated infrastructure has changed slightly. These locations for the ash dams were used by all specialists. The change in layout for the associated infrastructure did not affect the outcome of the specialist assessments.

1.2 Purpose of the specialist study

The purpose of the specialist study is to determine the visual and aesthetic impact of the proposed project on the receiving environment. Visual impacts can be described as a feature change in possible landscape views and the effect those changes will have on potential receptors as well as on the sense of place. The assessment of the significant visual criteria (refer to **section 1.1**) is based upon prediction of the feature impact in accordance to certain baseline conditions. Variation in land uses as well as the visual, aesthetic, social and cultural significance of the area form part of the baseline conditions.

The purpose of this study is to determine whether the project will have a positive or negative visual impact and alteration on the surrounding area, and if so, to what degree. The impacts will be determined through: identifying landscape and visual impacts associated with the development and estimating their magnitude, assessing their significance in a well-structured fashion and recommend mitigation measures to reduce the anticipated visual impacts.

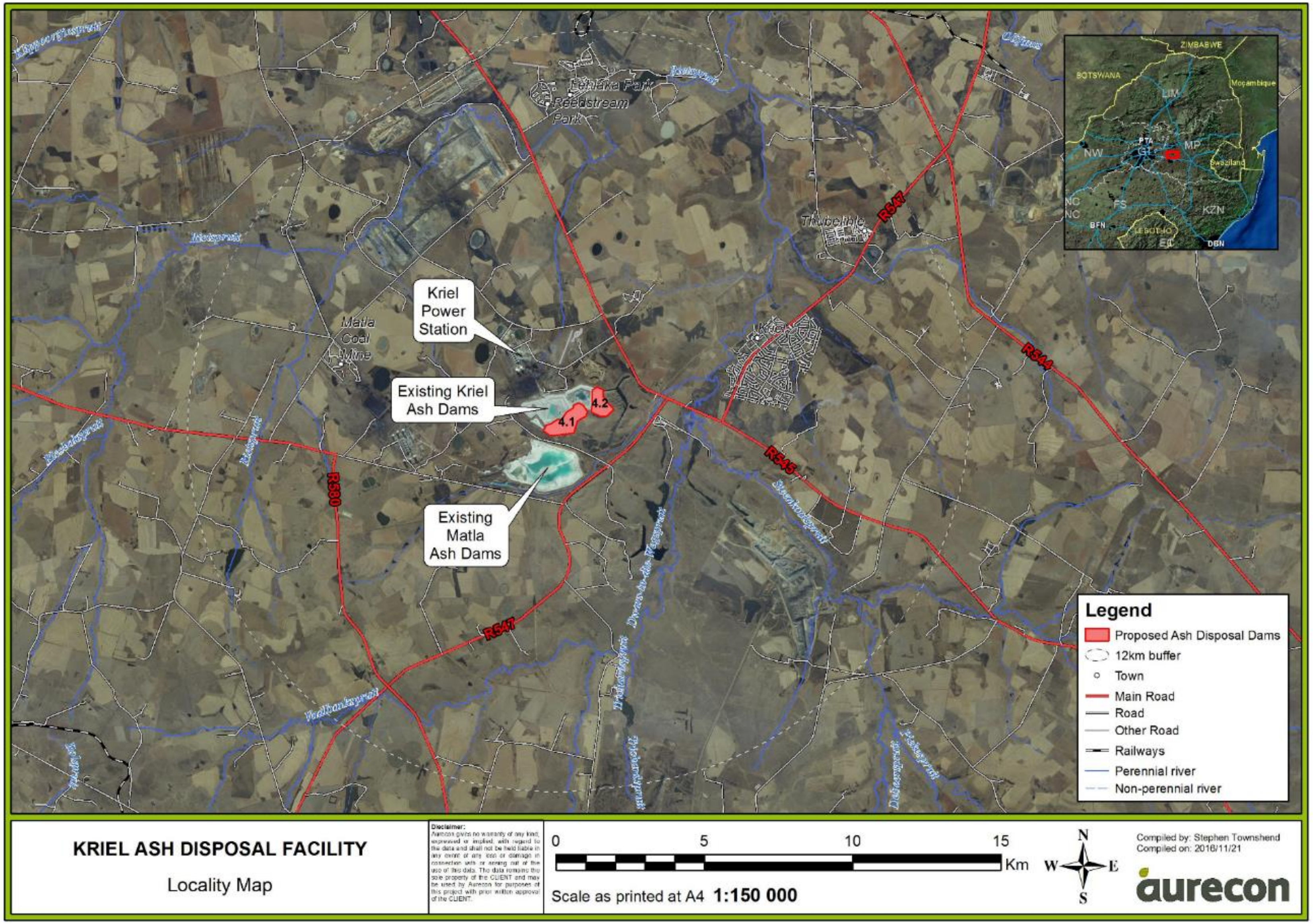


Figure 1-4 | Locality map of the proposed Kriel Ash Disposal Facility

1.3 Key issues

The key issues associated with the site and pertaining to the VIA can be summarised as follows:

"The landscape is covered in grassland with a few sparse trees. As such, the power station is visible for many kilometres in the surrounding area. Site 10 (also referred to as Ash Dam 4) is however adjacent to the existing Kriel ash dam complex and, as such, could limit the visual footprint of the proposed ash facility at this site." [2]

1.4 Terms of reference

The terms of reference, for the VIA, extracted from the final scoping report can be highlighted as follows:

- Undertake a review of baseline information, describe the receiving environment; and establish a view of the catchment area, view corridors, viewpoints, receptors and identification of potential lighting impacts at night.
- Undertake an assessment of the visual impacts at the candidate sites, in terms of the scale of impact (local, regional, national), magnitude of impact (low, medium or high) and the duration of the impact (construction, up to 10 years after construction and more than 10 years after construction).
- Identify mitigation measures to reduce or eliminate the potential identified visual impacts.

2 Scope of work

2.1 Overview

The scope of work for the VIA includes the assessment of the nature, extent, duration, magnitude, probability, confidence levels and significance of the specific visual criteria. Proposed management, monitoring programs and mitigation measures will also be included after impact significance has been assessed. Specific visual criteria to be addressed include the following:

- Visibility of the project;
- Degree of visual intrusion;
- Visual sensitivity of the area;
- Viewer sensitivity;
- Observer proximity; and
- Visual absorption capacity.

2.2 Methodology and approach

The Western Cape Province's guideline, *Oberholzer, B.2005. Guideline for involving visual and aesthetic specialists in EIA* processes has been used and referenced extensively throughout this document since, as at the time of writing, no similar guidelines have been published either for Mpumalanga or for South Africa in general. This guideline serves as a regulated benchmark for VIA's. According to this document the proposed project is a Category 5 development which will require a level 4 visual assessment. The visual criteria utilised for this assessment is listed above in section 2.1. The following measures will be rated in the selection of the preferred site:

- Identification of landscape characteristics, visual character and visual quality, generally based on geology, landforms, vegetation type, land cover and land use. The landscape characteristics and visual character were determined by means of desktop studies and digital photographs.

- Identification of important viewpoints, emphasis was placed on potential visual receptors and key observation points towards the proposed ash dams. Photographs and a GPS were used to record relevant geographical locations within the vicinity of the sites. Key observation points were selected according to their relevance in the landscape and the surrounding area. Visual impact was determined through:
  - Identifying view sheds, view catchment area and the zone which will be visually influenced.
  - Determining the relative visibility, or visual intrusion of the proposed project.
  - Determining the visual absorption capacity (VAC) of the landscape, usually based on topography, vegetation cover and the urban fabric; and
  - Determining the relative compatibility or conflict of the project with the surroundings.
- Identifying issues which relates to visual scenic resources through desktop studies and site visits.
- A comparison of the existing situation with the probable effect of the proposed project, through visual simulation, using photo-montages.
- Impact mitigation through:
  - Mitigating the negative impacts; and
  - Enhancing the positive impacts.
- Recommendations with regards to the preferred site, based on visual impact assessment.

2.3 Assumptions, limitations and risks

- Information gaps that might occur with regards to other specialists input; this may have an influence on the accuracy of the visual input at this stage of the process.
- Uncertainty about future expansion of the project.
- Technical design data was based on information stated in the final scoping report (FSR) (this information was received from Jones & Wagener).
- Photo simulations and visual GIS data will be based on initial locality plans which indicate the potential locations for the ash facility. It is understood that transportation of the ash from the power station to the new facilities will be via existing conveyor infrastructure and no new conveyor systems are required.
- Photomontages are an approximation and for illustration purposes only.
- The following information was not available at the time of writing this report and has therefore not been included in the VIA:
  - Length, area and finishes of access roads and internal roads;
  - Type and height of all ancillary structures;
  - Construction phase facilities such as construction camps , positions of stockpiles and batch mixing areas; and
  - Type and height of all outdoor signage and lighting.

3 Project environment

3.1 Baseline information

The baseline study will record and analyse the existing character, quality enhancement potential and sensitivity of the landscape and visual resources in the vicinity of the different sites.

The extent of the visual impact will depend on the following baseline information:

- Technical design data; and
- Landscape character.

3.1.1 Technical design data

The following table includes the technical design data received from Jones & Wagener.

3.1.1.1 Key data for Site 10 (Ash Dam 4)

Table 3-1 | Key data (amended from Jones & Wagener 2016)

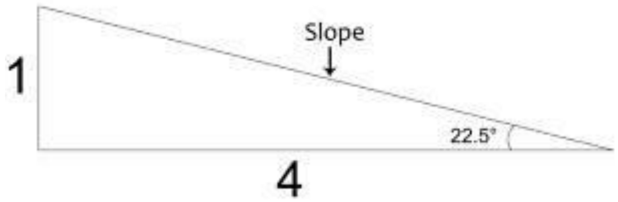
Capacity	71.5Mtons
Facility life	29 years
Maximum rate of rise	3m/year
*** Side slopes**	4H:1V
Footprint area	250ha – 320ha

*The slope is considered flat enough to vegetate / rehabilitate effectively.

3.1.1.2 Capacity and area

A model for the site has been developed as follows:

- Maximum extremities were used to develop a toe line from where a crest line was calculated at the set slope of 4H:1V.



- The actual height at which the set capacity is achieved was determined from the height / capacity relationship.
- The rate of rise is checked at final elevation to ensure that it is not exceeded.

3.1.1.3 Conclusion

According to Jones & Wagener the provisional rate of rise for Site 10 (Ash Dam 4) will be substantially lower than the 3m/year limit; this is due to the fact that the existing ash Dam 2 comes back into service once the dams on Site 10 reach the crest of Ash Dam 3.

3.1.2 Landscape character

Landscape characteristics will be discussed under the following headings:

- Topography;
- Vegetation (density and type);
- Receptors / viewers in the area; and
- Land use and diversity.

3.1.2.1 Topography

The Highveld Plateau is characterised by an undulating landscape with a few areas of rising ground which could block views. The Kriel Power Station is located within the Great Karoo Basin that contains sediments that were deposited in fluvial floodplains and shallow shelves. Dolorites a prominent feature of the Karoo Basin, intruded after sedimentation in the basin. [2]

The Karoo Basin has been subjected to several cycles of erosion, which resulted in weathering at great depths. Rocky outcrops are rare in the Kriel area and are often covered by transported soils Weathering in the area is largely dependent on climatic conditions with disintegration occurring in the dryer regions and decompositions in the in the wetter regions. [2]

The Kriel area is located within a wetter region and as a result experience decomposition of clay and minerals where water is available. Kriel is also underlain by the Vryheid Formation that contains sediments consisting of sandstone and sub ordinate gravels and mudrocks with exploitable coal seams. These sedimentary rocks are predominantly horizontally bedded or have very gentle dips. The Karoo sediments are dominated by sandstones and are most often closely intercalated with siltstones and shales / mudrocks. [2]

3.1.3 Vegetation

The Kriel Power Station is located within the Mesic Highveld Grassland Bioregion as defined by Mucia and Rutherford (2006). The dominant vegetation type found in the vicinity of the power station and surrounding areas is Eastern Highveld Grassland. This vegetation type occurs on plains on a general altitude of 1520m to 1780m, but also as low as 1300m, within the Mpumalanga and Gauteng Provinces. The landscape is characterised by low hills and pan depressions, and supports short dense grassland that is dominated by general Highveld grass species such as *Aristida Digitaria, Eragrostis, Themeda and Tristachya*. Small scattered rocky outcrops that are characterised by wiry, sour grasses and some woody species also occur within this area. Indigenous woody species are precluded as a result of frosty winters Eastern Highveld Grassland is an endangered vegetation type with only a handful of patches conserved. The majority of vegetation has been transformed due to cultivation, plantations, mining urbanisation and dams. [2]

Due to the lack of bushes and shrubs found in this vegetation community, vegetation density during winter months is fairly low and the line of site is not frequently obscured. During summer months the density increases as veld grass vigour returns.

