LEHATING SUBSTATION AND ASSOCIATED INFRASTRUCTURE PROJECT

VISUAL IMPACT ASSESSMENT

April 2016

REVISION 02

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VISUAL IMPACT ASSESSMENT REPORT

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VERIFICATION PAGE

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QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2008 which has been independently certified by DEKRA Certification under certificate number 90906882

Verification	Capacity	Name	Signature	Date
By Author	GIS Analyst	Zinhle Ngubane		11/04/16
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Executive Summary

A new substation is proposed in the Santoy Area, Hotazel, Northern Cape. Terratest (Pty) Ltd (Terratest) was appointed by Jeffares and Green (Pty) Ltd (J&G) on behalf of Eskom Distributions Northern Cape Operating Unit, to conduct a Visual Impact Assessment (VIA) for the proposed new Lehating substation and associated infrastructure. Information supplied by Eskom Distribution Northern Cape Operating Unit indicates that a new 132 kV Distribution Substation, and associated loop-in and loop-out lines are proposed.

The proposed site is located within a proposed mining area that is vegetated, and not clearly visible from the adjacent road with farm communities located to the south west of the proposed site. Alternative Line Option 3A, has the least visual impact on the landscape and the visual receptors and therefore is the recommended alternative.

No future developments are proposed for the area. The zone of visual influence will be limited to a maximum distance of 3 km. Receptors include the farmsteads and any neighbouring mines within the zone of visual influence. The visual impact of the substation on KOPs on the periphery of the zone of visual influence (approximately 4 km) is likely to be very low.

The assessment has included a literature review, preliminary viewshed analysis, site investigation, panoramic photograph montages and more detailed visibility analyses using a Geographic Information System.

The visual intrusion of the proposed substation structure is rated as medium to low, which indicates that the proposed development is partially compatible with the surrounding environment. However it will be visible to adjacent and nearby receptors. The visual impacts noted are a moderate to low visual exposure, visual absorption and landscape compatibility. The nature of the visual impact is summarised as a local, site related extent with long term duration of moderate intensity. The visual impact is collectively probable, with low to moderate significance.

Night time lighting, which may include lighting from construction equipment (moving visual impact), is expected as there is limited vegetative screening at the site. However, this is expected to blend with the lighting in the mine and the surrounding communities.

Given the height of the substation infrastructure (approximately 10 m), many of the sensitive receptors will only see the construction at later stages as the construction of the substation progresses in height.

This report finds that the proposed development has a medium to low visual impact.

VISUAL IMPACT ASSESSMENT REPORT

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1 INTRODUCTION

Terratest (Pty) Ltd (Terratest) was appointed by Jeffares and Green (Pty) Ltd (J&G) on behalf of Eskom Distributions Northern Cape Operating Unit, to conduct a Visual Impact Assessment (VIA) for the proposed new Lehating substation and associated infrastructure in the Hotazel area, Northern Cape.

The proposed new substation and associated infrastructure require Environmental Authorisation as per the National Environmental Management Act (Act 107 of 1998). Several specialist studies have been commissioned in order to address any possible social or environmental implications this new infrastructure may have. The results of the specialist studies are to be included in a comprehensive, site specific Environmental Management Programme (EMPr). Terratest has conducted this assessment in line with the "Guideline for Involving Visual and Aesthetic Specialists in EIA Processes" compiled by the Western Cape Department of Environmental Affairs and Development Planning (DEADP).

1.1 Terms of Reference

The aim of this study is to determine and assess the visual impact of the proposed new substation and associated infrastructure on the receiving environment. In order to meet the aim of this study, several objectives, aligned to the DEADP Guideline, have been identified and include:

- *"Identification of landscape types, landscape character and sense of place, generally based on geology, landforms, vegetation cover and land use patterns;*
- *Identification of viewsheds, view catchment areas and zones of visual influence, generally based on topography;*
- *Identification of important view points and view corridors within the affected environment, including sensitive receptors;*
- *Indication of distance radii from the proposed project to the various view points and receptors;*
- *Determination of the Visual Absorption Capacity (VAC) of the landscape, usually based on topography, vegetation cover or urban fabric in the area;*
- *Determination of the relative visibility, or visual intrusion , of the proposed project; and*
- *Determination the relative compatibility or conflict of the project with the surroundings"*

The assessment carried out in this study will provide the Environmental Assessment Practitioner (EAP), Jeffares & Green (Pty) Ltd, with information pertaining to the visual impact of the proposed new substation and associated powerlines. Knowing what these visual impacts will be and to what extent they will impact on the receptors will assist the EAP in compiling the mitigation measures to include in the site specific EMPr.

1.2 Approach Used for Visual Assessment

In accordance with the DEADP Guideline, Terratest has adopted the approach for a Level 3 Assessment, where moderate visual impact is expected. The guidelines summarise the approach to be followed to include the following aspects:

- Identification of issues raised, and 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; and
- Description of alternatives, mitigation measures and monitoring programs.

The findings and recommendations will need to be considered in the larger context of the project and incorporated into the site specific EMPr.

2 STUDY APPROACH AND METHODOLOGY

The VIA was conducted in three phases, namely:

- Data Collection and Literature Review;
- Preliminary Desktop Study; and
- Detailed Impact Assessment.

Details of each phase are described in the sub-sections that follow.

2.1 Data Collection and Literature Review

The location of the preferred site for the proposed new substation and the layout alternatives for the loop-in/loop-out lines were provided by the EAP. Terratest incorporated a variety of National Datasets in their assessment, these are *inter alia*:

- Topographical map sheets – 1: 50 000 (NGI);
- Georectified Orthophotos – 1: 10 000 (NGI);
- Contour data – 5 m (NGI);
- Geological Mapsheet - 1: 250 000 (Council for Geoscience);
- Land Cover Data (National Land Cover, 2014); and
- Spatial Development Framework (SDF) (2012).

This report has sourced information from various studies to ensure that as many aspects as possible have been incorporated and examined. All literature sources reviewed are included in the reference list, in **Section 8**.

Terratest has drawn on professional experience from EIA projects of a similar nature, and specifically visual studies in order to determine baseline conditions and the possible visual impacts of the project on the receiving environment.

2.2 Preliminary Desktop Study

A preliminary desktop study was conducted in order to determine the limits of the study area and to provide sufficient information to enable a well-prepared and thorough site investigation. The preliminary desktop study included a viewshed analysis and the identification of possible sensitive receptors for further investigation on site. The desktop study was conducted using a Geographic Information System (GIS). In particular, a suite of visibility tools in the 3D Analyst extension to ESRI ArcGIS software was utilised.

2.3 Site Investigation

A detailed site investigation was conducted on 23 June 2015.

Full panoramic photographs were taken at the potential substation site as well as at several Key Observation Points (KOPs) identified in the preliminary viewshed analysis. The site investigation involved an assessment at each KOP, which included:

- Visibility of the project;
- Visual Exposure;
- Visual Sensitivity of the Area;
- Visual Sensitivity of Receptors;
- Visual Absorption Capacity; and
- Visual Intrusion.

The findings on site allow for an accurate and thorough information base to be used in the assessment of the receiving environment.

2.4 Detailed Impact Assessment

The detailed impact assessment is a synthesis of GIS-based visibility analyses, site investigations, professional knowledge and literature research. The impact assessment considers the receiving environment by the observable elements such as; topography, vegetation, land use, and the built environment. In addition to this, the assessment contemplates the visual character, where human perception and social significance are key contributing factors. The detailed impact assessment can be found in **Section 6** of this report.

2.5 Assumptions and Limitations

Terratest was appointed to conduct the visual assessment during the planning phase of the project, therefore limited specific information pertaining to project infrastructure was made available. The analysis and findings are based on typical substation and powerline dimensions, therefore the 3D GIS simulations and analyses are based on these generic dimensions. Should the actual dimensions differ substantially, the visibility analyses may require modifications.

3 LEGISLATIVE FRAMEWORK

The environmental legislation is key in obtaining relevant authorisations and managing the impact on the environmental aspects of the project. The overarching environmental legislation in South Africa comes in the form of the National Environmental Management Act (No. 107 of 1998) (NEMA) and several other acts pertaining to the environment.

The NEMA is the overarching environmental legislation of the country. It supports the Constitution by enabling the right to an environment that is not harmful to the health and wellbeing of South African citizens; the equitable distribution of natural resources, sustainable development, environmental protection and the formulation of environmental management frameworks (Government Gazette, 1998).

The Act aims to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment; institutions that will promote co-operative governance; and procedures for co-ordinating environmental functions exercised by organs of state. Section 24 Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.

The NEMA contains a set of principles that govern environmental management, and against which all environmental management plans and actions are measured. Sustainable development requires the consideration of all relevant factors including, *inter alia*, the following:

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimized and remedied.
- The participation of interested and affected parties in environmental governance must be promoted, and people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation.
- The participation by vulnerable and disadvantaged persons must be ensured.
- Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.
- Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law.

The Act has a number of activities that indicate whether a development requires a Basic Environmental Assessment or a Full EIA consisting of a scoping phase and an impact assessment phase.

Within the EIA process, visual assessments are required as specialist input in the event that the perceived visual impact is substantive and may require mitigation. If the assessment is conducted early in the EIA process, it may not act as an obstacle to the process, but rather assist the EAP by providing feasible mitigation measures and recommendations. Such recommendations may even enhance the project.

4 PROJECT DESCRIPTION

4.1 Project Description and Alternatives

Lehating Mine applied for a 132 kV to 11 kV 9.5 MVA supply at Lehating. A Standard 132 kv Line and Premium Transformer Capacity, 1x132 kV line and 2x132/11 kV 10 MVA transformers were requested. A new substation must be constructed at Lehating with a 2x10 MVA 132 kV to 11 kV transformer. The substation will be constructed as part of the infrastructure within a mining operation, mining manganese (**Figure 4-1**).

Information supplied by Eskom indicates that a new 132 kV Distribution Substation, and associated loop-in and loop-out lines are proposed. This substation will be known as the Lehating Substation, and is situated north east of the Santoy, in the Hotazel area.

According to the NEMA, all projects requiring Environmental Authorisation must consider alternatives.

According the NEMA EIA Regulations (2010), alternatives are described as follows: *" "alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to—*

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity."

It is therefore understood that the applicant has investigated a layout alternative, in terms of the powerline route. For the purposes of this investigation, the visual impacts associated with this option have been stated.

4.2 Specific Infrastructure and Components

The project is currently at the conceptual phase and therefore Terratest was provided with a typical Layout Plan of a substation (**Figure 4-2**) as well as details on the height and servitude requirements for 132 kV powerlines.

A 52 m wide servitude will be required for the proposed 132 kV powerline. Each tower will be located 50 m apart. It is assumed that the steel monopole tower type (e.g. ESKOM, D-DT 7649) would be used in combination with other towers. For the purposes of this study, it is assumed that all towers will be between 18 m and 25 m in height. The substation is assumed to be a maximum of 10 m in height.

Plate 1 below indicates a typical substation structure, which is expected at the new Lehating Substation and **Plate 2** shows a typical 132 kV powerline which is expected for this project.

Plate 1: Example of a typical substation structure

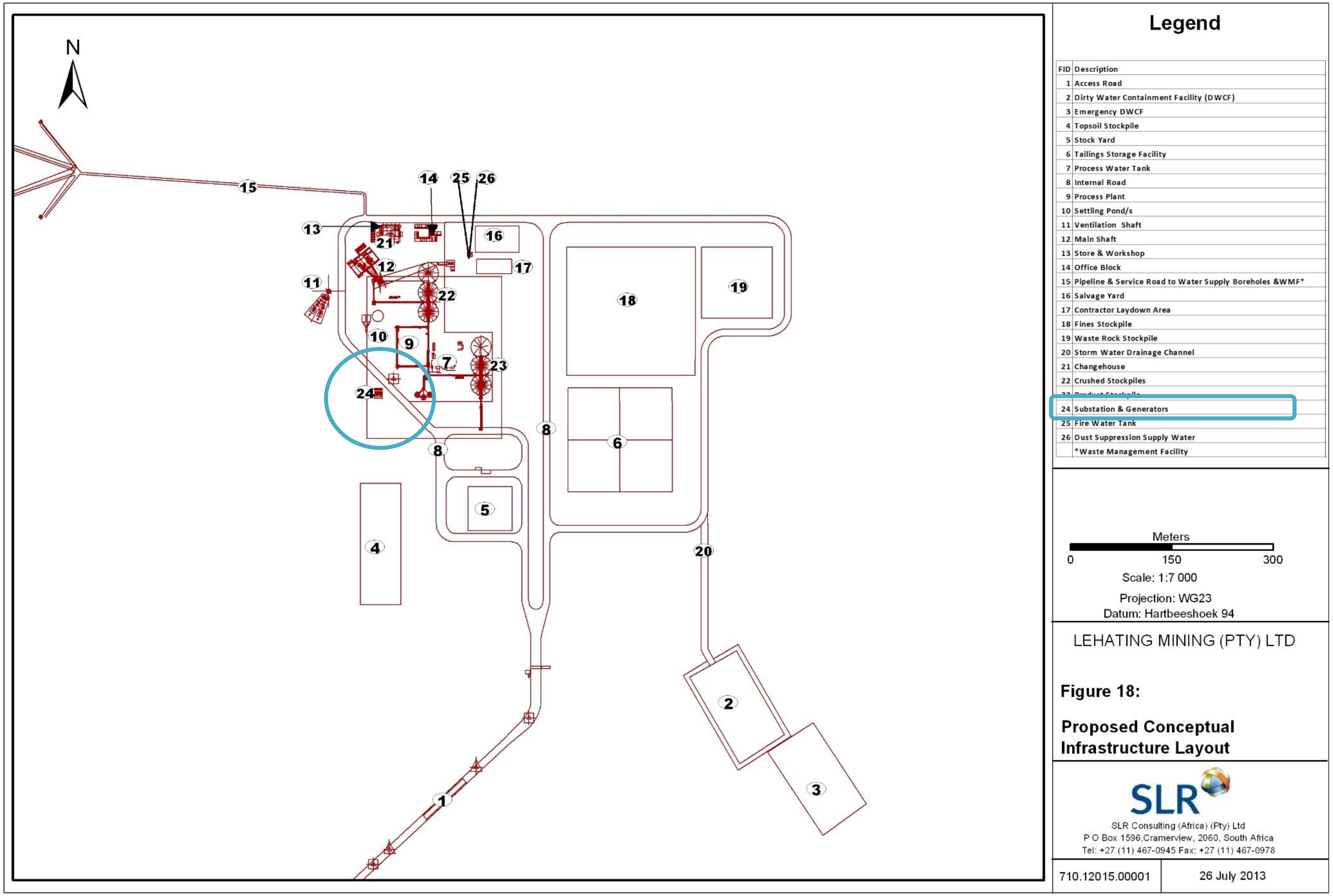

Figure 4-1: Proposed Conceptual Layout at the Lehating Mine Site. Substation Position Indicated by the Blue Circle (Extracted from Environmental Impact Assessment and Environmental Management Programme Report for the Proposed Lehating Mine).