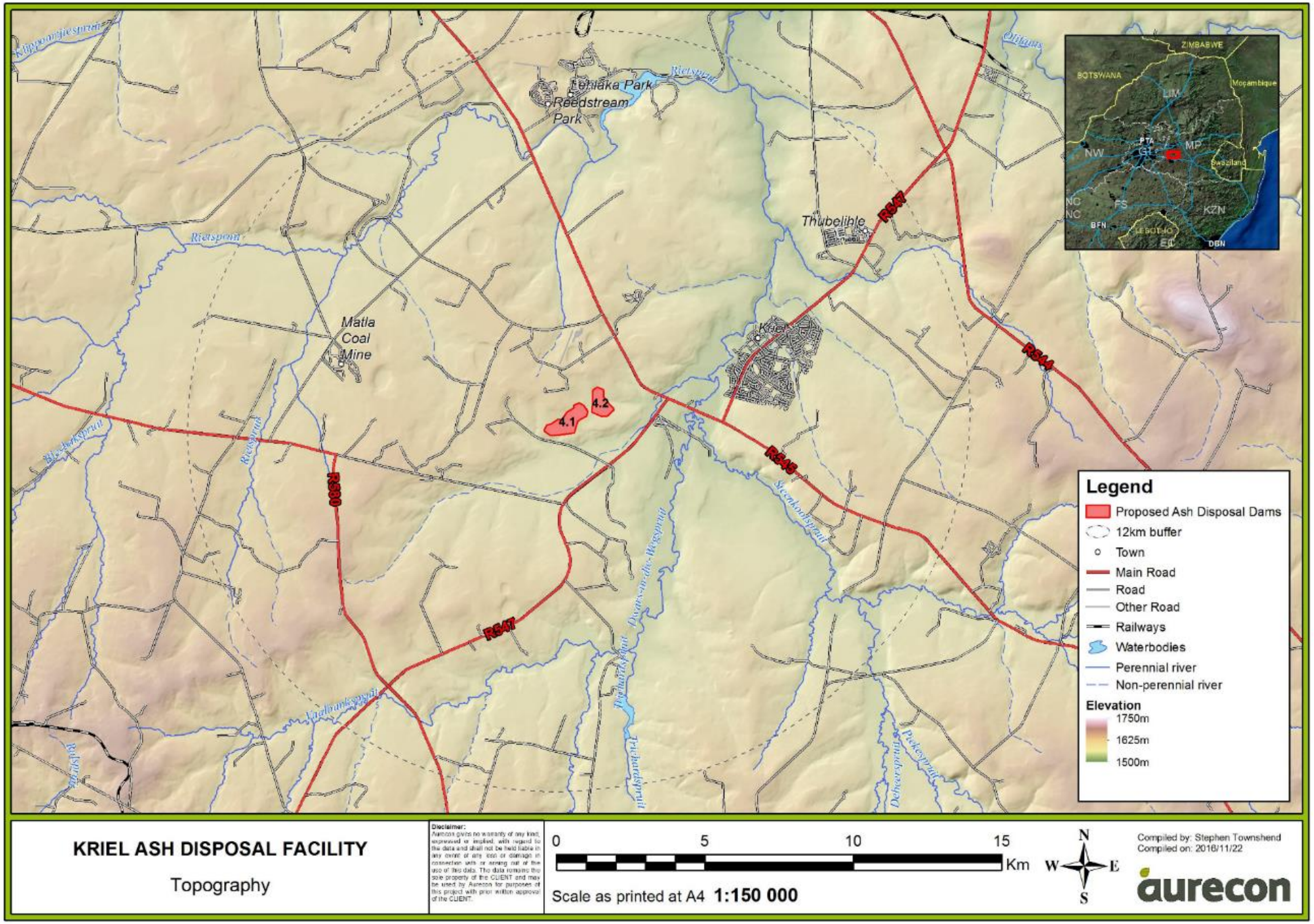


Figure 3-1 | Topography of the terrain surrounding the proposed Kriel Ash Disposal Facility

3.1.4 Receptors / viewers in the area

- Travellers on the R547 and R545 (refer to Figure 4-6 | Key observation point locations)
- Informal settlements and subsistence farmers located east of the site
- People residing west of the R547 main road going into the CBD of Kriel
- Residents of the Thubelihle informal settlement, located north east of the CBD of Kriel

3.1.5 Land use and diversity

As can be seen in Figure 3-2 | Land cover in the study area, land use within the surrounding area is dominated by mining (coal) and agricultural activities, which consist primarily of maize, occasional mixed crop rotation and cattle farming. The main urban area is the town of Kriel with Thubelihle Township located north of the town and another small informal settlement located along the R545.

3.2 Visual quality

Visual quality is based on human perceptions and expectations in the context of the existing environment and is rated according to the existing type of land cover (refer to **Figure 3-2** | Land cover in the study area) as well as the landscape's intrinsic physical properties. Ratings are based on seven key factors: landform, vegetation, water, colour, adjacent scenery, scarcity and cultural modifications which all forms part of the unique *genius loci* of a place.

Landscape quality increases with the presence of water, topographic ruggedness and where diverse patterns of vegetation occur. Areas which contain more natural features or harmonious man-made compositions will have a more favourable rating compared to areas where there is an increase in human activity which will have a less favourable rating.

Visual quality has been rated from low to very high, taking the existing context of the proposed area into consideration.

The following table provides an indication of the rating of the main land cover types in terms of the scenic preference model, the scenic preference model was mainly developed by the Regional Landscape Strategy Advisory Committee for the Lockyer Scenic Amenity study. [8] The scenic amenity of any locality is primarily determined by its scenic preference and modified by its visual exposure. The scenic preference model is used to quantify each land category in terms of the visual quality thereof.

Table 3-2 | Visual quality rating

Visual quality rating	Land cover
Very High	Bush thicket, Waterbodies, Wetlands
High	Bare rock and soil, Grassland
Medium	Cultivated land, Plantations, Urban (residential, commercial)
Low	Mines and quarries, Urban (industrial)

The largest land use surrounding the proposed sites is cultivated temporary commercial dryland, which has a medium visual quality. The second largest percentage land use is natural grassland which has a high visual quality (see Figure 3-3). As a result of the visual dominance, the close proximity, scale and extensiveness of the existing ash dams (laying south-west and north-west of the site) as well as the power stations situated to the north-west and west of the site the visual quality for the site will be low. Therefore an additional ash dam will not change the visual quality of the areas surrounding the site.

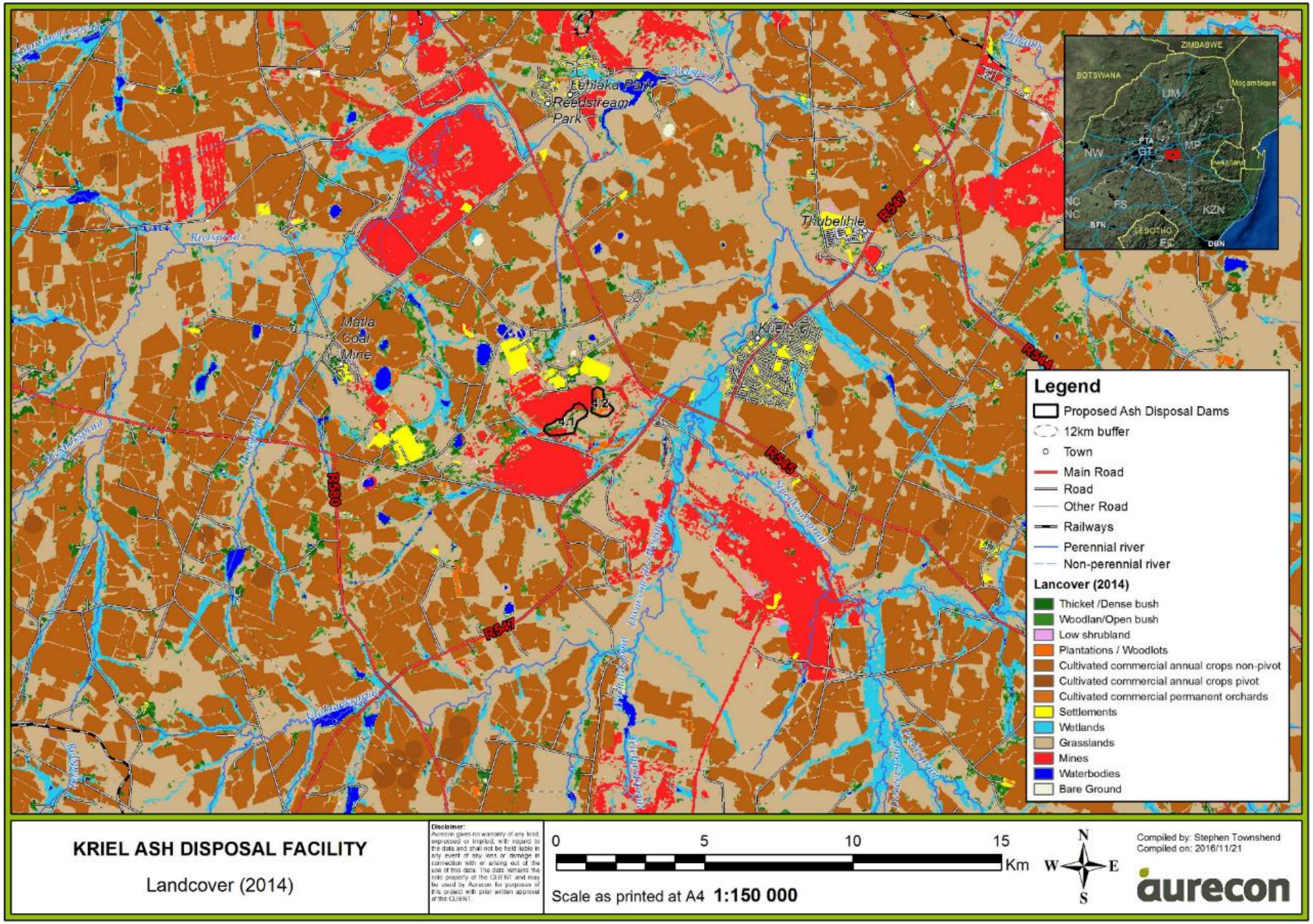


Figure 3-2 | Land cover in the study area

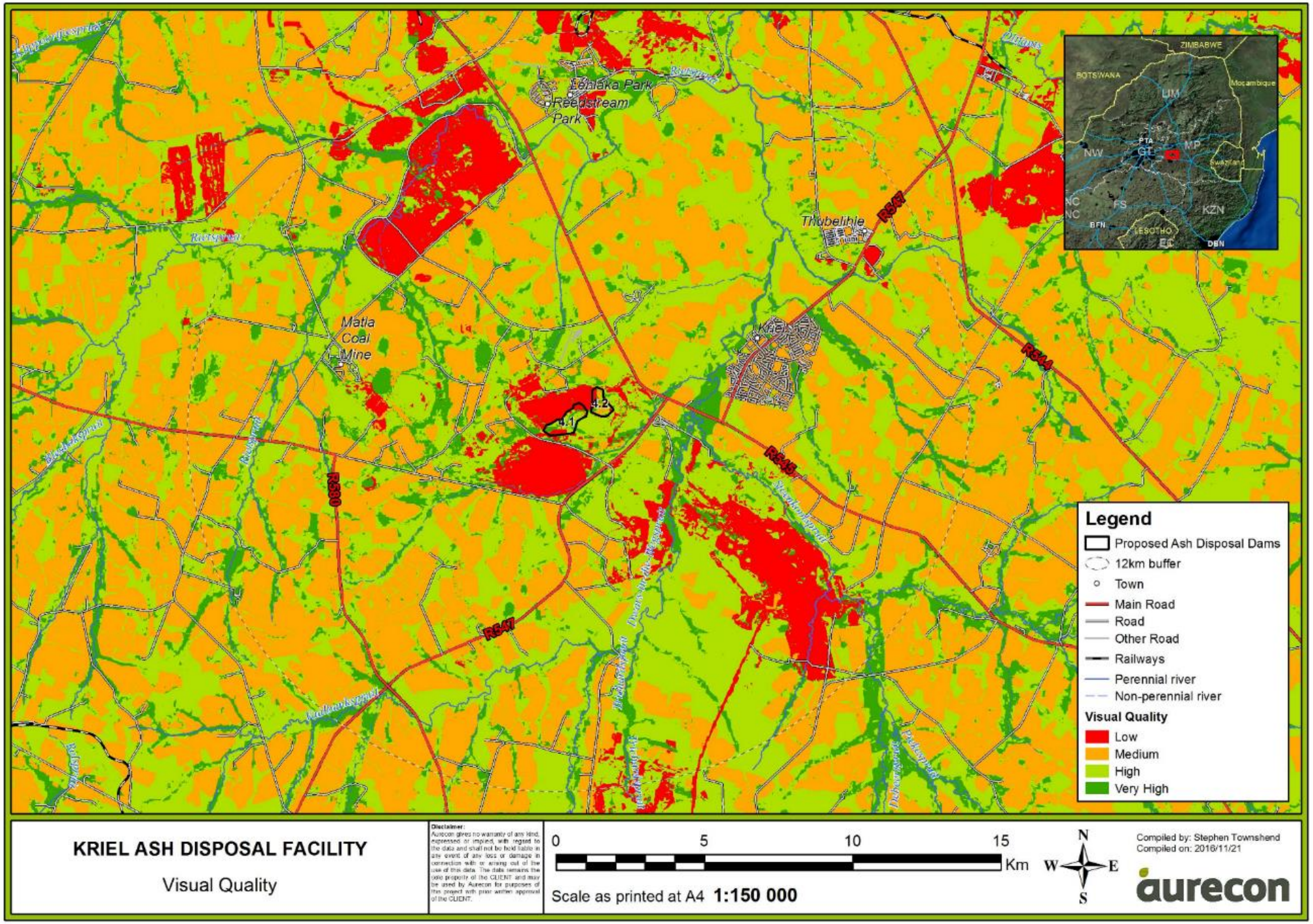


Figure 3-3 | Visual quality of the study area

3.3 Visual character

The visual character of the area is determined by a combination of topography (valleys, escarpments, koppies and rivers) as well as existing surrounding land use patterns (see Figure 3-4, Figure 3-5 and Figure 3-6).

Visual character is also subject to the presence of built infrastructure such as buildings, roads and industrial infrastructure such as power stations, factories and mines. Varying degrees of human transformation will trigger different visual characteristics which will depend on the degree of change from a natural, unspoilt setting to an urban environment.

The general area surrounding Kriel Power Station is visually characterised by mining structures and related activities, including mine dumps and open cast mines. Grazing, maize cultivation, heavy industrial activities such as various power stations and rural and peri-urban land, form the predominant land uses within the study area. The formal and informal residential areas situated east and south of the site contains medium population densities with typical (in the formal residential area) one residential dwelling per plot; this number might increase within the informal residential areas. The CBD of Kriel does not contain high rise buildings and can be seen as a typical small scale South African farming town.

Agricultural activities have transformed the landscape through the removal of natural vegetation to maize fields and grazing pastures. The Rietspruit dam, located approximately 10km north of the site, offers boating and other related recreational activities. The broader study area can be described as being rural with a sense of industrialisation. Large industrial infrastructure already play a significant role in the visual character of the area. The impact of additional ash dams adjacent to the existing ash dam at Kriel would largely be absorbed by the existing mining infrastructure and thus would not significantly alter the landscape character.

While it is usually preferable to consolidate any new impacts with existing visual impacts of the same type rather than impose it on a different landscape, the cumulative effects of several negative impacts tends to compound the perceived negativity associated with them. However, mitigation measures that help to blend the new development with the existing landscape can effectively neutralise this potential increase in negative perception. Since the Kriel ash dams and the nearby Matla ash dam are in relatively close proximity, cumulative impact must be considered. It is thus important to ensure that mitigation measures of the potential visual intrusion are effective for the new developments.

Figure 3-4 | South-westerly view from the R547 to Site 10 / Ash Dam 4

Figure 3-5 | View in a westerly direction from the R547 to Site 10 / Ash Dam 4

Figure 3-6 | View from the R545 in a north-westerly direction to Site 10 / Ash Dam 4

4 Impact analysis

4.1 Visual impact methodology

The methodology for the visual impact assessment is based on spatial analysis and incorporating data which was sourced from the site visit. The site will be evaluated according to the following criteria which will contribute to the overall impact result.

- Visibility of the project;
- Visual exposure;
- Degree of visual intrusion;
- Visual sensitivity of the area;
- Viewer sensitivity;
- Observer proximity;
- Visual absorption capacity (VAC).

Where applicable, the above mentioned criteria will be discussed and weighted according to extent, duration, magnitude, significance, probability of occurring, confidence and reversibility. Where the weighting table is not appropriate a reasonable explanation will inform the final analysis. The final analysis for each of the impact areas as well as the nature of the impact will be summarised by means of a final impact assessment.

Table 4-1 | Assessment criteria and weighting

Extent	Regional Beyond a 5km radius of the site	Local Within a 5km radius of the site	Site specific On site or within 100m of the candidate site		
Duration	Long term More than 15 years after construction	Medium term 5-15 years after construction	Short term Up to 5 years after construction	Construction period Up to 2 years	
Magnitude	High Natural and/or social functions and/or processes are severely altered	Medium Natural and/or social functions and/or processes are notably altered	Low Natural and/or social functions and/or processes are slightly altered	Very low Natural and/or social functions and/or processes are negligibly altered	Zero Natural and/or social functions and/or processes remain unaltered
Significance ratings	High ▪ High magnitude with a regional extent and long term duration ▪ High magnitude with either a regional extent and medium term duration or a local extent and long term duration ▪ Medium magnitude with a regional extent and long term duration	Medium ▪ High magnitude with a local extent and medium term duration ▪ High magnitude with a regional extent and construction period or site specific extent and medium term duration ▪ Medium magnitude with any combination of extent and duration except site specific extent and medium term duration ▪ Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term ▪ Low magnitude with a	Low ▪ High magnitude with a site specific extent sand construction period duration ▪ Medium magnitude with a site specific extent and construction period duration ▪ Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term ▪ Very low magnitude with a regional extent and long term duration	Very low ▪ Low magnitude with a site specific extent and construction period duration ▪ Very low magnitude with any combination of extent and duration except regional and long term	Neutral Zero magnitude with any combination of extent and duration

		regional extent and long term duration			
Probability ratings	Definite Estimate greater than 95% chance of the impact occurring	Probable Estimated 5-95% chance of the impact occurring	Unlikely Estimated less than 5% chance of the impact occurring		
Confidence ratings	Certain Wealth of information on and sound understanding of the environmental factors potentially influencing the project	Sure Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact	Unsure Limited useful information on and understanding of the environmental factors potentially influencing this impact		
Reversibility ratings	Irreversible The activity will lead to an impact that is in all practical terms permanent	Reversible The impact is reversible within 2 years after the cause or stress is removed			

4.2 Visual Impact Assessment Resources

The software tools and techniques that were used during the visual impact assessment include:

- Geographic Information System technology using ArcGIS Desktop

GIS operations included:

- Data capturing and processing
- Mapping
  - Site visit
  - Photographs
  - Photographic simulation
  - Scoping report

4.3 Key observation points

During the site visit, key observation points were identified based on traffic volumes (major routes) and higher population densities (see Figure 4-1 to Figure 4-5). These areas are considered as key observation points which were identified through the results of the viewshed analysis.

The following table is a graphic presentation of where photos were taken during the site visit. Key observation points are centred on the outskirts of Kriel, along the R545 and R547, as well as the T-junction where traffic slows and thus visual incidence of the site will thus become more frequent.

4.3.1 Key observation points

Key Observation Point	Coordinates	Distance from impact	View duration	Direction of view
5	26° 15' 55.50"S 29° 15' 5.70"E	4km	Extensive	South west

Figure 4-1 | Key observation points 5

Key Observation Point	Coordinates	Distance from impact	View duration	Direction of view
6	26° 16' 25.00"S 29° 14' 51.66"E	3.7km	Extensive	West

Figure 4-2 | Key observation points 6

Key Observation Point	Coordinates	Distance from impact	View duration	Direction of view
7	26° 15 '7.55"S 29° 12' 48.26"E	1.5km	Moderate	South west

Figure 4-3 | Key observation points 7

Key Observation Point	Coordinates	Distance from impact	View duration	Direction of view
11	26° 16' 7.11"S 29° 13' 40.58"E	2km	Extensive	West

Figure 4-4 | Key observation points 11

Key Observation Point	Coordinates	Distance from impact	View duration	Direction of view
12	26° 17' 7.04"S 29° 12' 43.91"E	1.5km	Moderate	North west

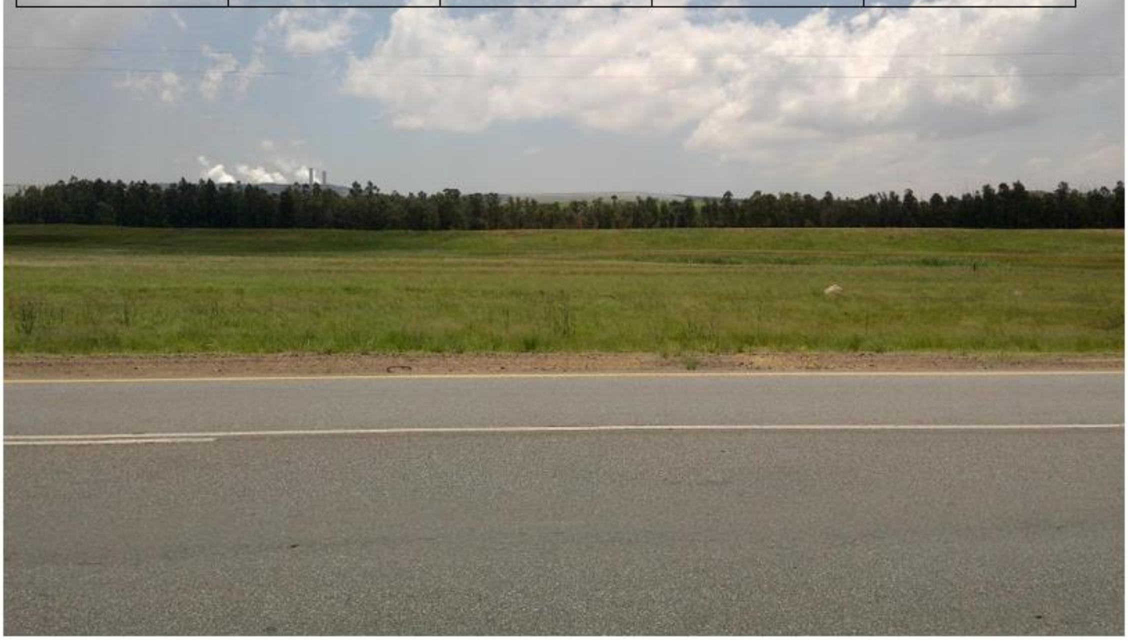


Figure 4-5 | Key observation points 12

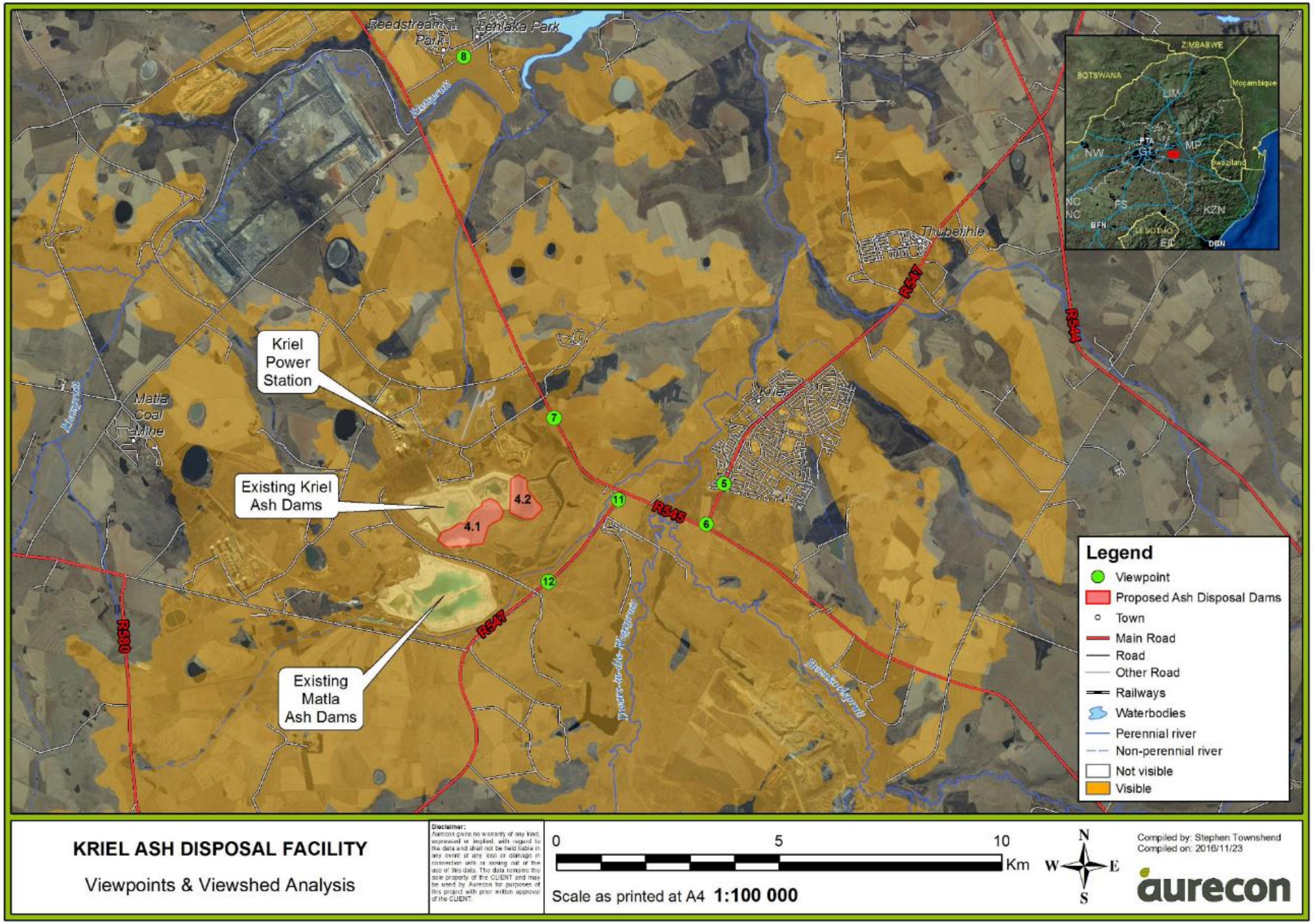


Figure 4-6 | Key observation point locations

4.4 Visual impact criteria

4.4.1 Visibility of the project

The visibility of the project is the geographic area from which the project will be visible, or view catchment area. The actual zone of visual influence of the project may be smaller because of screening by existing trees and buildings. [3] The GIS software only generates visible and non-visible areas based on landform data, therefore actual site visit analysis will be utilised to supplement the results of the viewshed analysis and determine the overall visibility. The viewshed analysis was done using several points along the crests of both ash dams at the maximum height of each, as indicated by Jones & Wagener [1]. An observer height was set at 1.75m above the digital elevation model (DEM) surface and the results can be seen in **Figure 4-7 |** Viewshed analysis.