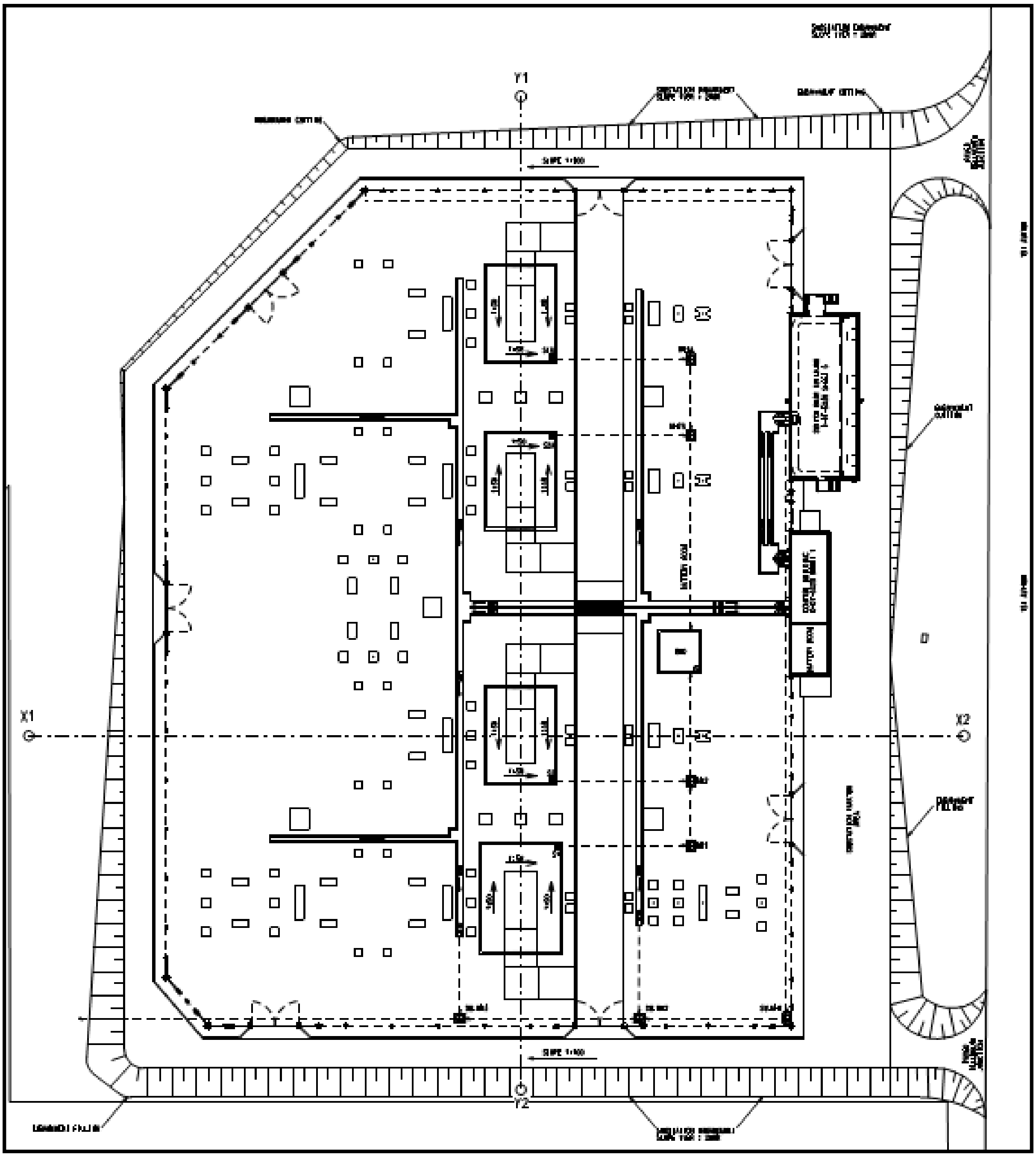

Figure 4-2: Typical Layout Plan of a Substation.

Plate 2: Photograph of a Typical 132 kV Powerline

5 ASSESSMENT OF RECEIVING ENVIRONMENT

The proposed substation site is located north east of Santoy, in the Hotazel area. Access to site can be gained by an access road through the Lehating farm. **Figure 5-1** below shows the locality of the study area and **Figure 5-2** indicates the site plan for the project showing the three line alternatives and the location of the substation.

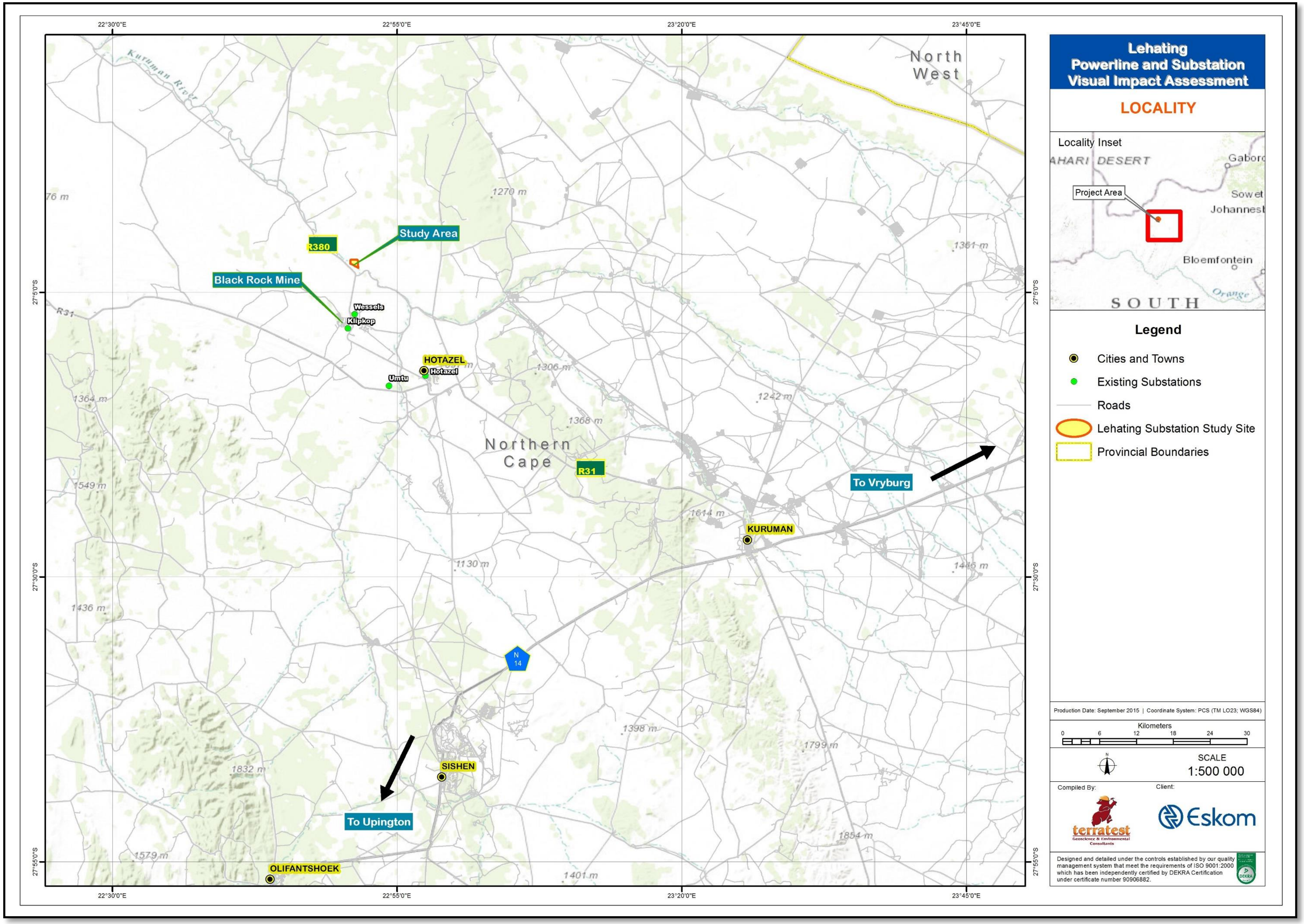

Figure 5-1: Locality Map

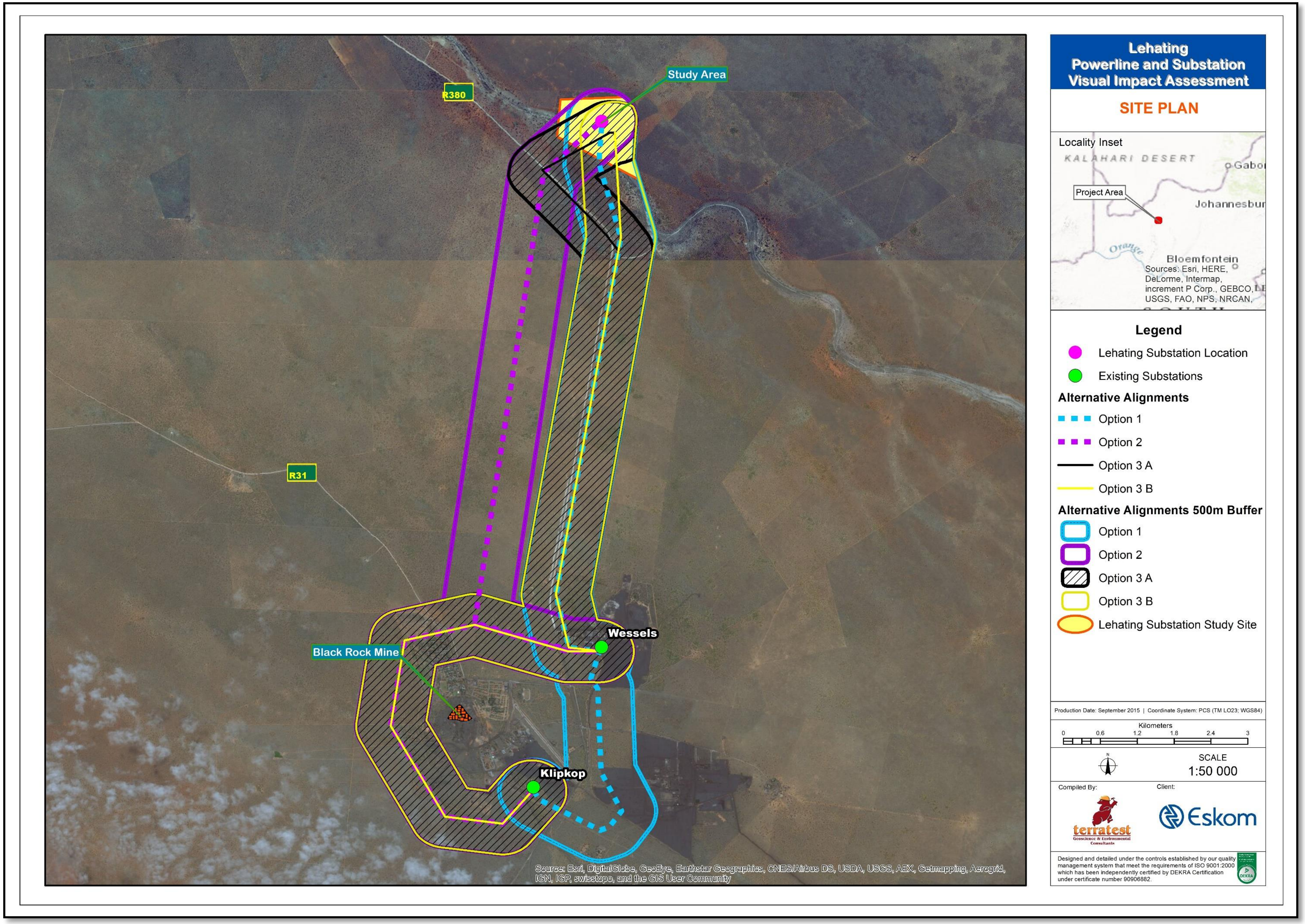

Figure 5-2: Site Plan

5.1 Landscape Character Assessment

A Landscape Character Assessment (LCA) is an evaluation of visible features that define the character of a landscape in an objective manner. This assessment considers the physical aspects of the landscape. It deals with the "*components or features within a landscape that individually and collectively define the landscape characteristics."(Swanwick 2002).*

5.1.1 Topography

The area is characterised by a flat, undulating landscape. The elevation from the project area in a northerly direction increases by some 25 m over a distance of 10 km. To the north west, the elevation decreases by approximately 20 m over approximately 10 km and to the west, elevation increases by some 40 m over 10 km. The topography along the southern and eastern borders to the study area increases from the study site by approximately 50 m over a 10 km distance. The Kuruman River flows in a north westerly direction, within the western part of the study site boundary, which contributes to the overall topography.

Figure 5-3 below indicates the four lines (10 km) used to generate profile graphs, in a northerly, easterly, southerly and westerly direction. The profile graphs provide an overall understanding of the site topography and this information is used in the detailed visibility analysis later in this report.