The visibility of the project is measured according to:

- High visibility: visible from a large area
- Medium visibility: visible from an intermediate area
- Low visibility: visible form a small area around the project site

Table 4-2 | Visibility of project, visual assessment criteria Site 10 / Ash Dam 4

Criteria	**Rating (without mitigation)**	**Motivation**
Extent	Regional	Due to the height and actual footprint the ash dam will be visible from areas located further than 5km
Duration	Long term	The ash dam will be in existence for a long term
Magnitude	Very low	The introduction of an additional ash dam facility will not noticeably change the existing structures on site
Significance	Low	The introduction of an additional facility will not noticeably change the existing sense of place
Probability of occurrence	Probable	Due to the need for additional power supply the impact will probably take place
Confidence levels	Sure	With 3D GIS modelling confidence levels are increased
Reversibility ratings	Irreversible	The proposed ash dam is a key component in the proposed operations expansion project

Criteria	**Rating (with mitigation)**	**Motivation**
Extent	Regional	Due to the height and actual footprint the ash dam will be visible from areas located further than 5km
Duration	Long term	The ash dam will be in existence for a long term, even after rehabilitation it will still be a recognisable man-made structure
Magnitude	Very low	The introduction of an additional ash dam facility will not noticeably change the existing processes on site
Significance	Low	The introduction of an additional facility will not noticeably change the existing sense of place

Criteria	Rating (with mitigation)	Motivation
Probability of occurrence	Probable	The impacts will probably take place
Confidence levels	Sure	With 3D GIS modelling confidence levels are increased
Reversibility ratings	Irreversible	The proposed ash dam is a key component in the proposed operations expansion project
Mitigation and management measures None. The proposed ash dam facility will be effectively screened and anchored within the context of the existing topography. The greater area around the ash dam facility would therefore not change.		

Summary

Even though Site 10 / Ash Dam 4 is reasonably visible from populated areas, visibility in general was rated as medium and the significance rated as low. As a result of the topography Site 10 / Ash Dam 4 will not be visible from areas lying to the north. The low significance is the result of the proximity and location of existing mining related infrastructure.

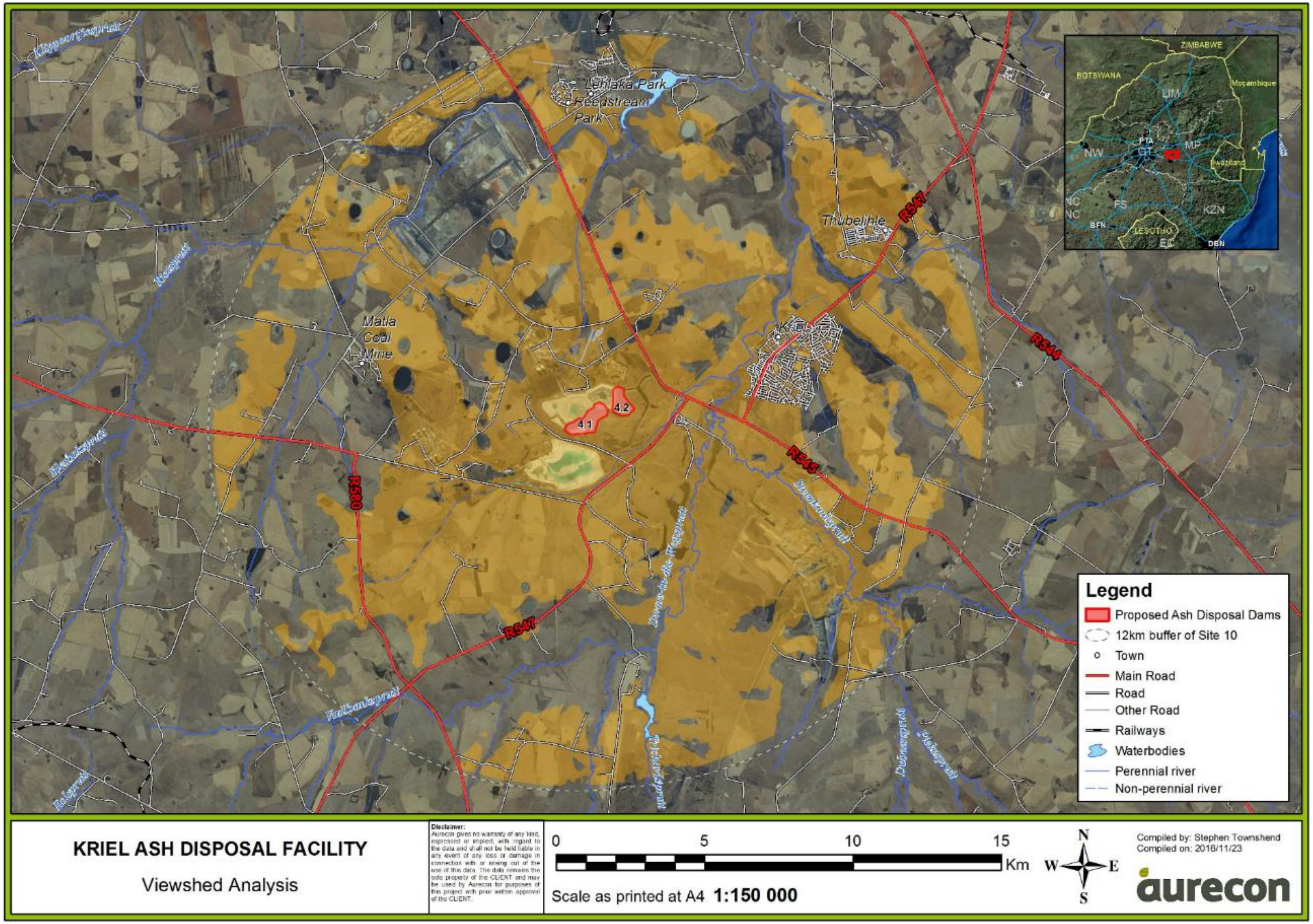


Figure 4-7 | Viewshed analysis

4.4.2 Visual Exposure

The visual exposure of the proposed project is based on the distance, direction, and duration of view from a potential impact and is derived from a combination of a proximity analysis and a viewshed analysis. The viewshed analysis was done using several points along the crests of both ash dams at the maximum height of each, as indicated by Jones & Wagener [1]. An observer height was set at 1.75m above the digital elevation model (DEM) surface and the results can be seen in **Figure 4-7 | Viewshed analysis**. The viewshed analysis accurately represents the visibility of some or all of the proposed project from any other place in the region but does not take non-topographical obstructions into account, for example from vegetation or atmospheric haze. Such obstructions to visibility are addressed in 4.4.74.4.7.

The footprint of the ash dams was used as the starting point of the potential impact and buffer radii of 1km were generated from this Figure 4-10 | Viewer proximity to spatially represent the visual exposure of proximity, since the visibility of an object decreases exponentially over distance and accordingly the scale of visual impact will diminish as the viewer moves away. [3] (Refer to **Figure 4-8 | Visual exposure)** An exponential decrease means that the largest visual exposure will occur in very close proximity to the proposed project, in this case <1km, but this exposure drops off sharply as distance increases even though the impact might be visible and completely unobstructed. For spatial representation purposes, this exponential gradient has been be generalised into zones Very High (0-1km), High (1-2km), Medium (2-3km), Low (3-4km), and Insignificant (>4km).

Visual exposure is measured according to:

- High exposure: dominant or clearly visible
- Medium exposure: recognisable to the viewer
- Low exposure: not particularly noticeable to the viewer

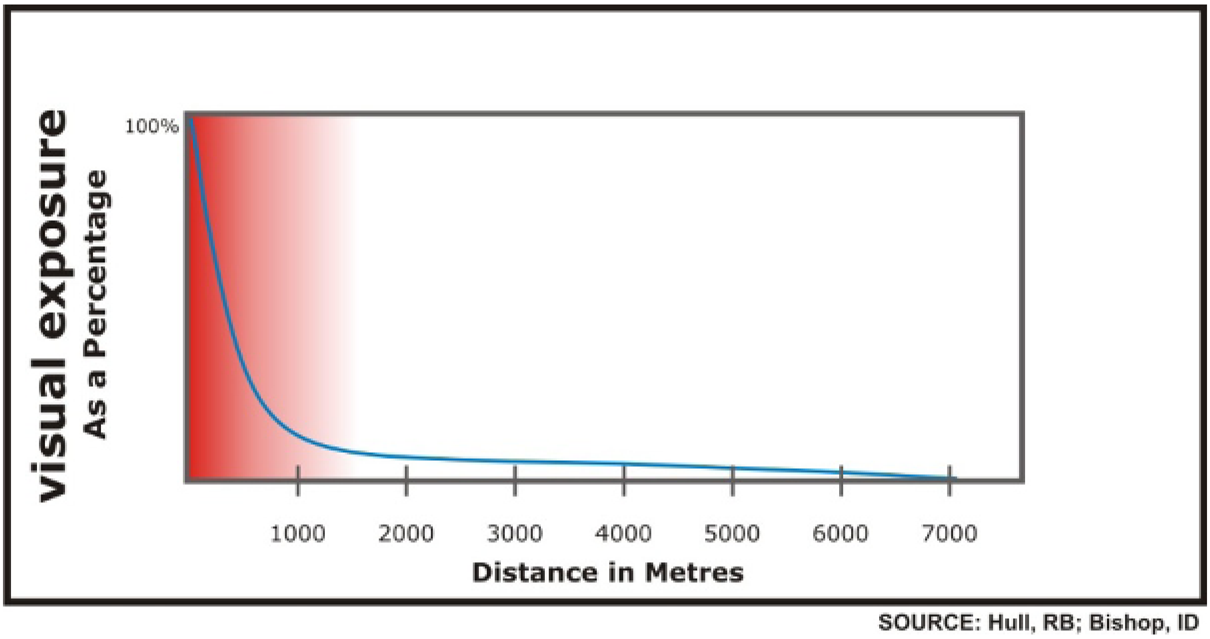


Figure 4-8 | Visual exposure

Summary

Reference should be made to **Figure 4-6 | Key observation point locations**. The visual exposure at key observation points 5 and 6 will be medium as the ash dams, despite having a nearly unobstructed view, will come into the peripheral view of southbound drivers approaching the T-junction of the R545, and falls within the "low" band of viewer proximity. The visual exposure at key observation point 7 would be medium as drivers on the R545 in both directions drive past the proposed ash dams and it does not fall within the cone of vision in either direction but does fall within the high band of viewer proximity. Similarly, key observation points 11 and 12 are in relatively close proximity to the proposed ash dams but the cone of vision of motorists on the R547 will generally not be directed towards the site, hence the exposure will also be medium. In summary, the exposure would range from medium to high and views would in general be mostly unobstructed from areas to the east and southeast. These views would however mostly be from drivers and would therefore only be temporary in duration.

4.4.3 Degree of visual intrusion

The degree of visual intrusion is related to the idea of context and maintaining the integrity of the landscape or townscape. The level of compatibility or congruence of the project will be rated against the landscape compatibility criteria and will then be combined in order to form a resultant rating. [3]

Degree of visual intrusion is rated as follows:

- High visual intrusion: results in a noticeable change or is discordant with the surroundings
- Medium visual intrusion: partially fits into the surroundings, but clearly noticeable
- Low visual intrusion: minimal change or blends in well with the surroundings.
- No visual intrusion: negligible change to the surroundings

Summary

Site 10 has no visual intrusion as the proposed ash dams would be positioned in front of an existing ash dam and the associated power station and cooling towers forms part of the backdrop. Additional ash dams will not alter the sense of place as it will blend into their immediate surrounds.

4.4.4 Visual sensitivity of the area

Visual sensitivity is "the inherent visibility of the landscape, usually determined by a combination of topography, landform, vegetation cover and settlement pattern."[3]

Visual sensitivity is rated as follows:

- High visual sensitivity: highly visible and potentially sensitive to areas in the landscape
- Medium visual sensitivity: moderately visible areas in the landscape
- Low visual sensitivity: minimally visible areas in the landscape

Summary

Due to the location of the study area the sensitivity of the landscape to a change of this nature would be low due to existing heavy industrial activities, which would absorb any changes in land use and would provide the context within which the proposed ash dam would be located. Site 10 is located approximately 2km from the R545 and forms part of the driver's field of vision when driving in a south-westerly direction, leaving the town of Kriel, on the R547. The area around Site 10 has been rated with a low - medium sensitivity due to it being located between various main roads.