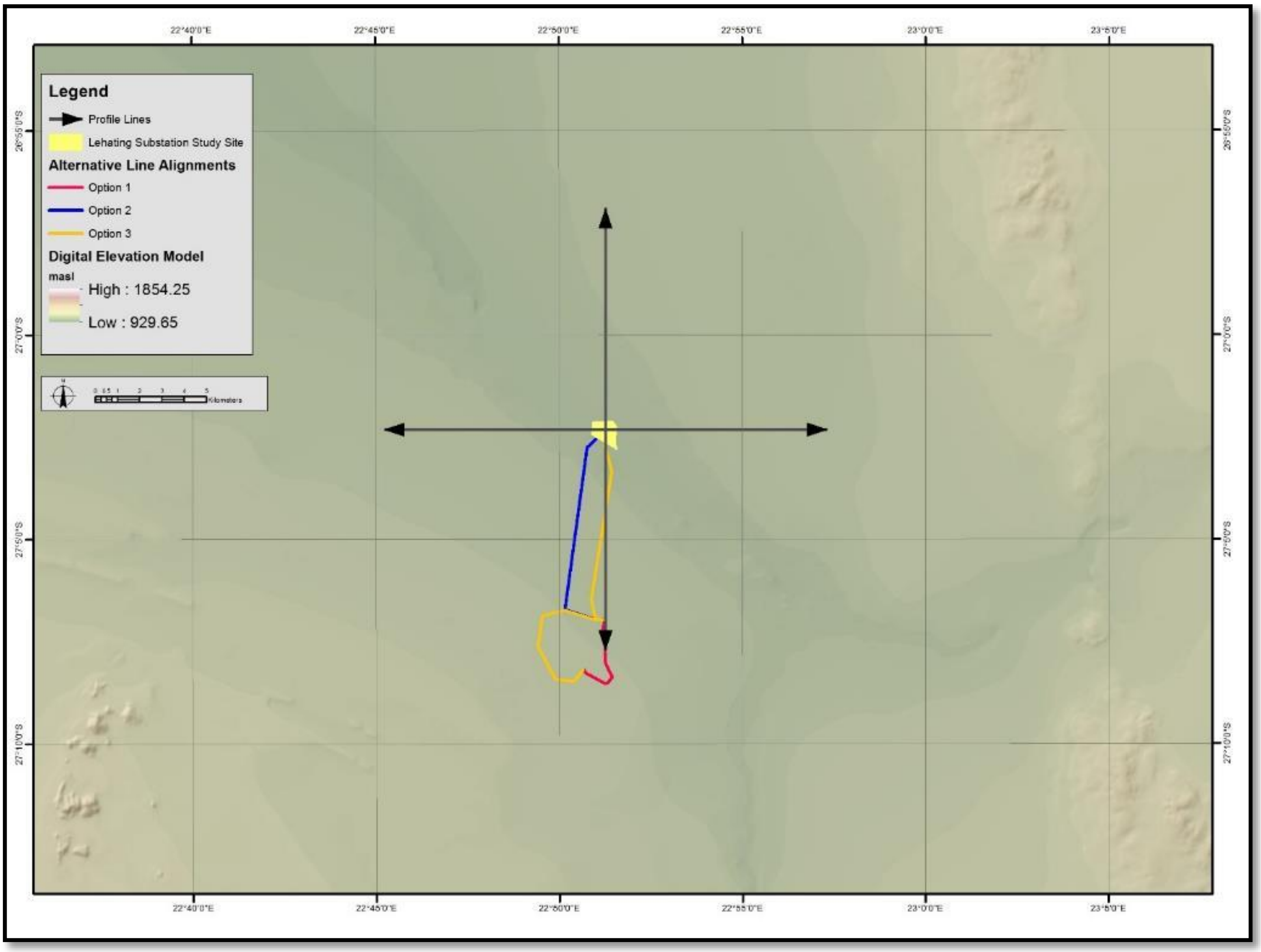

Figure 5-3: Graphic Indicating Profile Lines for Site Topography

Figure 5-4 to Figure 5-7 indicate the profile of the overall topography. The value of considering the overall topography is that this information informs the detailed visibility analysis. The terrain increases slightly in elevation to all four directions from the substation, therefore observation points in these areas will be considered**. Figure 5-8** shows the site topography.

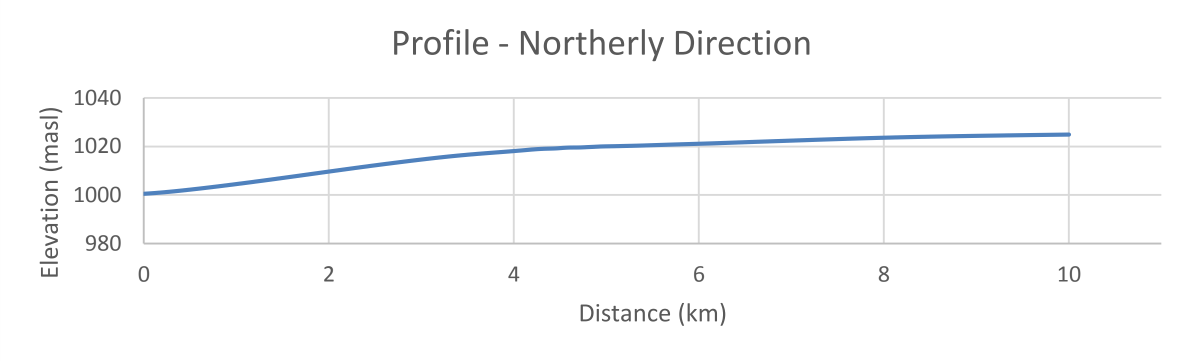

Figure 5-4: Profile in a Northerly Direction

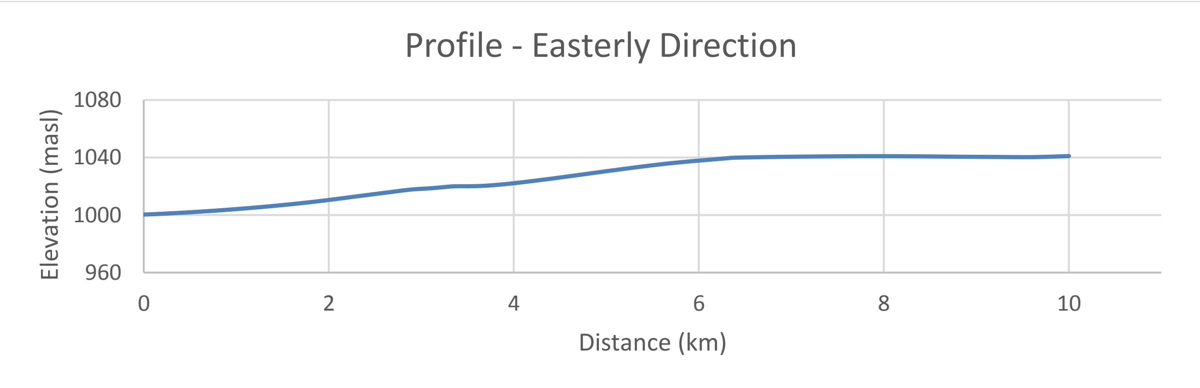

Figure 5-5: Profile in an Easterly Direction

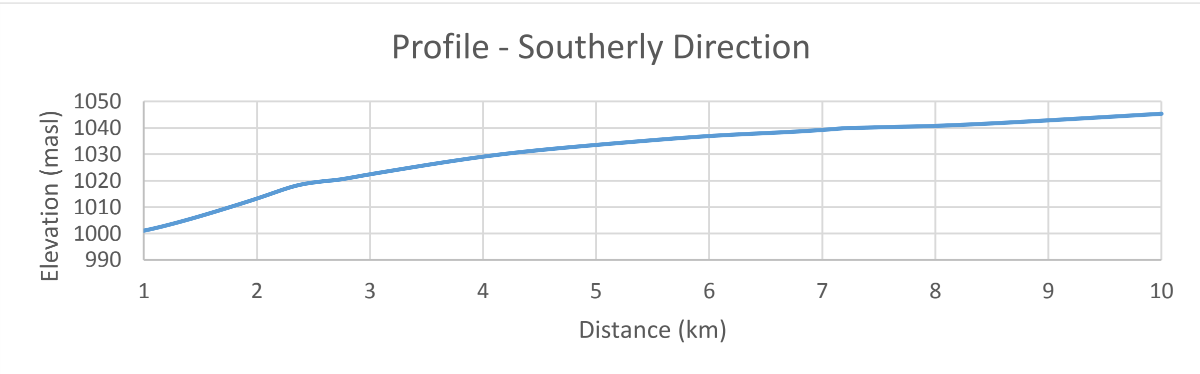

Figure 5-6: Profile in a Southerly Direction

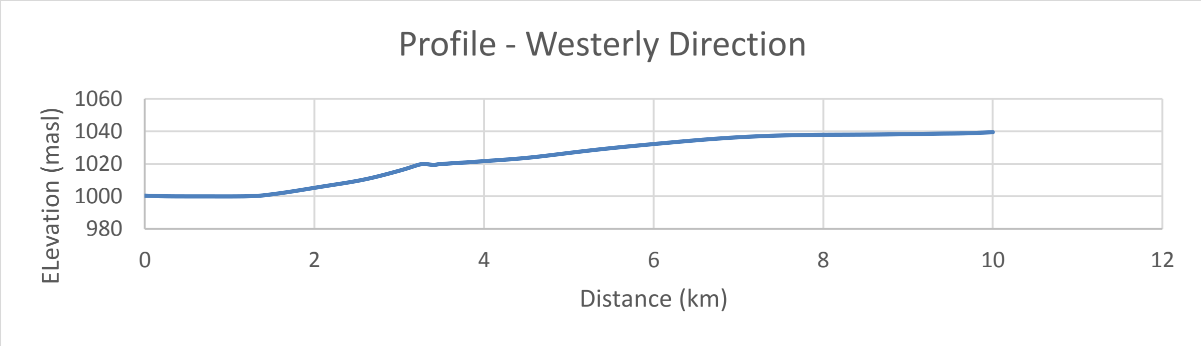

Figure 5-7: Profile in a Westerly Direction

Surface geology at the proposed site comprises predominantly of Cenozoic deposits which are part of the Kalahari Formation. The Kalahari Formation is approximately 80 m thick and overlies the Dwyka Formation. The Dwyka Formation is approximately 200 m thick and overlies the Hotazel Formation. The Hotazel Formation contains important minerals and the mining operation will target this formation for manganese. The Hotazel Formation is approximately 20 m thick in the area of investigation and overlies the Ongeluk Formation. There are also two distinct topographic highs formed by the rocks of the Olifantshoek Supergroup outcrop approximately 30 km southwest of the mine and the rocks of the Asbestos Hill Subgroup outcropping approximately 20 km towards to the east the site.

The site geology is described as shale, shaly sandstone, grit, sandstone, conglomerate, coal in places near base and top, from the Ecca formation. The geology to the immediate right of the site is described as Grey to pink coarse-grained granite; red, medium grained near the top, and this lithology is of the Wilgerivier formation. **Figure 5-9** indicates the overall geology for the site and surrounding areas.

Plate 3 illustrates the topography of the study area in a 3D perspective using a 2x vertical exaggeration in order to clearly identify the topographical features discussed above.

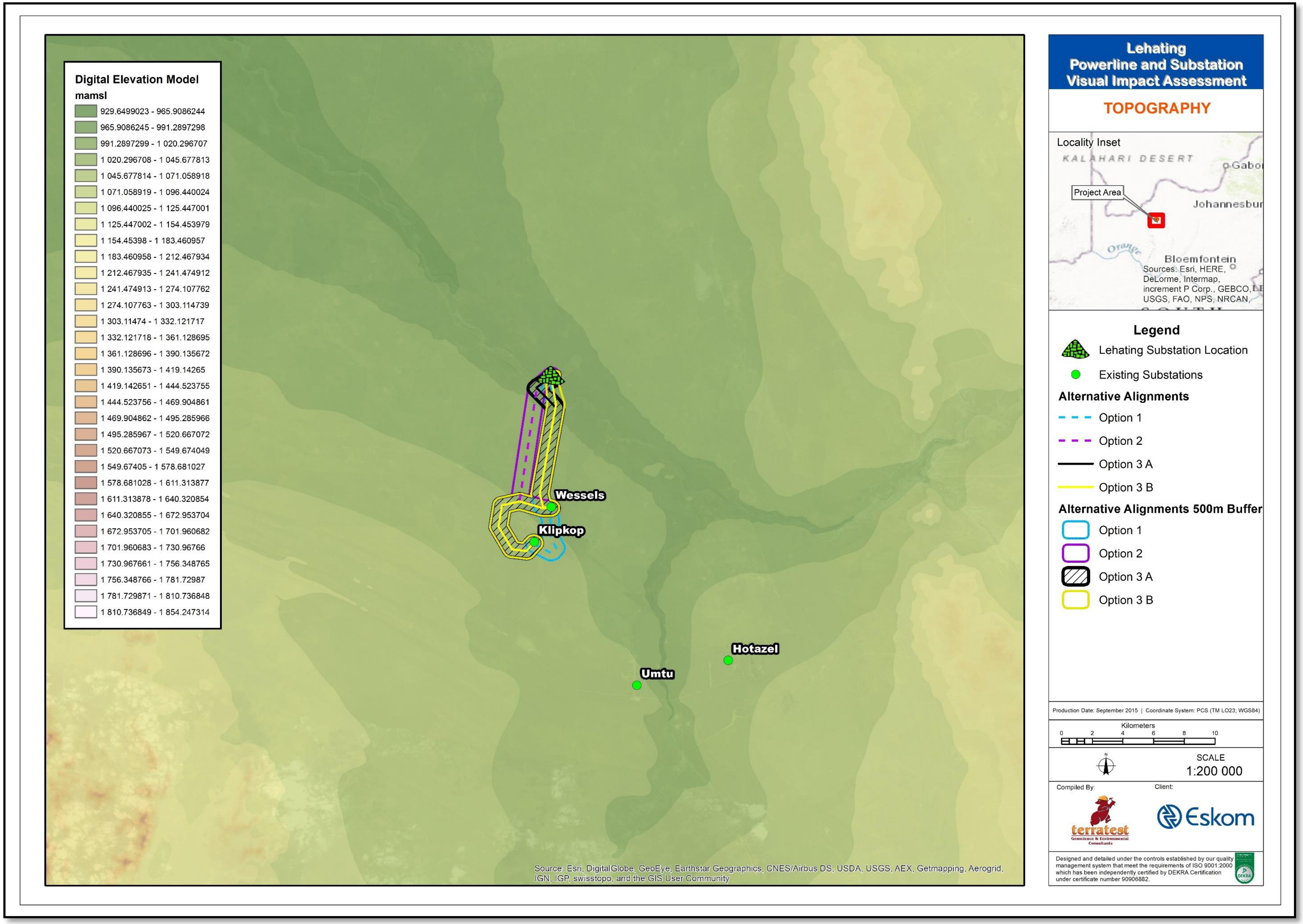

Figure 5-8: Site Topography

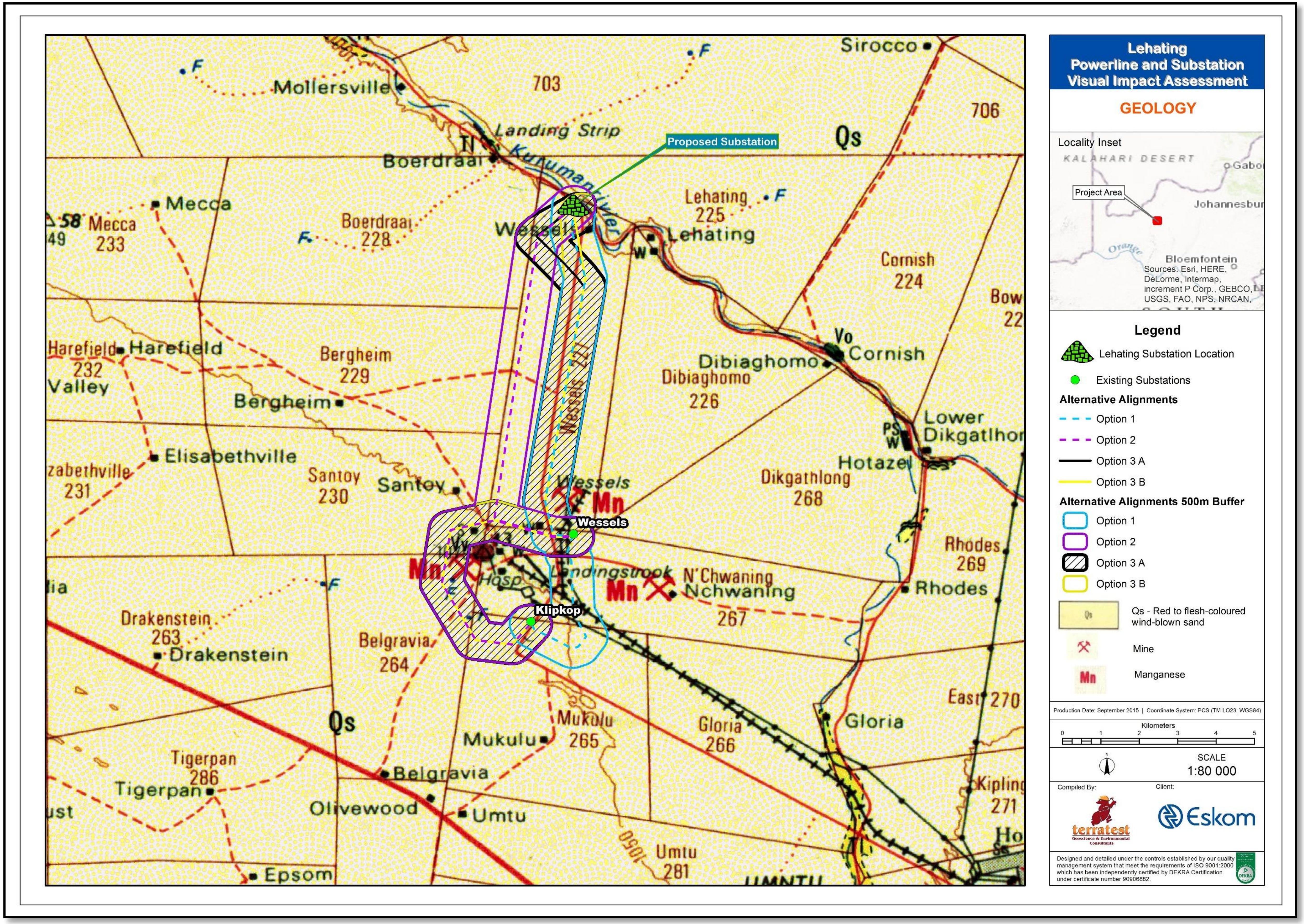

Figure 5-9: Geology

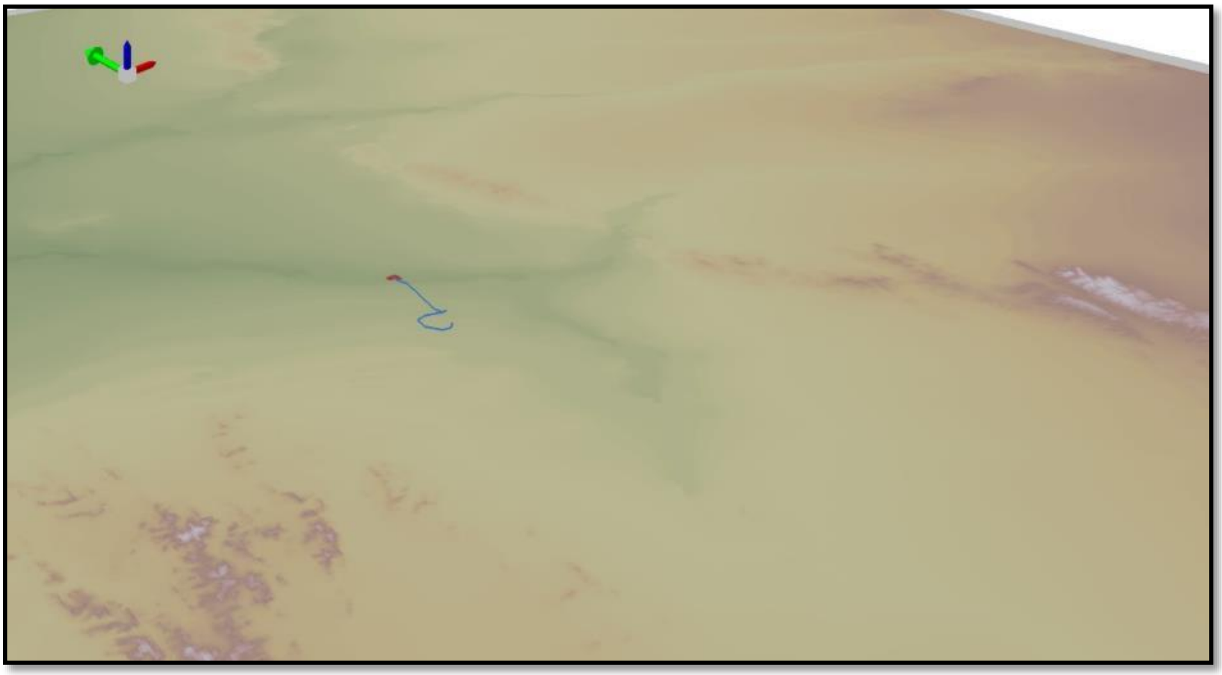

Plate 3: 3D Scene View of the Proposed Substation Site and the Preferred Powerline Option.

5.1.2 Land Use and Landcover

The site is located within a low shrubland dominated vegetation according to the National Landcover/Landuse 2014 (**Figure 5-10**). This vegetation is characterised by natural / semi-natural low shrub vegetation, typically with ≤ 2 m canopy height. It includes a range of canopy densities encompassing sparse to dense canopy covers. Very sparse covers may be associated with the bare ground class. This type of vegetation is typically associated with low, woody shrub, karoo-type vegetation communities, although it can also represent locally degraded vegetation areas where there is a significantly reduced vegetation cover in comparison to surrounding, less impacted vegetation cover.

Land use surrounding the study area is a mixture of agriculture, community, infrastructure/servitudes, recreational activities and mining activities. The agricultural activities currently undertaken include grazing for livestock. Farmers in the area rely on groundwater and borehole access to provide water for their livestock because the area receives low annual rainfall. The Black Rock (10 km south) and Hotazel communities (19 km south east) are both located to the south of the study area. The Black Rock and Hotazel communities have residential components as well as varying types of amenities and facilities such as schools and shops. The potential receptor communities are farm homesteads approximately 2.5 km from the proposed infrastructure site;

The study area incorporates various roads and powerlines. The un-surfaced R380 road runs along the southern side of the Kuruman River to the south of the project site, linking Hotazel in the south east with McCarthy's Rest border post in the north. Various un-surfaced farm roads are present throughout the study area and surrounding properties.

A 132 kV power line is located to the south of the study area, which follows the R380 road route (on the northern and eastern side of the road).

There are various mining projects or operations in the immediate vicinity of the study area and these include the Black Rock Mine and the Hotazel Mine.

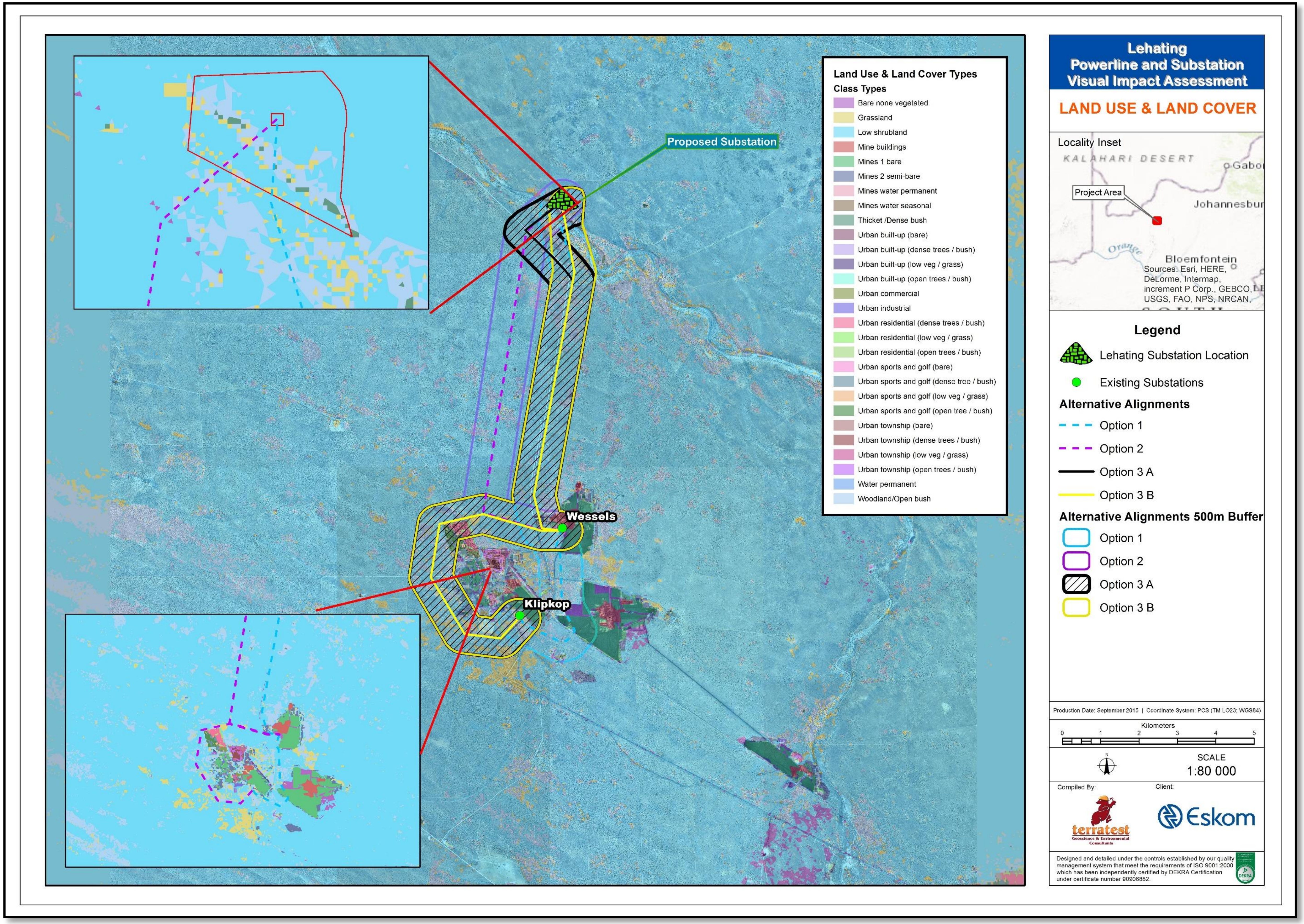

Figure 5-10: Land Use and Land Cover

5.1.3 Spatial Development Framework

According to the Joe Morolong Local Municipality Spatial Development Framework (SDF) there is little evidence to suggest that there is development pressure that warrants any new development around the Hotazel area. Currently there are large vacant stands south of the core town area. This should be sufficient to accommodate any future growth.

Due to the fact that Lehating and surrounding areas are predominantly within the mining corridor, the municipality has no activities planned for the area and they encourage expansion of the mining sector in the area. **Figure 5-11** below shows the proposition of the expansion for the Black Rock mining area which is about 10 km from the proposed Lehating substation.