4.4.5 Viewer sensitivity

"The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. It is also dependent on their perception of the area and their ability to adapt to changes in their environment and can include how frequently they are exposed to the view." [5]

A visual receptor's sensitivity is based upon the viewer's:

- Familiarity with the actual scene;
- Circumstances that brings them into contact with that view;

- Nature of the view (full or glimpsed, near or distant). [5]

Roads and residential areas are the two main areas which will have differing viewer perception.

Roads: Roads are used by people to reach a routine destination, a holiday destination or as part of a leisure experience. The road network in the study area includes the main roads which are the R547 and R545 as well as some secondary tarred roads and dirt roads which provide access to farms. The R545 links the towns of Ogies and Bethal whereas the R547 is the main road towards central Kriel and Thubelihle, the R547 also provides access to the N17.

Residential areas and farmsteads: The town of Kriel and the informal settlement of Thubelihle lies 3.7km and 9km respectively east of the proposed site. Farmsteads are located in a dispersed pattern.

Viewer sensitivity is measured according to:

- High sensitivity, e.g. residential areas, nature reserves and scenic routes or trails
- Medium sensitivity, e.g. sporting or recreational areas, or places of work
- Low sensitivity, e.g. industrial, mining or degraded areas

Table 4-3 | Viewer sensitivity

Criteria	Rating (without mitigation)	Motivation
Extent	Local	The largest viewer incidence would be experienced within a 5km radius from the site. These viewers would most probably be people residing and doing mine related work in the area.
Duration	Long term	The ash dam will be in operation for more than 15 years after construction.
Magnitude	Low	The existing ash dams are already dominating the surrounding landscape context and the proposed additional dam would minimally affect the existing viewer sensitivity. The majority of potential viewers are also familiar with the existing landscape context.
Significance	Low	As above.
Probability of occurrence	Probable	The impact would most probably occur.
Confidence levels	Sure	Even though the social impact assessment has not been consulted there is a reasonable understanding of the existing social environment.
Reversibility ratings	Irreversible	The impact will be permanent.

Criteria	Rating (with mitigation)	Motivation
Extent	Local	The largest viewer incidence would be experienced within a 5km radius from the site. These viewers would most probably be people residing and doing mine related work in the area.
Duration	Long term	The ash dam will be in operation for more than 15 years after construction. Even after rehabilitation it will still be a recognisable man-made structure.

Criteria	Rating (with mitigation)	Motivation
Magnitude	Very low	The intensity of the impact will decrease if the ash dam is rehabilitated according to existing mine rehabilitation plans.
Significance	Very low	As above.
Probability of occurrence	Probable	The impact would most probably occur.
Confidence levels	Sure	Even though the social impact assessment has not been consulted there is a reasonable understanding of the existing social environment.
Reversibility ratings	Irreversible	Even after rehabilitation the ash dam profile will still be recognisable as a man-made structure.
Mitigation and management measures Position the ash dam on site in such a way that travellers on the R545 and R547 receive minimum perpendicular views towards the proposed impact. After operations the ash dam should be shaped and rehabilitated appropriately according to the mine's existing rehabilitation plans.		

Summary

Viewer incidence for Site 10 / Ash Dam 4 is rated as low significance (see Figure 4-9). Clear views would be from key observation points 5, 6 and 11, turning from the R545 onto the R547. The viewer sensitivity would be low due to the actual familiarity of the scene as well as the positioning of the ash dam within the existing mine context.

Occurrence of a negative perception must be expected especially during the construction phase of the project due to a potential increase in dust pollution.

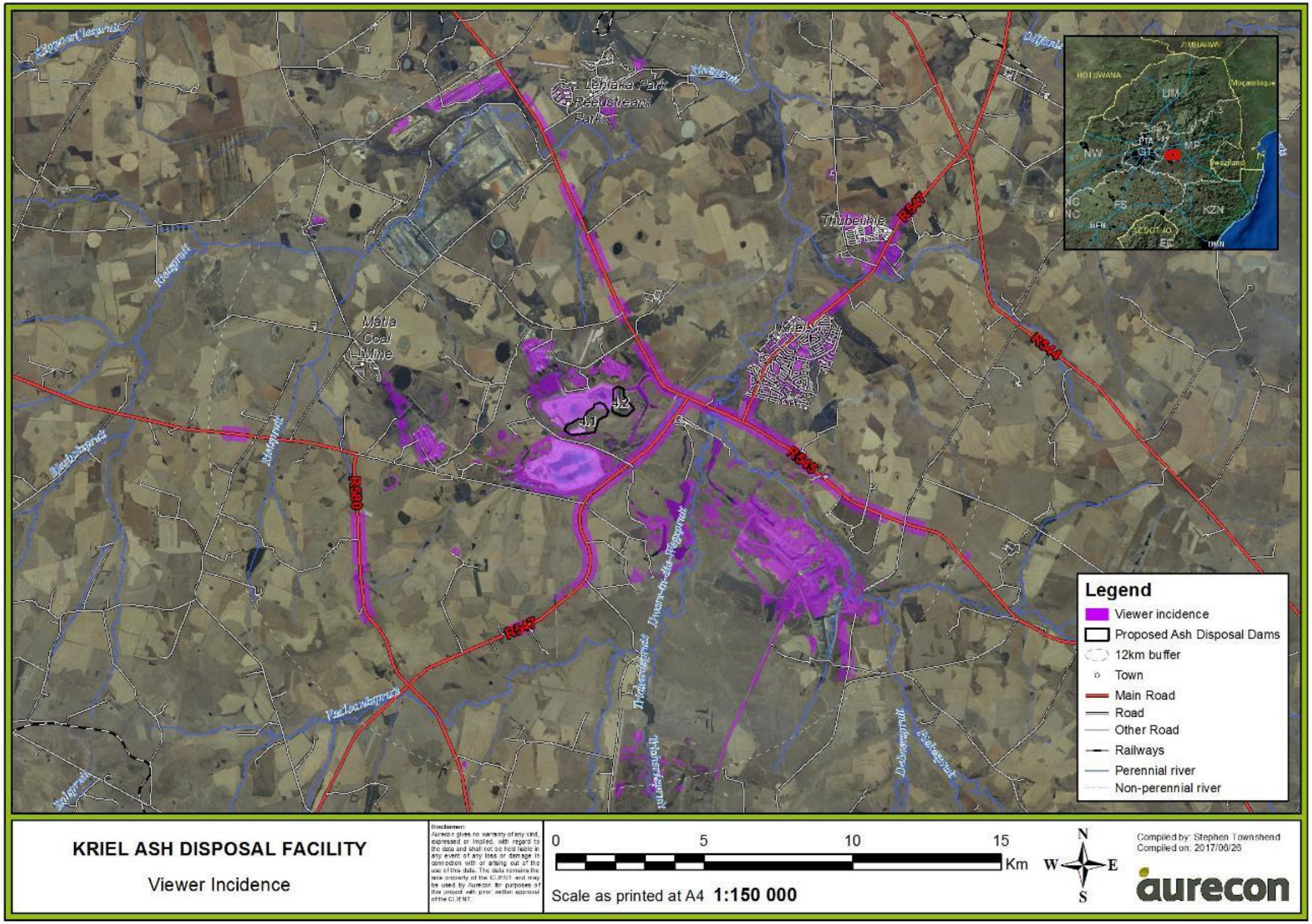


Figure 4-9 | Viewer incidence

4.4.6 Observer proximity

In order to determine the primary visual impact, the principle of reduced impact over distance has been applied. (It is important to note that the screening effect of the topography has been ignored). The degree to which an object fills a person's central field of vision (the central field of vision covers a 50 to 60 degree angle) determines the visual impact it might cause.

Using a GIS buffer analysis, the circumference of the ash dam wall was viewed from incremental distances and were measured accordingly (refer to **Figure 4-10 | Viewer proximity**).

The core area has been set at a radius of 1km. At 2km from the viewing location the exposure decreases to 50%. Given the scale of the project, the dam will be visible from a long distance. For the purpose of this assessment the analysis is limited to a radius of 4km.

Table 4-4 | Relation between distance and impact rating

Distance	Impact rating
0-1km	Very high impact
1-2km	High impact
2-3km	Medium impact
3-4km	Low to medium impact
More than 4km	Low impact

Summary

None of the main public roads are within the very high impact zone but significant stretches of these roads still fall within the high impact zone. The further the driver moves away in a north westerly or south easterly direction, the lower the impact becomes, as well as being outside the typical field of vision for motorists. As a result of the proximity to the main roads and the relatively small distance from the CBD of Kriel the overall observer proximity impact will be medium.

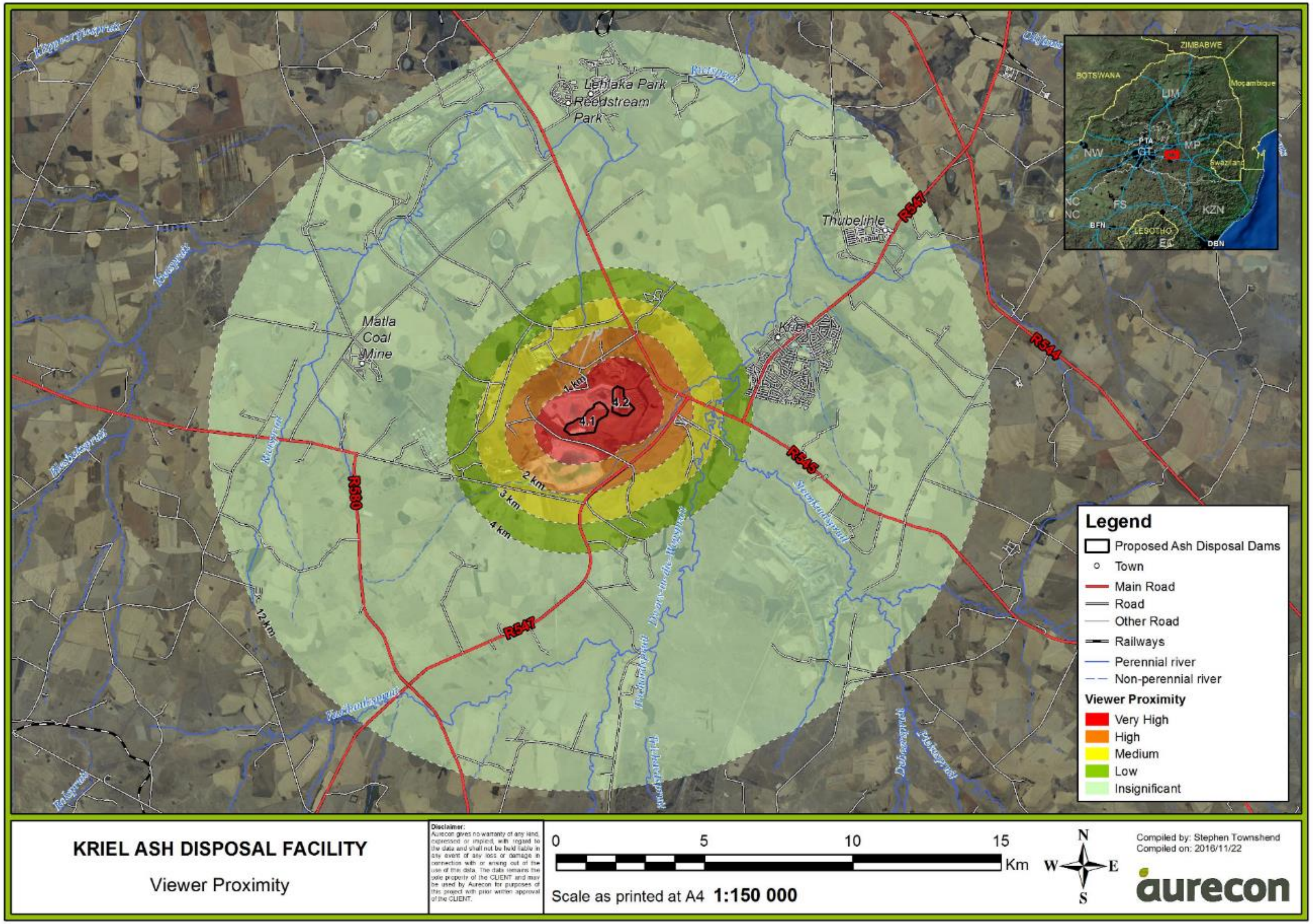


Figure 4-10 | Viewer proximity

4.4.7 Visual absorption capacity

Visual absorption capacity is an indication of the relative ability of the landscape to accept physical changes without transforming its visual character and quality. [3]

- High VAC: Effective screening by topography, vegetation and structures
- Medium VAC: Partial screening by topography, vegetation and structures
- Low VAC: Little screening by topography, vegetation and structures

The following factors are taken into account:

- Landform (slope)
- Land use
- Land cover (vegetation height and structures)

Table 4-5 | VAC criteria assessment for Site 10 / Ash Dam 4

Criteria	Rating (without mitigation)	Motivation
Extent	Local	The additional ash dam facility will be congruent with the existing context and will be absorbed by the existing land use.
Duration	Long term	The ash dam will be in operation for more than 15 years after construction.
Magnitude	Low	The proposed ash dam will form a unity with the existing ash dams.
Significance	Low	Same as above.
Probability of occurrence	Probable	The impact will probably take place.
Confidence levels	Certain	Photomontages indicate the ability of the existing environment to absorb the proposed change, even without mitigation.
Reversibility ratings	Irreversible	The impact to the site will be permanent.