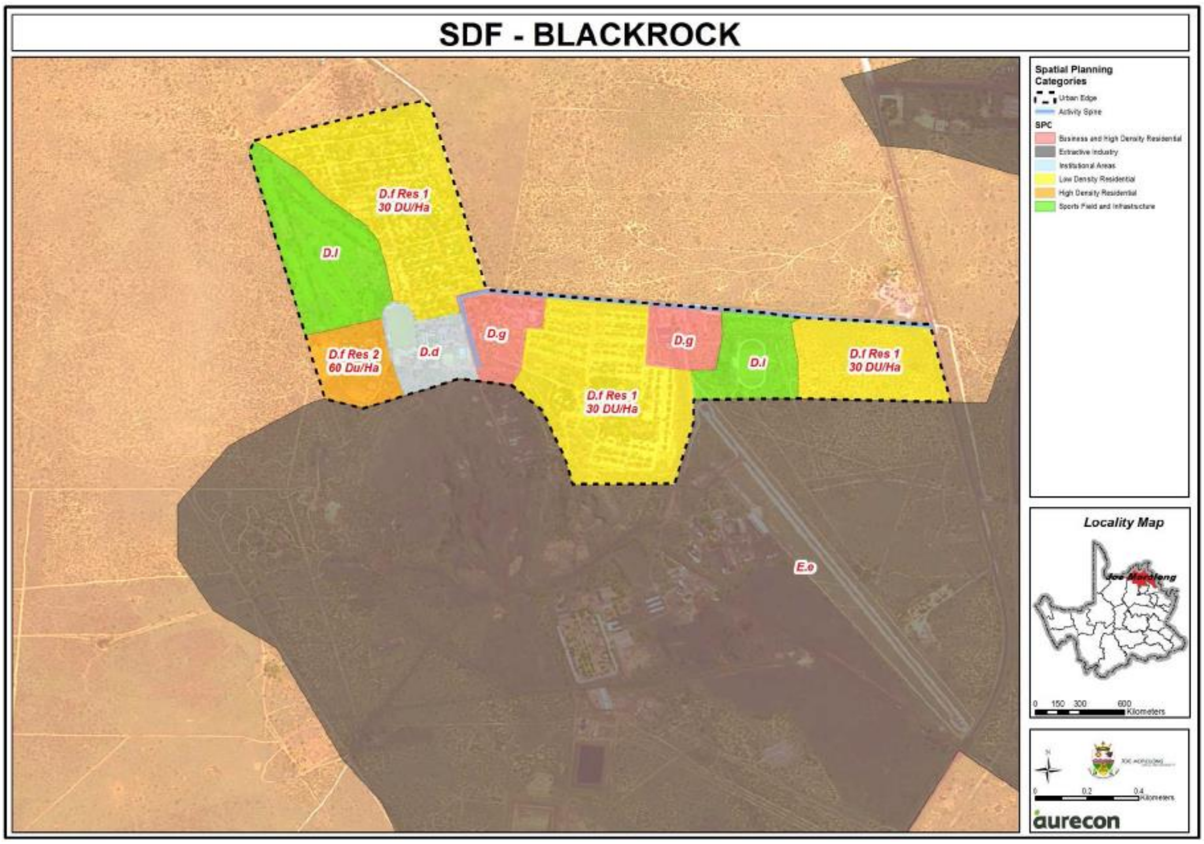

Figure 5-11: The Black Rock Mining Hub (Extracted from 2012/2013 Joe Morolong Local Municipality SDF).

5.1.4 Site Character and Surroundings

The proposed site for the substation is within a flat area with open plains displaying semi-arid vegetation and ephemeral drainage lines. This proposed site will not be clearly visible from the adjacent road. Livestock and game farms and associated farm settlements are typical of the region. In contrast, to the south of the project area, the noticeable surroundings are characterised by scattered operational and closed mining operations, and supportive infrastructure such as rail and road networks, power lines and the residential and business centre of Hotazel. Areas located to the north, east and west of the proposed project area remain relatively undisturbed and are characterised by semi-arid vegetation cover.

Plate 4: View of the Cattle Kraal to the West of the Substation.

Plate 5: View of the Powerlines Along the R308 Road to the West of the Proposed Site and of an Entrance to One of the Farm Houses.

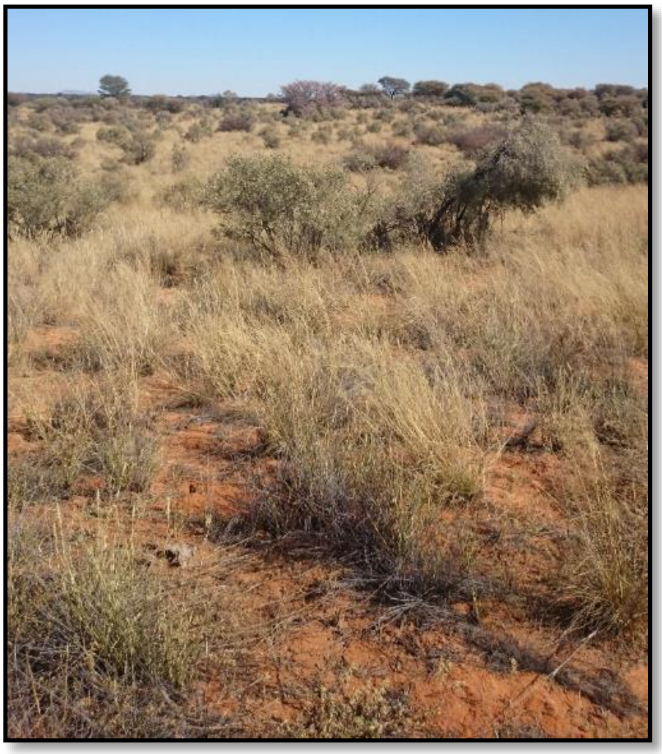

Plate 6: View of the Vegetation Around the Proposed Substation Site in the South East Direction.

5.2 Perceived Visual Character

The perceived Visual Character of the landscape is an observation of the environment from human perception. Several key factors have been interrogated in order to assess the overall visual character of the affected landscape and adjacent areas. Such factors include visual quality, sense of place, and landscape diversity.

5.2.1 Visual Quality

Visual quality evaluates the influence of different landscape compositions on scenic attractiveness. This is a qualitative evaluation. The three main categories which indicate visual quality are: vividness, intactness and unity, and are described in more detail in **Table 5-1** below.

Table 5-1: Visual Quality Criteria

INDICATOR	CRITERIA
Vividness	The memorability of the visual impression received from contrasting landscape elements as they combine to form a striking and distinctive visual pattern.
Intactness	The integrity of visual order in the natural and man-built landscape, and the extent to which the landscapes is free from visual encroachment.
Unity	The degree to which the visual resources of the landscape join together to form a coherent, harmonious visual pattern. Unity refers to the compositional harmony of inter-compatibility between landscape elements.

The indicators and criteria described above are rated according to the following evaluation scale: Low = 1, Moderate = 3 and High = 5. These values are divided by 3 to obtain an average (U.S.D.O.T. 1981).

The visual quality of the affected landscape has been assessed, whereby the evaluation values have been applied in a larger assessment matrix.

5.2.2 Landscape Diversity and Sense of place

Flat, open plains displaying semi-arid vegetation and ephemeral drainage lines define the landscape character of the project area. Livestock and game farms and associated farm settlements are typical of the region.

In contrast, the region to the south of the project area is characterised by scattered operational and closed mining operations, and supportive infrastructure such as rail and road networks, power lines and the residential and business centre of Hotazel. Areas located to the north, east and west of the proposed project area remain relatively undisturbed and are characterised by semi-arid vegetation cover.

To the south of the proposed project area, the sense of place is influenced by a largely flat, natural landscape, dominated by mining and community land uses. These areas are considered to have a low sense of place, being that the landscape generally has few, if any, valued features.

The flat plains, which occur to the north, east and west of the proposed project area, create a contained, complex yet coherent spatial dimension, which invites the visitor into a scene dominated by these natural edges and which add “wildness” to the scene. These factors combine to evoke a strong emotional response in the visitor, created by a landscape that is unique and has a distinct character of its own. This landscape type has a high sense of place as this landscape exhibits a positive character with valued features.

6 ASSESSMENT OF VISUAL IMPACTS

6.1 Visibility and Exposure

The visibility of the project refers to geographic area from which the project will be visible. It can also be described as the view catchment area, and may have a varied Zone of Visual Influence (ZVI) depending on the landscape type and possible screening of existing vegetation or buildings (DEADP, 2005).

The visibility of the proposed substation and powerlines was determined using a suite of visibility tools in the GIS software. A viewshed analysis was conducted of the substation site using a 10 m and 1.5 m offset for the substation elevation and an average observer eye level, respectively.

A viewshed is an area of the landscape which has observation points at which the proposed infrastructure can be visible from. These points were considered Key Observation Points (KOP). A viewshed, however, does not take into account the distance of the KOP's from the proposed development. When determining the magnitude of a visual impact, it is important to consider the distance of a viewer to the proposed development. Hull and Bishop (1988), have identified an inverse relationship between distance and visibility i.e. as the distance increases, the visual impact decreases. Therefore a fuzzy viewshed analysis was conducted on the KOPs using GIS software to determine visibility across varying distances from the proposed substation positions. This analysis takes into account the decrease in visibility over distance. The results of the fuzzy viewshed analysis for individual KOPs are found in Annexure A.

It should be noted that the visibility analysis uses a digital terrain model based on contour data, therefore the visibility analyses consider the worst-case scenario because no additional surface features are incorporated into the model. Screening of vegetation and other man-made structures is not considered, hence the site investigation and photo montages are required to extend and refine the visibility analysis. The topography may also act as a natural screen to minimise the visual impact.

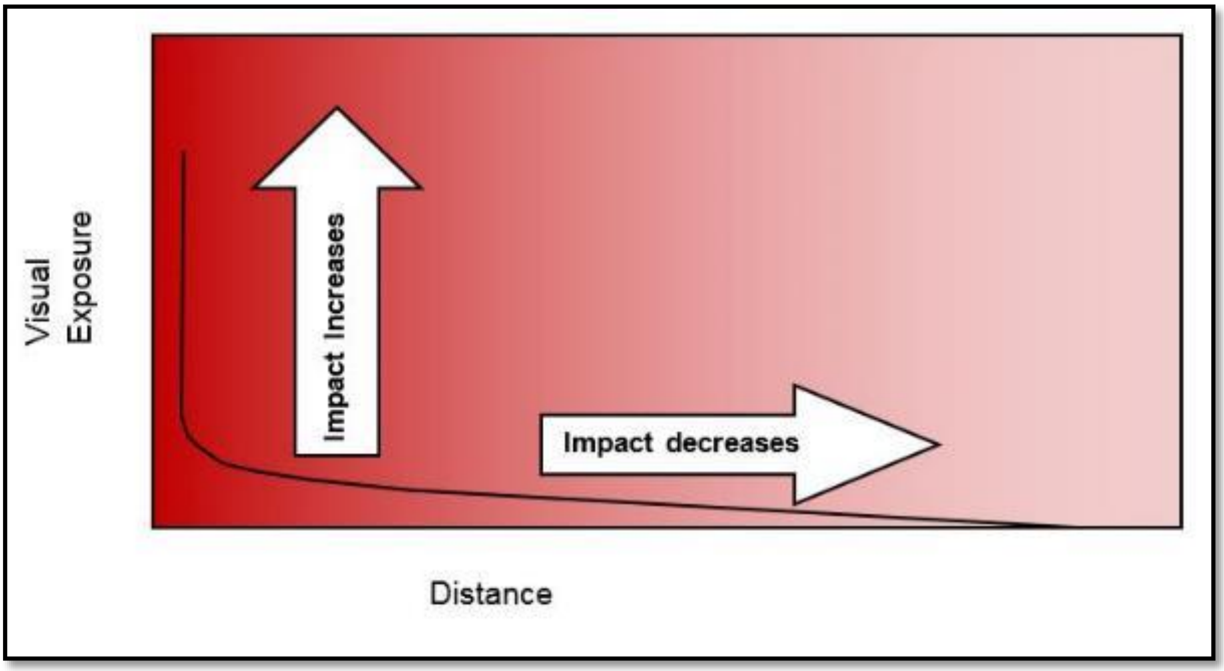

Figure 6-1: Visual Exposure (Hull and Bishop, 1988).

Field work was conducted to groundtruth the preliminary KOPs identified during the initial desktop asessment. Several KOPs were eliminated as topography, buildings, vegetation, or man-made structures acted as natural barriers. This was only evident on inspection of the site and the surrounding landscape. The remaining KOPs were further scrutinized in a more detailed 3D assessment in GIS. Panoramic photographs were also captured from each KOP to confirm actual visibility and ensure a correlation with the 3D simulations.

The ZVI for the substation is perceived to be approximately 3 km. The flat terrain excludes visible lines of site to the three alternate substation positions for a large portion of the surrounding area within the ZVI, specifically on the western side, as the residential area acts as an immediate visual barrier. The substation and powerlines may be visible from the peripheral landscape, as depicted in the viewshed analysis, however climatic effects such as general haze may limit the visibility. Furthermore, the vegetative cover on the eastern side of the proposed site significantly reduces the visibility from various vantage points.

The number of KOPs decreased to six after the site inspection and detailed fuzzy viewshed analyses were conducted. KOP 1, 4, 5, 6, 8, and 11 were assessed in more detail. **Figure 6-2** indicates these KOPs. **Figure 6-4** to **Figure 6-8** indicate the KOP and the panoramic photographs taken from each KOP viewpoint.