Criteria	Rating (with mitigation)	Motivation
Extent	Local	The additional ash dam facility will be congruent with the existing context and will be absorbed by the existing land use.
Duration	Long term	The ash dam will be in operation for more than 15 years after construction.
Magnitude	Very low	The introduction of mitigation measures related to ancillary structures will reduce the overall impact and will further increase the VAC.
Significance	Very low	Same as above.
Probability of occurrence	Probable	The impact will probably take place.

Criteria	Rating (with mitigation)	Motivation
Confidence levels	Certain	Photomontages indicate the ability of the existing environment to absorb the proposed change.
Reversibility ratings	Irreversible	The impact to the site will be permanent.
Mitigation and management measures Where applicable related ancillary structures should be covered with appropriate landscaping techniques.		

Summary

The visual absorption capacity's significance is rated as low. The landscape has a high visual absorption capacity within the context of the proposed ash dam facility for both the proposed ash dams as well as the ancillary structures of pump houses and seepage catchment dams. The presence of similar infrastructure is an important factor in the determination of visual absorption capacity. The majority of the area surrounding proposed Site 10 / Ash Dam 4 has an industrial character and additional similar facilities would not be incongruent in this setting.

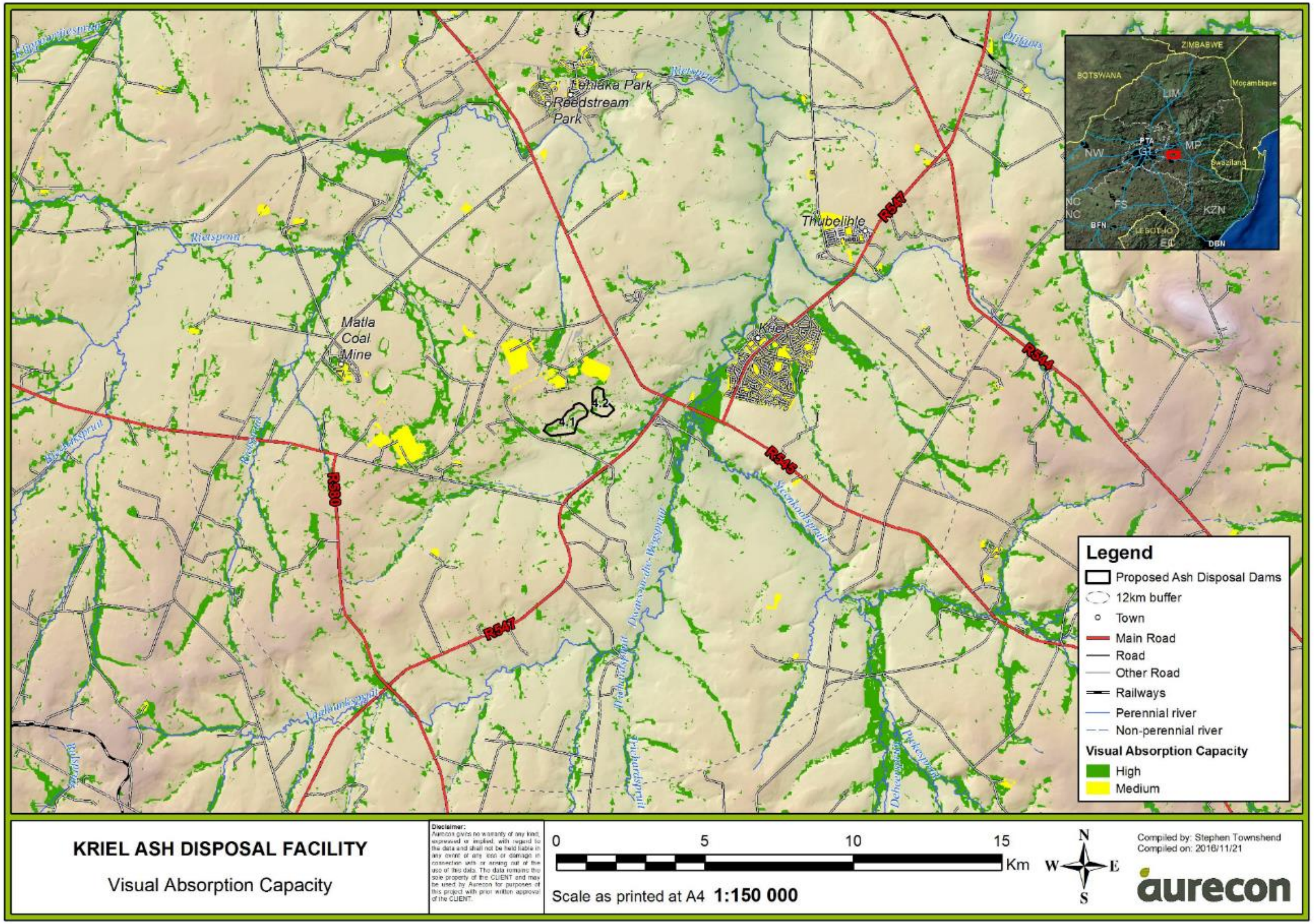


Figure 4-11 | Visual absorption capacity

5 Lighting

The lighting analysis is conceptual because no specific lighting plan was available at the time of writing this report. The assumption was made that a high concentration of light sources would be found around the ash dam periphery. Impacts will most likely occur as a result of light trespass and glare. Lighting criteria for Site 10 can be summarised in table format as:

- The outcome of the rating will have an impact on the visual impact index
- The visual analysis will be inaccurate as other existing sources of lighting have to be included
- The lights at night for Site 10 is already established as this is an existing mining site with an existing lighting policy

Possible affected receptors include farm houses and settlements closer than 2km from the light source. The impact of lighting is measured according to the scale and intensity of lighting sources within the surrounding area.

Table 5-1 | Lighting criteria assessment, Site 10 / Ash Dam 4

Criteria	Rating (without mitigation)	Motivation
Extent	Regional	The current lights at night context are well established.
Duration	Long term	The light structures will be in use for at least 15 years after construction.
Magnitude	Low	As a result of the established lights at night context the existing light intensity will not severely increase.
Significance	Low	As above.
Probability of occurrence	Definite	It is highly likely that light impacts will occur.
Degree of certainty	Unsure	No existing and proposed lighting information was available.
Reversibility ratings	Reversible	Impacts from light sources are reversible.

Criteria	Rating(with mitigation)	Motivation
Extent	Local	The current lights at night context are well established.
Duration	Long term	The light structures will be in use for at least 15 years after construction.
Magnitude	Very low	With mitigation measures the effect of the additional light sources could be reduced to almost negligible.
Significance	Low	As above.
Probability of occurrence	Definite	It is highly likely that light impacts will occur.
Degree of certainty	Uncertain	No existing and proposed lighting information was available.

Criteria	Rating(with mitigation)	Motivation
Reversibility ratings	Reversible	Impacts from light sources are reversible.
Mitigation and management measures ■ The use of mass lighting should be avoided ■ All light sources should be directed downwards ■ Lighting sources should be shielded where possible ■ Where possible trees should be planted around ancillary structures which will be visible from human settlements and main roads (such as the R545 and R547) ■ Development of a lighting policy for all phases of the project		

6 Visual impact index

The resulting visual impact significance, as discussed above, was integrated to obtain a conclusive result.

6.1 Site 10

6.1.1 Visual impact assessment

The visual impact assessment is a generalised summary of the results of the individual visual impact criteria. It is intended to be an overview that can be used to highlight the differences between, for example, different site options, or between differences in mitigation options. Criteria left out of the visual impact assessment are considered to be either not appropriate or will have only a negligible effect on the assessment regardless of available options. For the purposes of this report only one site option exists, therefore leaving only a comparison between mitigation options.

The visual impact assessment index, as highlighted at the end of **Table 6-1 | Summary for visual impact criteria assessed**, represents the final findings of the assessment and is intended to inform the decision-making process between available options.

Table 6-1 | Summary for visual impact criteria assessed

Visual impact criteria	Impact significance (without mitigation)	Impact significance (with mitigation)
Visibility of the project	Low	Low
Viewer incidence and perception of the study area	Low	Very low
Visual absorption capacity	Low	Very low
Lighting	Low	Low
VIA index	Low	Low to very low

7 Typical mitigation measures

7.1 Construction phase

The construction contract must include the stripping and stockpiling of topsoil. Topsoil would be used later on during the rehabilitation phase. The presence of degraded areas and disused construction roads, which are not rehabilitated, will increase the overall visual impact.

The main mitigation measure during the construction phase will be effective rehabilitation of the construction camps (including temporary access roads, laydown areas and worker camps) and all other areas affected by the construction works. As such it is imperative that the implementer and its contractor fully comply with the rehabilitation requirements as depicted in the approved Construction Environmental Management Programme (CEMP). The specifications for rehabilitation should be detailed and included in the Environmental Management Program so that the operations can be monitored for compliance.

All cut and fill slopes and areas affected by construction work should be progressively topsoiled and re-vegetated as soon as possible.

Cut and fill slopes should mimic the shapes and angles found in the adjacent area.

Specifications with regards to the placement of construction camps, as well as a site plan of the construction camp, indicating waste areas, storage areas and placement of ablution facilities should be included in the Environmental Management Program. These areas should either be screened or positioned in areas where they would be less visible from human settlements and main roads (such as the R545 or the R547).

Dust, as a result of construction activities and haulage, should be suppressed through regular watering of surface areas or the implementation of other dust suppression techniques.

Due to the nuisance and the visual impact associated with lighting, security and construction lighting should, as far as possible, only be focused on temporary structures and construction works. Where this is unavoidable, lighting should be as unobtrusive as possible and reflectors can be used to avoid light spillage.

7.2 Operational phase

Suitable tree species could be planted in front of the proposed ash dam embankment in order to soften the ash dam's linear profile; this mitigation measure will be effective from distances located further than 3km from the impact.

Slopes should be vegetated using suitable indigenous grass species (or as specified in the mine's existing rehabilitation plan) as this will allow the ash dam to blend in with the existing landscape colours. The presence of existing tree lines already illustrates the effectiveness of strategic vegetation planting in screening the development from critical angles, as can clearly be seen from Viewpoint 12.

When vegetation is cleared for servitudes and roads, the edges of the cleared area should be irregular or curvilinear rather than straight and sharp. Irregular and curvilinear lines would blend in with the natural formation of the landscape and as a result minimise the visual impact.

New ancillary structures must be built in the same style to ensure visual continuity and may also be very effectively screened with vegetation and tree lines of indigenous species.

7.3 Closing phase

Slopes should be vegetated using suitable indigenous grass species (or as specified in the rehabilitation plan) as this will allow the ash dam to blend in with the existing landscape colours.

8 Conclusion

According to the Western Cape's DEA&DP (as guideline) the construction of mining related infrastructure is categorised as a Category 5 Development with medium to high visual impact expected. From the above visual impact assessment it is clear that, due to the significant amount of existing visually imposing mine-related infrastructure, the visual impact will be significantly less. The Visual Impact Assessment has also demonstrated that the proposed ash dam will have a low impact on the existing environment. Despite the physical characteristics of the area (topography and vegetation cover) which allows for wide vistas, the nature of land uses (existing mining infrastructure) ensures a low level of visual sensitivity and a VAC. During the initial years of the ash dam's lifespan the visual impact can even be considered as negligible and the visual impact will increase in relation to the years.

The additional ash dams will be visually absorbed into the surrounding context and would not be in contrast to the present activities and structures found within the immediate context of the site. Visual intrusion would be much lower as the proposed ash dam would relate to the existing ash dams with regards to colour, shape and scale. As stated by Jones and Wagener the maximum rate of rise for the ash dam would also be notably less than if it were a separate greenfields development. This will further reduce the overall visual impact.