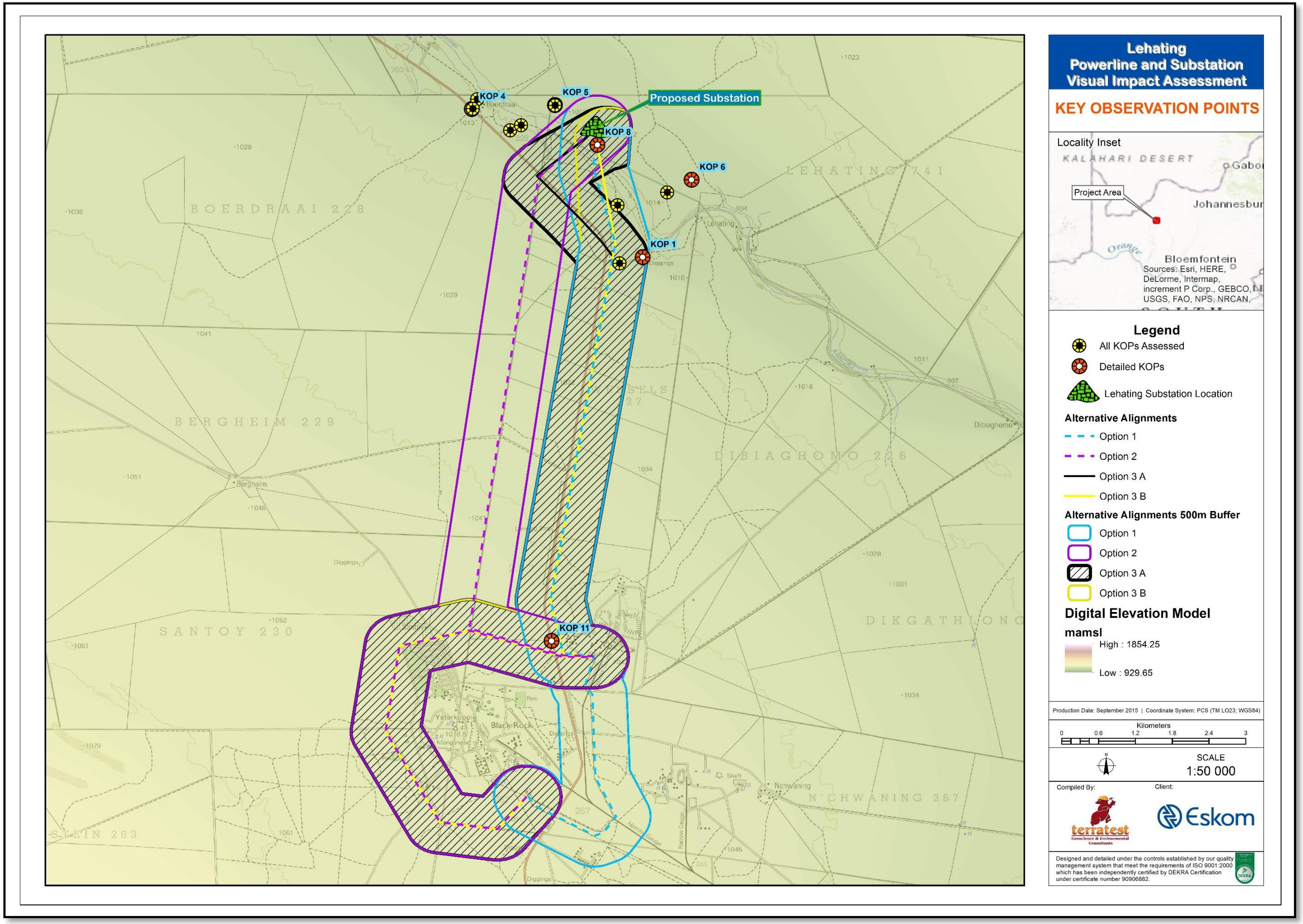

Figure 6-2: Key Observation Points

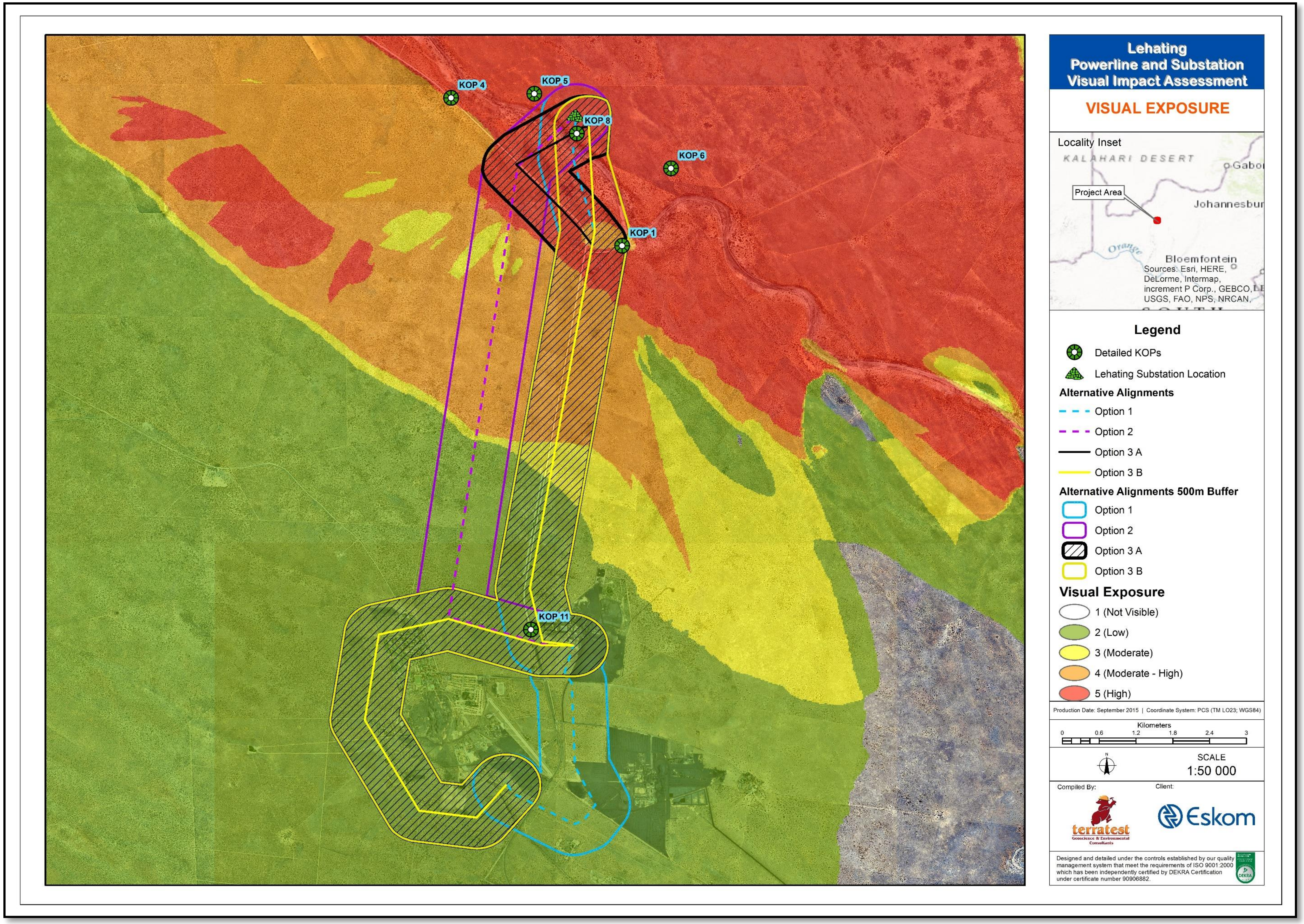

Figure 6-3: Cumulative Visual Exposure from all KOPs.