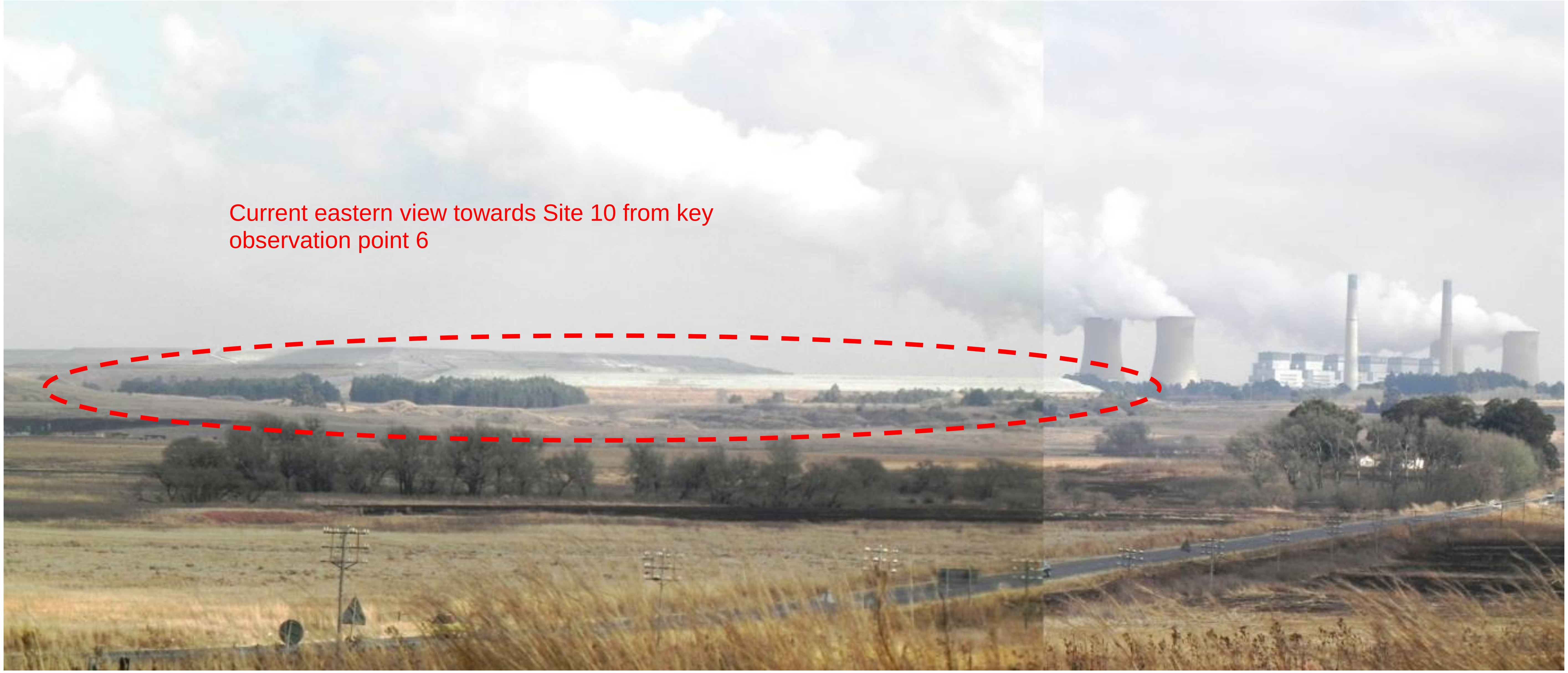
Viewer sensitivity can also be considered to be lower as regular travellers and people residing in Kriel, Thubelihle and the informal settlement are familiar with the visual scene related to existing mining and power station activities. However, this is not an excuse to ignore the recommended mitigation measures. The Kriel ash dams and the nearby Matla ash dam poses considerable potential for a cumulative impact that would further negatively impact the surroundings. While it is usually preferable to consolidate any new impacts with existing visual impacts of the same type rather than impose it on a different landscape, the cumulative effects of several negative impacts compounds any perceived negativity associated with them. Mitigation measures should thus be regarded as just as important as if the impact were to occur in a pristine landscape. The presence of existing tree lines already illustrates the effectiveness of strategic vegetation planting in screening the development from critical or sensitive angles.

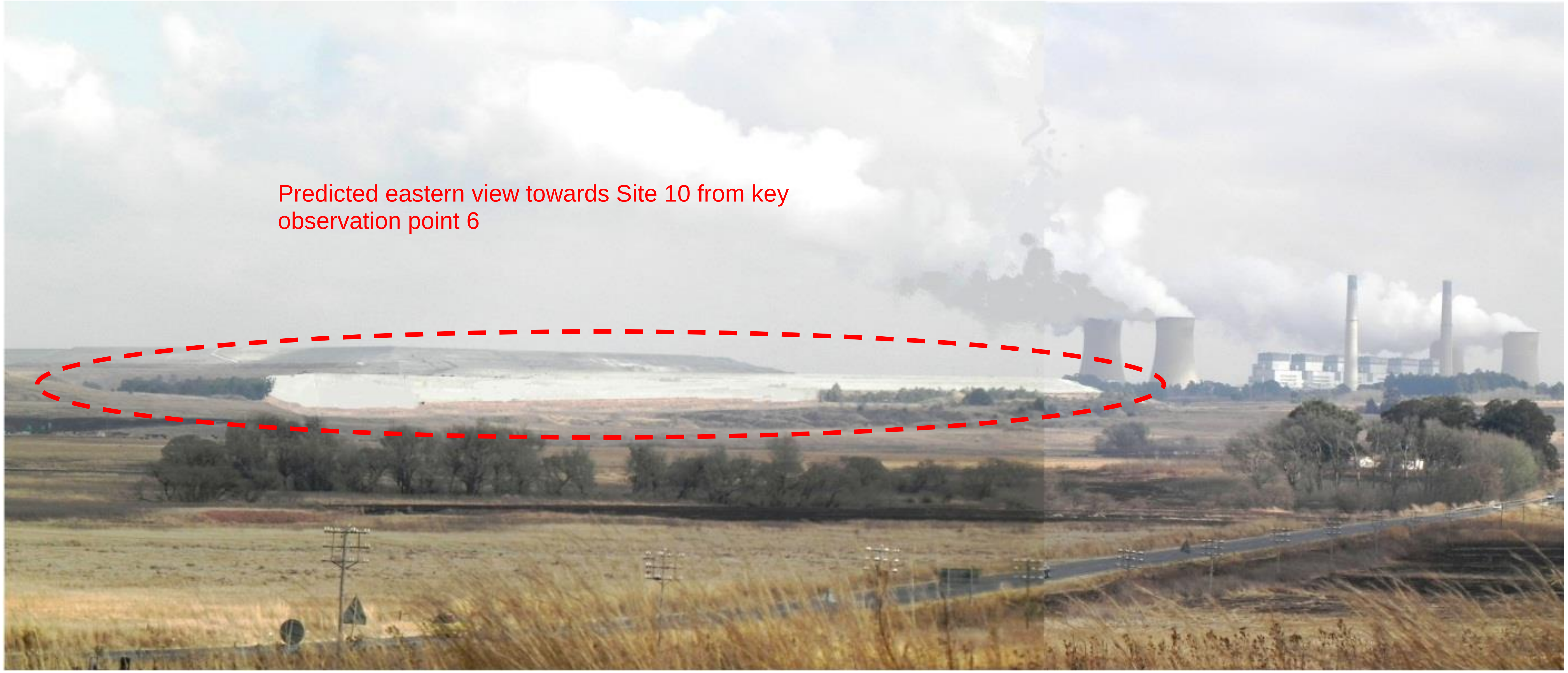
9 References

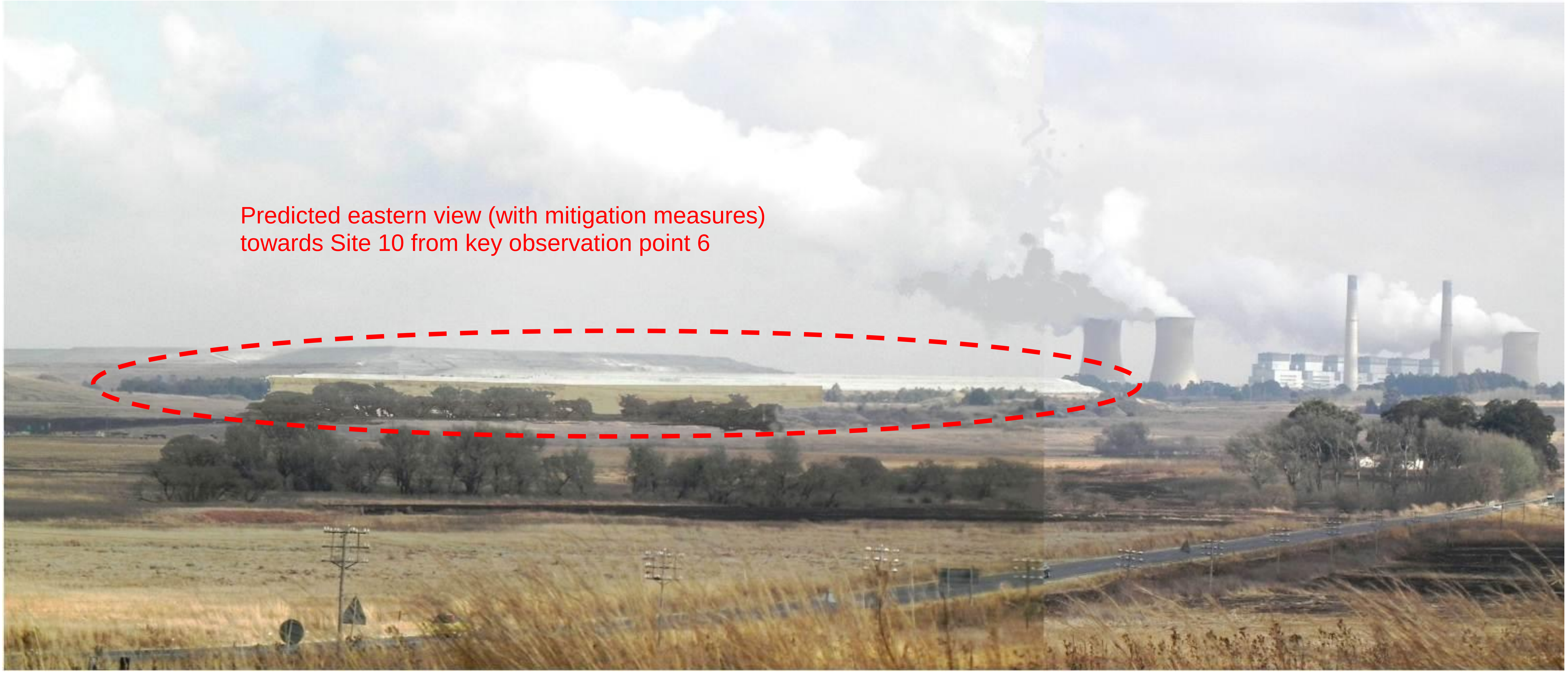
1) Jones and Wagener Consulting Civil Engineers.2016. Kriel Power Station Ash Dam 4 – Site 10 Concept Design Update. Report no.:JW044/16/E821- Rev 0.
2) Aurecon.2016. Integrated Environmental Impact Assessment: Proposed expansion of Ash Disposal Facility, Kriel Power Station, Mpumalanga. Final Scoping Report. Report No.11081/113084
3) Oberholzer, B. 2005.*Guideline for involving visual & aesthetic specialists in EIA processes:Edition 1.CSIR Report No ENV-S-C 2005 053 F.* Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.
4) Mucina,L.&Rutherford M.C,(eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. South African National Biodiversity Institute, Pretoria.
5) Stead,S. 2008. Visual Impact Assessment: Proposed Telecommunication Tower as part of the proposed emergency and disaster management center. VRM Africa, George.
6) MetroGIS (Pty) Ltd. March 2007. Visual Impact Assessment, Project Lima – Steelpoort.
7) DEAT 2004 Environmental Management Plans Integrated Environmental Management Information Series 12. Department of Environmental Affairs and Tourism DEAT, Pretoria.
8) Lockyer Steering Committee. July 2002. *Scenic Amenity of the Lockyer, A community resource for the enjoyment of current and future generations.* www.derm.gld.gov.au/register/p0064aa

9) Hull, R. B. & Bishop, I.D., 1998, Scenic impacts of Electricity Transmission Towers: The influence of landscape type and Observer Distance. *Journal of Environmental Management*. 1998 (27).