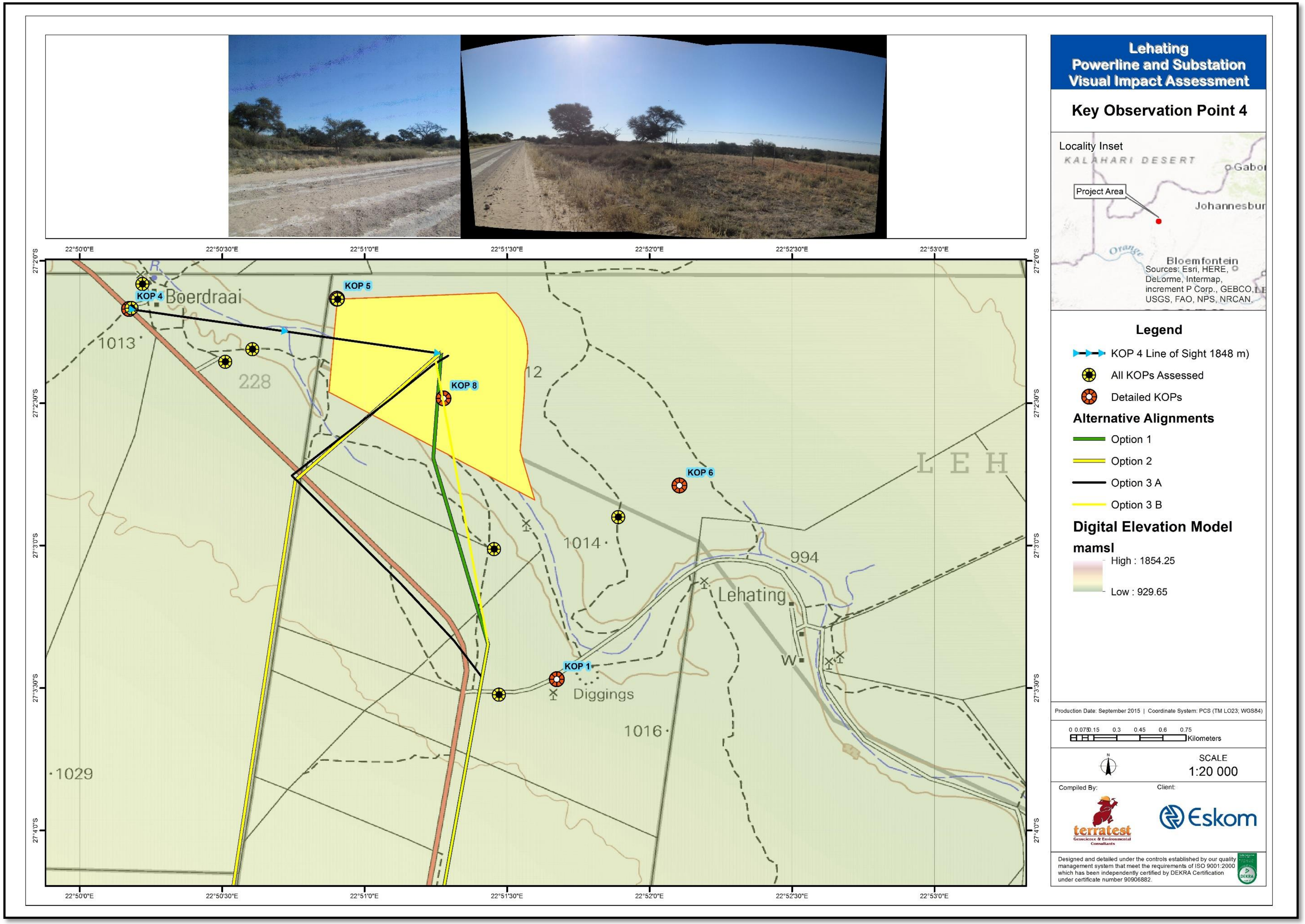

Figure 6-4: KOP 4

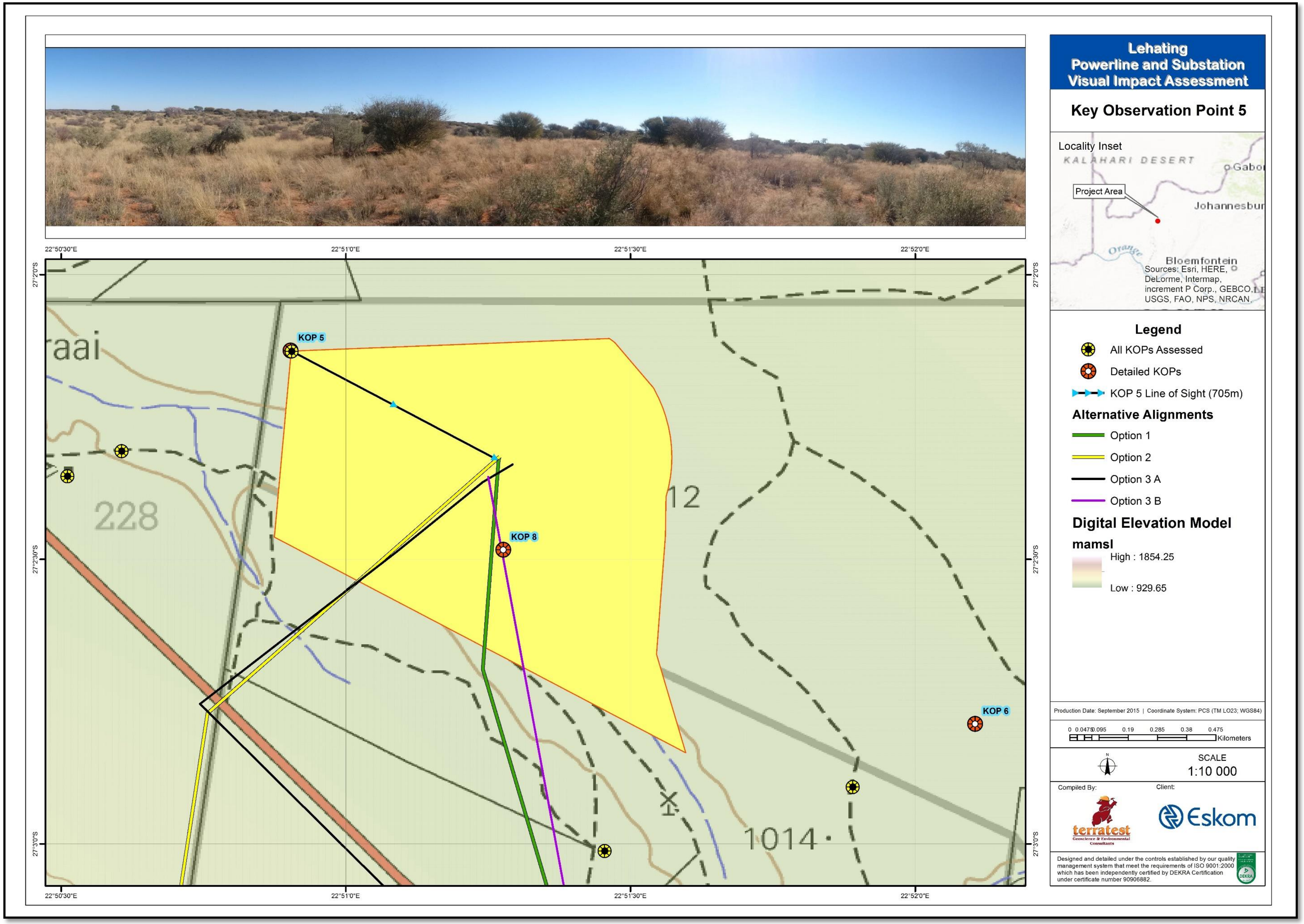

Figure 6-5: KOP 5

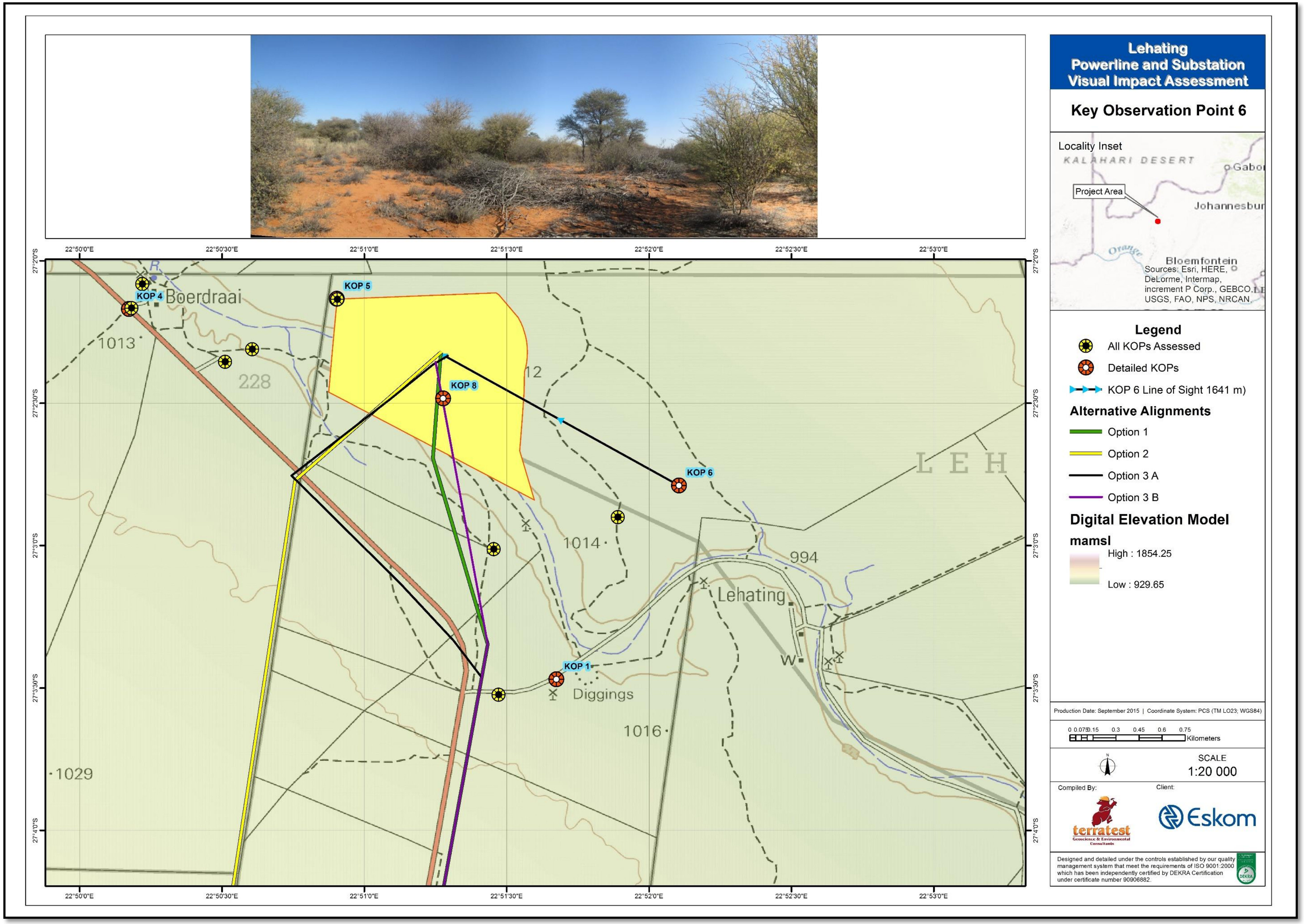

Figure 6-6: KOP 6

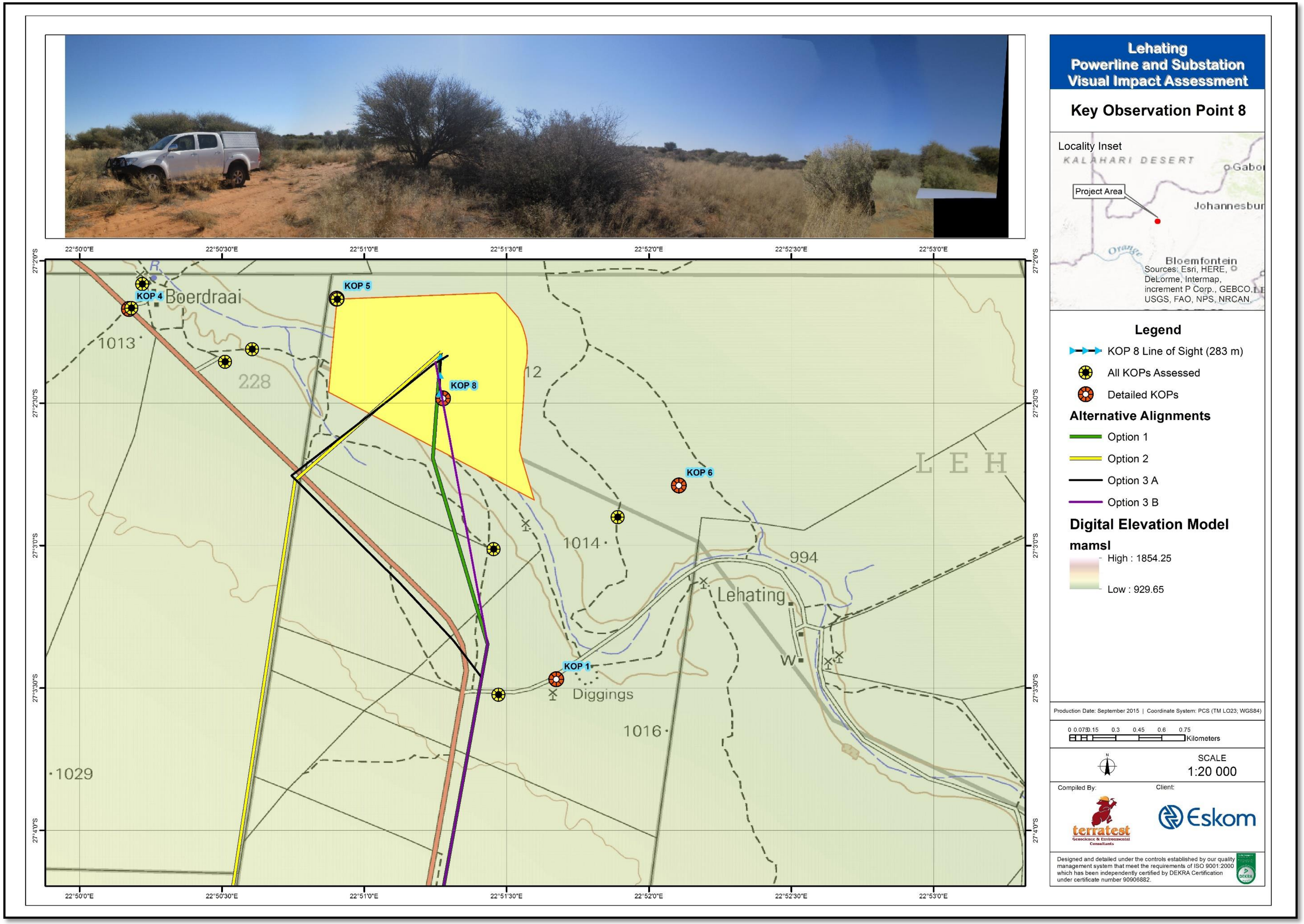

Figure 6-7: KOP 8

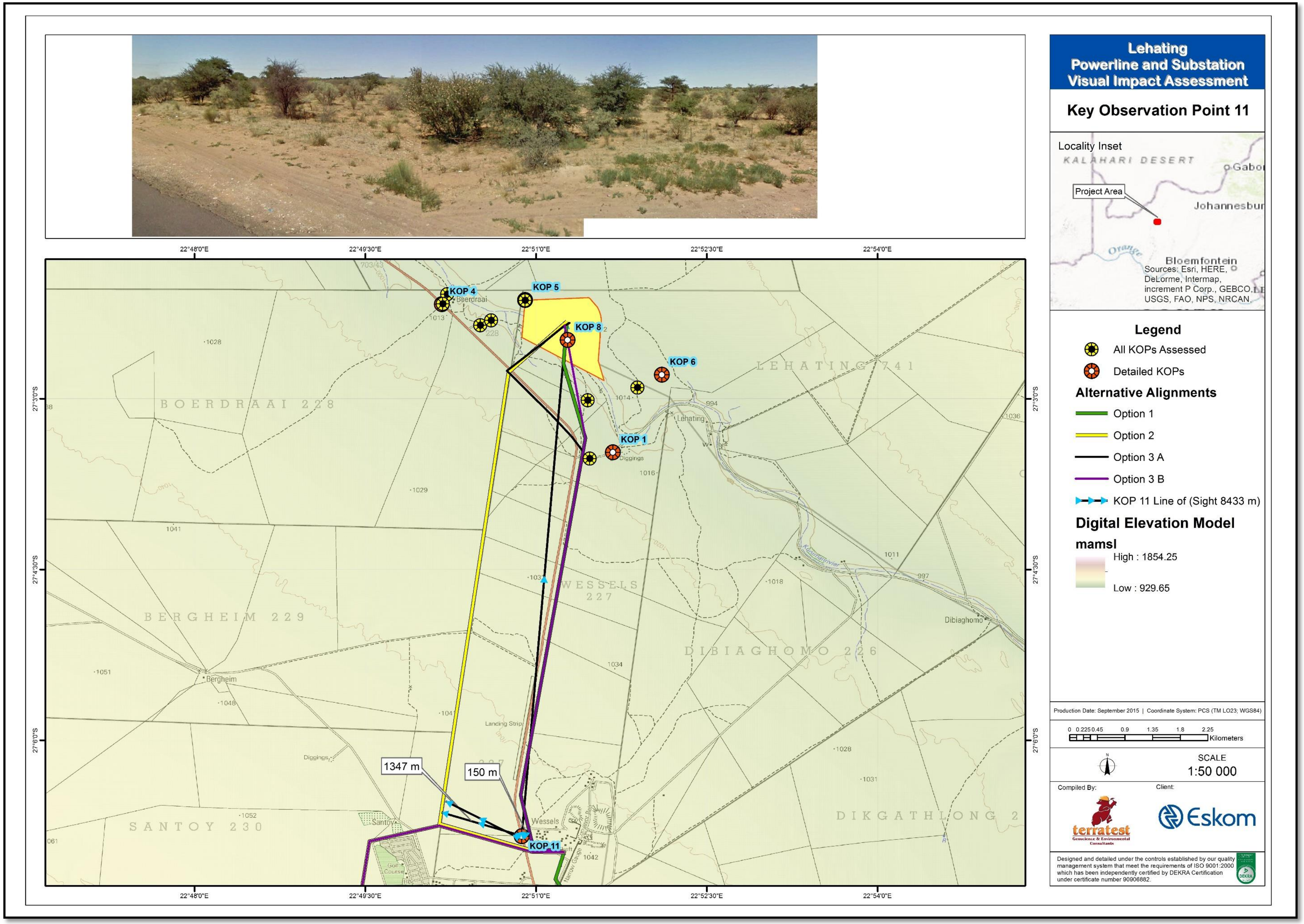

Figure 6-8: KOP 11

6.2 Magnitude of Visual Impacts

A matrix was developed to determine the overall magnitude of the visual impact by the proposed substation and powerlines. The following criteria have been rated, following desktop and site analyses.

- Visual Character;
- Visual Quality;
- Visual Exposure;
- Distance Rating;
- Visual Absorbtive Capacity (VAC);
- Landscape Compatibility; and
- Viewer Sensitivity.

6.2.1 Visual Character

This rates the compatibility of the development to blend into the current landscape. The ratings range from 1 – 5. High compatibility with the environment indicates that there will be a low visual impact. Low compatibility with the environment indicates that there will be a high visual impact. The ratings are as follows: 5 = Low Compatability (High Impact); 3 = Moderate and 1 = High Compatibility (Low Impact).

6.2.2 Visual Quality

Visual quality assesses the state of the current environment. A high quality environment is an environment which is natural. An environment with low quality indicates that the landscape has been severely modified. The visual quality criteria have been discussed in **Section 5.2.1.** The landscape is rated according to the following evaluation scale: 5 = High Quality (High Impact); 3 = Moderate Quality (Moderate Impact) and 1 = Low Quality (Low Impact).

These values are divided by 3 to obtain an average (U.S.D.O.T. 1981).

6.2.3 Visual Exposure

Visual Exposure is determined by the distance between the proposed project and selected viewpoints. The visual exposure of a proposed project will diminish with an increase in distance from the project. Two aspects were rated: Exposure rating and distance rating. Exposure rating rates how visible the proposed development is from a KOP (Figure 15). The rating is as follows: 1 = not visible; 2 = low visibility; 3 = moderate visibility; 4 = moderate – high visibility and 5 = high visibility.

6.2.4 Distance Rating

Distance rating proportions the visual impact of the proposed development at various distances. High magnitude impacts are rated 5, and these are within a close distance to the proposed activity. The lowest visual impact will occur at a greater distance. **Table 6-1** summarises the distance rating system.

Table 6-1: Distance Rating System

Location of development (from viewpoint)	Category	Value
0 to 0.5km	Adjacent	5
0.5km to 1km	Foreground	4
1km to 3km	Middle ground	3
3km to 5km	Distant middle ground	2
5km and greater	Background	1

6.2.5 Visual Absorption Capacity

The Visual Absorbtion Capacity (VAC) is the potential of the environment to conceal the proposed development. The VAC is rated from high (1) to low (5). High VAC indicated that the environment effectively conceals the proposed development, hence there is a low visual impact (1). Low VAC indicated that the environment does not conceal the propsed development hence the visual impact is high (5).

6.2.6 Landscape Compatibility

This rates how the proposed development will change the ‘sense of place’ of the area. Minimal change to the sense of place indicates that the development is highly compatable to the surrounding area, hence high = 1. Noticable change to the receiving environment indicated a low compatability with the surrounding environment hence low = 5. Moderate change has been given a value of 3.

6.2.7 Viewer Sensitivity

This is the viewer sensitivity of the receiving environment. A sensitive receiving environment includes residential areas and scenic routes. The proposed development will have a higher visual impact in these areas than the industrial areas. High sensitivity is rated 5, these are most impacted upon. Low sensitivity is rated 1 as these are least impacted upon.

Table 6-2: Magnitude Calculations

ACTIVITY	VISUAL CHARACTER	QUALITY	EXPOSURE	DISTANCE	VAC	LANDSCAPE COMPATIBILITY	VIEWER SENSITIVITY	MAGNITUDE
SUBSTATION POSITION WITHOUT MITIGATION	2	2	2	3	2	1	2	**2**
SUBSTATION POSITION WITH MITIGATION	1	2	1	3	1	1	1	**1.4**
LINE 3A WITHOUT MITIGATION	1	2	1	2	2	1	2	**1.7**
LINE 3A WITH MITIGATION	1	2	1	2	1	1	1	**1.3**
LINE 3B WITHOUT MITIGATION	1	2	2	3	3	2	2	**2.1**
LINE 3B WITH MITIGATION	1	2	1	3	2	2	1	**1.7**

The results of the magnitude of the visual assessment have been considered for all three line alternatives, however the magnitude calculations have been considered for the preferred alternative, Line Option 3A and 3B. The criteria, once rated to a total score of magnitude, were then assessed according to the following impact rating framework.