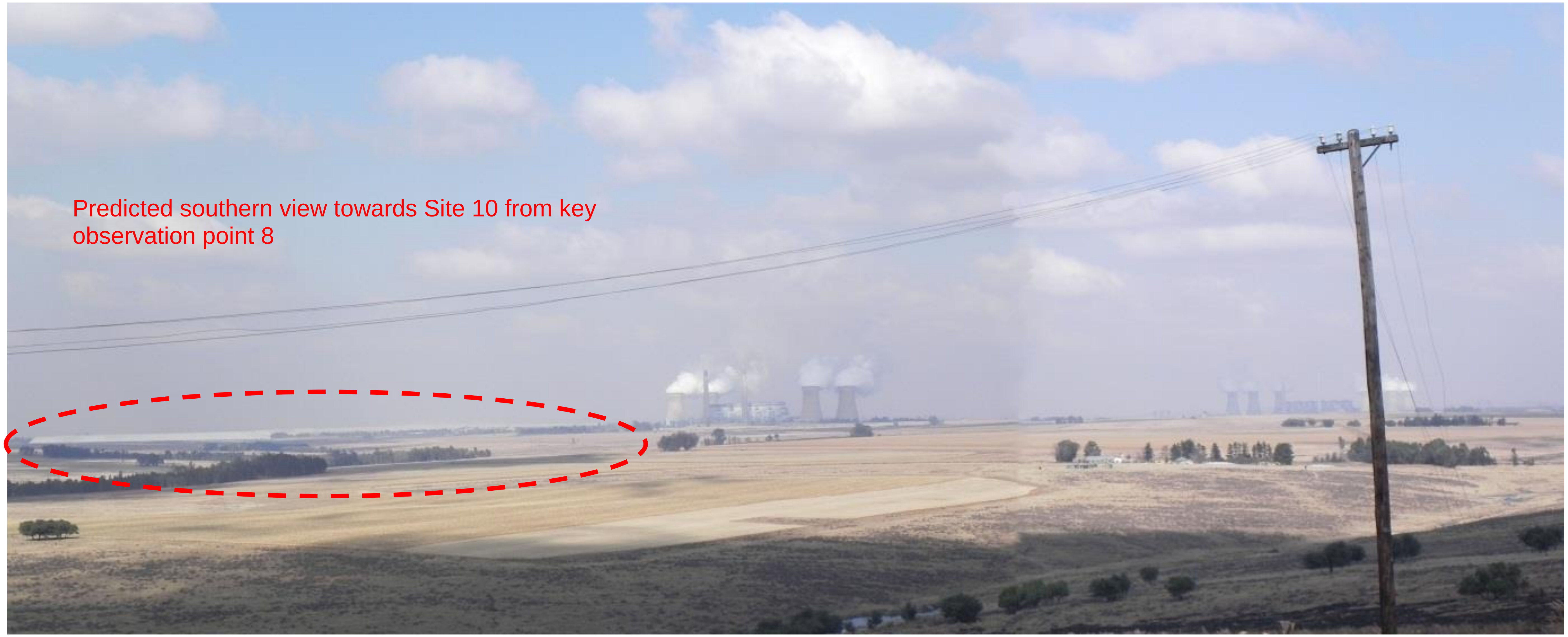
Appendix A:
Photo montages


Current eastern view towards Site 10 from key observation point 6


Predicted eastern view towards Site 10 from key observation point 6


Predicted eastern view (with mitigation measures)
towards Site 10 from key observation point 6


Current southern view towards Site 10 from key observation point 8


Predicted southern view towards Site 10 from key observation point 8


Predicted southern view (with mitigation measures)
towards Site 10 from key observation point 8

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Aurecon offices are located in:
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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

INTEGRATED ENVIRONMENTAL IMPACT ASSESSMENT:
PROPOSED EXPANSION OF ASH DISPOSAL FACILITY, KRIEL POWER STATION, MPUMALANGA

Specialist:	Visual Impact Assessment		
Contact person:	Stephen Townshend		
Postal address:	Aurecon Centre, Lynnwood Bridge Office Park, 4 Daventry St. Lynnwood Manor		
Postal code:	0081	Cell:	072 185 6986
Telephone:	(012) 427 3689	Fax:	
E-mail:	stephen.townshend@aurecongroup.com		
Professional affiliation(s) (if any)	GISSA		

Project Consultant:	Aurecon South Africa (Pty) ltd		
Contact person:	Franci Gresse		
Postal address:	PO Box 494, Cape Town		
Postal code:	7441	Cell:	082 891 2384
Telephone:	021 526 6022	Fax:	086 723 1750
E-mail:	Franci.gresse@aurecongroup.com		

4.2 The specialist appointed in terms of the Regulations_

I, Stephen Townshend, declare that –

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

[signature]

Signature of the specialist:

Aurecon

Name of company (if applicable):

2016 / 11 / 23

Date:

MC CILLIERS
Landscape Architect BL (UP), SACLAP

27 June 2017
Ref: Kriel ADF VIA Peer Review

Aurecon South Africa (Pty) Ltd
Aurecon Centre, Lynnwood Bridge Office Park
4 Daventry Street
Lynnwood Manor
Tshwane
0081

Attention: Stephen Townshend / Dirk Pretorius
Email: Stephen.townshend@aurecongroup.com

RE: PEER REVIEW OF VISUAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED EXPANSION OF THE KRIEL ASH DISPOSAL FACILITY

With reference to the peer review of the Visual Impact Assessment for the Proposed Expansion of the Kriel Ash Disposal Facility compiled by your firm.

The peer review was undertaken as set out in the Terms of Reference (ToR) contained in the peer review appointment documentation. The ToR contained the following:

1. *A review of the Specialist report compiled by Aurecon for the prosed Expansion of the Kriel Ash Disposal Facility, in terms of the National Environmental Management Act (No 107 of 1998) and the Environmental Impact Assessment Regulations (2014).*
2. *The review must ascertain whether or not the report has met the minimum legal requirements in terms of the NEMA EIA Regulations (2014, Appendix Six, Specialist Reports), and determine whether or not the report contains sufficient information to inform decision making by the competent environmental authority.*
3. *Identifying whether there are any obvious information gaps, omissions, or inaccuracies that may need to be addressed.*
4. *Include specific Terms of reference from DEA:*
   - i. *A CV clearly showing expertise of the peer reviewer;*
   - ii. *Acceptability of the terms of reference;*
   - iii. *Is the methodology clearly explained and acceptable;*
   - iv. *Evaluate the validity of the findings (review data evidence);*
   - v. *Discuss the suitability of the mitigation measures and recommendations;*
   - vi. *Identify any shortcomings and mitigation measures to address the short comings;*
   - vii. *Evaluate the appropriateness of the reference literature;*
   - viii. *Indicate whether a site-inspection was carried out as part of the peer review (site visit not mandatory);*
   - ix. *Indicate whether the article is well-written and easy to understand.*

* Contact No. 082 824 5830 * Email: mithaworx@gmail.com * P.O. Box 14766 Hatfield, 0028 *

Herewith the comments related to the ToR as follows:

1. The report had been reviewed with reference to the National Environmental Management Act (No 107 of 1998) and the Environmental Impact Assessment Regulations (2014).
2. In the opinion of the reviewer, the report has met the minimum legal requirements in terms of the NEMA EIA Regulations (2014, Appendix Six, Specialist Reports). It has also been determined that the report contained sufficient information to inform decision making by the relevant environmental authority.
3. No obvious information gaps, omissions, or inaccuracies were found or had to be addressed.
4. With reference to the specific Terms of reference from DEA, herewith the following comments:
   i. An abbreviated CV can be found in Appendix A.
   ii. The ToR were acceptable and agreed upon.
   iii. The VIA methodology was clearly explained in the report and was acceptable.
   iv. The findings of the report were evaluated and found to be valid.
   v. Mitigation measures and recommendations were found to be executable and suitable.
   vi. No shortcomings were identified.
   vii. Reference literature was found to be relevant and appropriate.
   viii. A site inspection was not carried out as part of the peer review. The reviewer, however, is familiar with the area and the project and was previously involved with a similar project within the same study area.
   ix. The report was well written and easy to understand.

Yours Sincerely

Mitha Cilliers
Pr LArch (UP)

* Contact No. 082 824 5830 * Email: mithaworx@gmail.com * P.O. Box 14766, Hatfield, 0028 *

APPENDIX A

Mitha Cilliers has obtained a Bachelors of Landscape Architecture from the University of Pretoria in 2001. She first worked as Candidate and then Professional Landscape Architect since 2002. She has freelanced as Landscape Architect and Visual Impact Assessment Specialist since 2008. Her clients include firms such as:

- Newtown Landscape Architects
- MetroGIS
- Visual Resource Management Africa
- Africa Geo Environmental Services Polokwane
- LEAP Landscape Architect & Environmental Planner

She has worked on projects ranging from solar panel installations, both transmission and distribution power lines, both opencast and underground mines as well as residential developments and a broadcasting station for DSTV.

Mitha's professional registrations, memberships and involvement include:

- Institute for Landscape Architecture in South Africa – Chairperson, Gauteng Branch (2017)
- South African Council for the Landscape Architectural Profession - Committee Member, Academic Forum (2015 - 2016)
- Institute for Landscape Architecture in South Africa – Member, National Executive Committee (2014 - 2017)
- Institute for Landscape Architecture in South Africa – Committee Member, Gauteng Branch (2014 - 2017)
- Green Building Council of South Africa - Member (2010 - 2011)
- South African Council for the Landscape Architectural Profession - Committee Member, Registration Committee (2009 - 2016)
- South African Council for the Landscape Architectural Profession - Registered Landscape Architect (2007)

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MITHA CILLIERS

Occupation	**Landscape Architect / Visual Impact Specialist**
Total Years Work Experience	15 (South Africa and abroad) / 8
Age	39

Contact Details

Cell phone	+27 82 824 5830
Email	mithaworx@gmail.com
Residential Location	Mountain View, Pretoria, Gauteng, South Africa

Personal Details

Gender	Female
Nationality	South African
Language	Afrikaans, English

Education

2001 University of Pretoria **Bachelors of Landscape Architecture**
1996 Ben Vorster Hoër Skool **Grade 12 (Matric)**

Landscape Architectural & Visual Impact Specialist Profile - Career History

1. JANUARY 2014 - PRESENT

Self-employed

FREELANCE LANDSCAPE ARCHITECT & VISUAL IMPACT ASSESSMENT CONSULTANT

Clients
- *LEAP Landscape Architect & Environmental Planner.*
- *Africa Geo Environmental Services Polokwane.*
- *Moderator for TUT*: Landscape Technology (3rd year), Plant Material Studies (3rd year) (since 2014).
- *Examiner SACLAP Professional Exams* (2013).
- *Invigilator SACLAP Professional Exams* (since 2009).

2. APRIL 2013 – JANUARY 2014

Newtown Landscape Architects

LANDSCAPE ARCHITECT & VISUAL IMPACT ASSESSMENTS

Responsibilities
- Conducting visual impact assessment.
- Assisting with tasks in the Environmental Impact Assessment division.
- Landscape development plans and landscape design projects.

3. 2008 – APRIL 2013

Self-employed

FREELANCE LANDSCAPE ARCHITECT & VISUAL IMPACT ASSESSMENT CONSULTANT

Clients
- *Visual Resource Management Africa:* Sub-consulting Visual Impact Assessments.
- *MetroGIS:* Sub-consulting Visual Impact Assessments.
- *Newtown Landscape Architects*: Sub-consulting Visual Impact Assessments.
- *KWP Architects & Landscape Architects*: Landscape Design & Documentation.
- *Servest Landscaping (former REAL Landscaping):* Landscape Design & Documentation.
- *Private Clients:* Residential & Office Landscape Design.

Responsibilities
- Conducting site investigations and compiling visual impact assessment reports to be internally reviewed by VRMA / MetroGIS / NLA and submitted to the Environmental Practitioner (VRMA / MetroGIS / NLA's clients).
- Documentation of designs by Principal Landscape Architect.
- Design and schedule of quantities of landscape projects.
- Landscape design, documentation and installation management.

4.	2005 – 2007
KWP Architects & Landscape Architects	

CANDIDATE & REGISTERED LANDSCAPE ARCHITECT

Responsibilities
- Reporting to the Landscape Director.
- Landscape design for various types of projects ranging from residential garden design to industrial landscaping, including the landscape upgrade of the SASOL plant in Secunda.
- General project administration and documentation including Bills of Quantities, tender evaluation and site inspections.
- Landscape maintenance auditing at the Nelspruit Riverside Government Offices.
- Preparation of Environmental Impact Assessment Reports for proposed housing developments.
- Environmental Control Officer on various housing developments.

5.	2003 - 2004
Sigma Gibb Angola, part of the GIBB Africa Group	

CANDIDATE LANDSCAPE ARCHITECT

Responsibilities
- Reporting to the Project Landscape Architect.
- Landscape Architect on a residential housing estate development in Luanda, Angola.
- Design and draughting for various other landscape projects in Luanda, Angola.

6.	2002 - 2003
Newtown Landscape Architects	

CANDIDATE LANDSCAPE ARCHITECT

Responsibilities
- Reporting to the Landscape Director.
- Design and draughting for various projects ranging from private residential gardens to public parks.
- Project administration including Bills of Quantities, tender evaluation and site inspections.

7.	2000
Lizelle Gregory Landscape Architect	

STUDENT LANDSCAPE ARCHITECT
- Office administration, rendering of plans, minutes of site visits, site inspections, presentation, drawings, preparation of Environmental Impact Assessment Reports.

8.	1997/1998/2000
Newtown Landscape Architects - Pietersburg (Polokwane)	

STUDENT LANDSCAPE ARCHITECT
- Office administration, rendering of plans, minutes of site visits, site inspections, presentation drawings.

Professional Courses / Training

2016	**Wetlands Workshop**	University of the Orange Free State
2012	**ISO14001:2004 Module 1**	South African Bureau of Standards
2011	**Green Star Rating Course**	Green Building Council of South Africa

Professional Certifications / Registrations / Memberships

- Institute for Landscape Architecture in South Africa – Chairperson, Gauteng Branch (2017)
- Institute for Landscape Architecture in South Africa – Committee Member, Gauteng Branch (2014 - 2017)
- Institute for Landscape Architecture in South Africa – National Executive Committee Member (2014 - 2017)
- South African Council for the Landscape Architectural Profession - Committee Member, Academic Forum (2015 - 2016)
- Green Building Council of South Africa - Member (2010 - 2011)
- South African Council for the Landscape Architectural Profession - Committee Member, Registration Committee (2009 - 2016)
- South African Council for the Landscape Architectural Profession - Registered Landscape Architect (2007)