Table 6-3: Rating Framework

SPATIAL SCALE		DURATION	
Site Specific –	1	One day to one month	1
Area Specific –	2	One month to one year	2
Local –	3	One year to ten years	3
Regional - (neighbouring areas)	4	Life of operation	4
National –	5	Permanent	5
FREQUENCY OF ACTIVITY		**FREQUENCY OF IMPACT**	
Annually or less -	1	Almost never	1
6 monthly -	2	Very seldom	2
Monthly -	3	Infrequent	3
Weekly -	4	Often/ regularly	4
Daily -	5	Daily	5
OVERALL CONSEQUENCE		**OVERALL LIKELIHOOD**	
Sum of magnitude (Table 6-4), spatial scope and duration.		***Sum of Frequency of Activity and Frequency of Impact***	
SIGNIFICANCE RATING - Overall Likelihood multiplied by Overall Consequence			

The final accumulated values have been given the following significance rating in order to quantify the visual impacts.

Table 6-4: Significance Rating

VALUE	SIGNIFICANCE RATING
High	126-150
Medium-High	101-125
Medium	76-100
Low-Medium	51-75
Low	26-50
Very Low	1-25

Table 6-5: Overall Visual Impact

Activity	MAGNITUDE	SPATIAL SCALE	DURATION	OVERALL CONSEQUENCE	FREQUENCY OF ACTIVITY	FREQUENCY OF IMPACT	OVERALL LIKELIHOOD	SIGNIFICANCE	CUMULATIVE
SUBSTATION POSITION WITHOUT MITIGATION	2	2	5	**9**	5	3	**8**	**72**	**Low-Medium**
SUBSTATION POSITION WITH MITIGATION	1.4	2	5	**8.4**	5	3	**8**	**67.2**	**Low-Medium**
LINE 3A WITHOUT MITIGATION	2	1	3	**6**	5	3	**8**	**48**	**Low**
LINE 3A WITH MITIGATION	1.3	1	3	**5.3**	5	3	**8**	**42.4**	**Low**
LINE 3B WITHOUT MITIGATION	2.1	1	3	**6.1**	5	3	**8**	**48**	**Low**
LINE 3B WITH MITIGATION	1.7	1	3	**5.7**	5	3	**8**	**45.6**	**Low**

6.3 Summary of Findings

6.3.1 Substation

The visual character was rated to be a value of 2. This indicates that there is a moderate to low visual impact as the proposed structure will have a high compatibility with the environment. The quality of the area is rated as 3. This indicated a high to moderate existing quality of the area. Although numerous mining related structures dominate the landscape to the south of the project area, the overall scene surrounding the project area is characterised by the Kuruman River channel and associated sand dune, open views with grazing lands and associated activities. Since that the substation will be within a mining area, the mining activities may mask the visibility of the substation.

Several KOPs were identified. The site investigation confirmed that while many of the KOPs had clear site lines to the substation position, others would not be able to see the structure due to the flatness of the topography, and particularly the vegetation cover.

The visual exposure was rated as a value of 2, indicating a moderate to low exposure to the various viewpoints and KOPs. This is attributed to the flat terrain and limited vantage points for elevated sight lines. The actual viewshed noted from the various KOPs varied, and the site investigation confirmed that the substation is positioned within the flat terrain with very few ridges surrounding it. This will mitigate the visual exposure to some extent. The Visual Absorption Capacity was therefore rated as 2, as the surrounding landscape will effectively absorb and conceal the visual impact.

The proposed infrastructure will result in a minor change in the sense of place of the area, this results in a low visual impact rating of 1 for compatibility. The sensitivity of the receiving environment is moderately low.

The magnitude of the visual impact is considered to be an average of the above characteristics. The results indicated a total magnitude of 2, which was combined with the overall visual impact rating framework.

The spatial scope, duration, frequency of activity, and frequency of impact have all been considered in order to quantify the overall visual impact of the substation. Slight variations in the impact scores relate to the implementation of mitigation measures. The construction of the substation is considered permanent and the duration and frequency of the activity are also permanent. The frequency of the day time impact may diminish over time as the visual intrusion initially imposed on sensitive viewers regresses.

The flat topography excludes visible lines of site to the substation for a large portion of the surrounding landscape. The infrastructure may be visible from the peripheral landscape, as depicted in the viewshed analysis; however climatic effects such as general haze, as well as the natural screening of vegetation will limit the visibility.

The effects of night time lighting have been considered, however are not deemed to be of rateable significance owing to the lighting of the mining area in which the substation will be. It is expected that any lighting erected at the substation would be an extension on the overall night time lighting of the mine.

6.3.2 Powerlines

Due to the already existing linear infrastructure along the proposed route for most of Line Alignment Option 3, the explanations and ratings below are therefore an explanation of only option 3.

The visual character was rated to be a value of 1 for both Option 3A and Option 3B. This indicates that there is a low visual impact as the proposed development will have a high compatibility with the environment. For both options, the quality of the area is rated as 2. This indicates the area is of a low to moderate quality. This is attributed to the modification of the natural environment. The lines cover areas of different land uses including natural areas hence the moderate rating. The lines cover a large area and site visits indicate a low overall visibility from KOP's, hence the rating value 2 for Option 3B. Option 3A is visible in the middle ground from some KOP's and has been given a distance rating of 2 whereas Option 3B is more visible and was given a distance rating of 3. This particular rating was reached owing to the length of the powerlines and the changing visibility from viewpoints, i.e. the powerlines are not visible for the entire length at any given KOP. The locality of the lines also cover mixed land uses, reducing overall visibility.

The environment is able to conceal the development of Option 3A through natural features. This absorptive capacity has a value of 1 indicating low visual impact. This rating owes it to that Alternative 3A will run parallel to an existing Eskom powerline for most of its route and this will mask the visibility. Alternative Option 3B will run through mixed land use, including residential area and natural land cover and therefore the VAC was rated to be 3. The proposed development will result in a low change in the sense of place of the area. This high compatibility with the current sense of place results in a visual impact rating of 2. The sensitivity of the receiving environment is low as the proposed development passes many different land uses and terrains. It will therefore have a low visual impact rating. The magnitude of the visual impact is considered to be an average of the above characteristics. The results indicate a low visual impact rating of 1.7 for option 3A and 2.1 for Option 3B.

The spatial scope, duration, frequency of activity, and frequency of impact have all been considered in order to quantify the overall visual impact of both line options. No variations in the impact scores relate to the implementation of mitigation measures. The construction of the powerlines is considered permanent and the duration and frequency of the activity are also permanent. The frequency of the impact may diminish over time as the visual intrusion initially imposed on sensitive viewers regresses. While the powerlines are expected to be visible beyond 3 km, the landscape and the varying components will dominate the viewable landscape. As such, it is likely that the powerlines will blend into the landscape and be absorbed visually.

Even though, the cumulative visual impact for both Options is the same, Alternative Line Option 3A is the recommended alternative. This Alternative has smaller areas of potential visual exposure due to that there are already existing powerlines on most of the route even though it is not too far from the major roads. This alternative has the best ability to consolidate the linear infrastructure (existing vertically disturbed landscapes) within this region. This is due to the alignments running parallel to the existing transmission and distribution lines.

6.3.3 Construction Phase

The visual impacts associated with the construction phase are considered to be medium, but limited to the construction period. Visual impacts may include:

- The loss of vegetation (a valuable visual resource) as a result of clearing for the purposes of construction,
- Impacts on overall air quality and visibility due to fugitive dust emissions, particularly during windy conditions; and
- Night time lighting, which may include lighting from construction equipment (moving visual impact) is expected as there is limited vegetative screening at the site

Given the height of the substation infrastructure (approximately 10 meters), many of the sensitive receptors will only see the construction at later stages as the construction of the substation progresses in height.

7 CONCLUSION AND RECOMMENDATIONS

The overall visual impact of the proposed substation and associated infrastructure is perceived to be medium to low. While the visual intrusion on adjacent sensitive receptors is evident, the visual impact is not expected to infringe on the constitutional rights of these receptors. Furthermore, the visual impacts identified are not a fatal flaw to the proposed project and recommended mitigation measures can be implemented to offset, to some extent, the visual impacts identified.

Several mitigation measures can be incorporated into the design, construction and operational phases, to offset the visual impacts.

7.1 Design

The project is currently at the planning phase, and therefore the opportunity exists for integration of visual mitigation techniques before construction commences. It is recommended that screening measures are incorporated into the substation design. Such measures could include:

- Limiting the number of trees surrounding the construction site that will be removed;
- Planting trees as a method of screening the lower structures, and subsequently detracting from the vertical height of the infrastructure;
- Using neutral, mat-finish paint colours for any ancillary structures or buildings in order to improve visual absorption in the landscape; and
- Highly reflective materials should be avoided, and if this is not possible, a mat-finish paint should be applied to conceal glare and reflection.

7.2 Construction

Visible dust will be present at the construction site due to earth moving equipment and vehicles on the dirt access roads. This will temporarily decrease the visual quality of the local area. Standard dust control mitigation should be followed as per the site specific EMPr.

The construction area and site camp should be kept tidy and litter-free throughout construction as visible litter is visually unpleasant for adjacent sensitive receptors, i.e. residents, and passing vehicular traffic. All construction materials should be stored on site. Construction sites should be screened in the form of shade cloths at fence level. This will obstruct views of construction elements on site. All substances such as cement which may be toxic to flora and fauna should be strictly controlled to avoid degradation of the surrounding environment. No foreign material generated/deposited during construction shall remain on site.

The colour of building materials should blend into the natural environment as best as possible. It is suggested that colours similar to the surrounding vegetation be used, such as browns, beiges and greens, in order to blend into the landscape at a distance and be visually neutral.

Should construction activities take place at night, it is recommended that construction lighting be directed downward and inward (towards the construction centre). This will limit construction spill light at night time, which can be visually intrusive.

7.3 Operation

There will be a very limited change in the sense of place and the visual quality of the local landscape due to the development of the substation and the erection of the powerlines. Stockpiles should be created and sloped to create the least visual impact. In addition to this, some screening techniques can be implemented at the site, such as planting trees and ensuring that the materials and choice of paint colour for any ancillary structures is brown or grey in order to blend in with the landscape.

White paint should be avoided. Suggested mitigation measures should be monitored and modified if necessary to ensure there is a minimum visual impact. The operational phase is expected to be over an extended period of time (>20 years), therefore maintenance of any painted structures should be conducted.

8 REFERENCES

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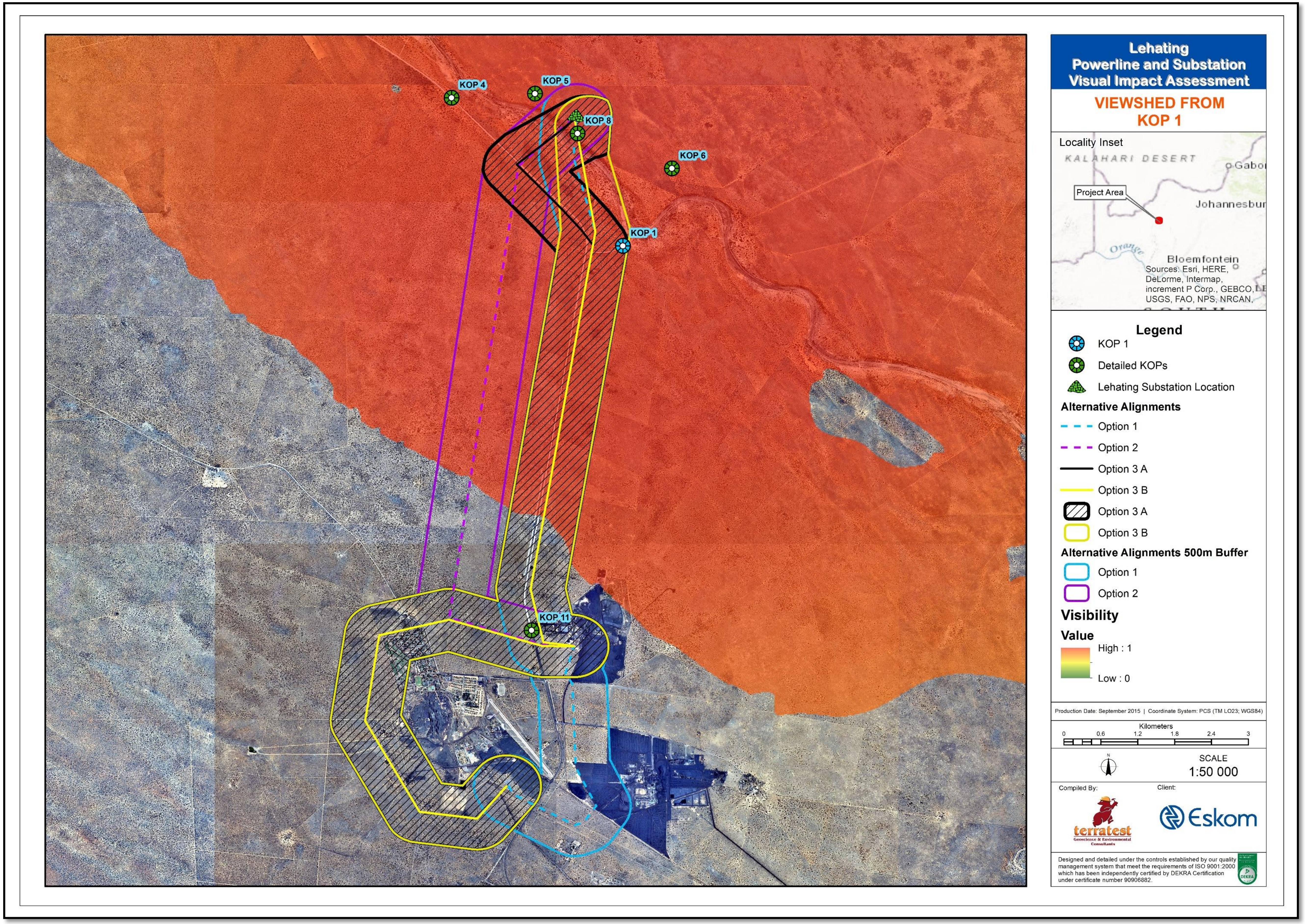
Annexure A: FUZZY VIEWSHED FROM DETAILED KOPs



KOP 4
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Powerline and Substation
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Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN,
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Detailed KOPs
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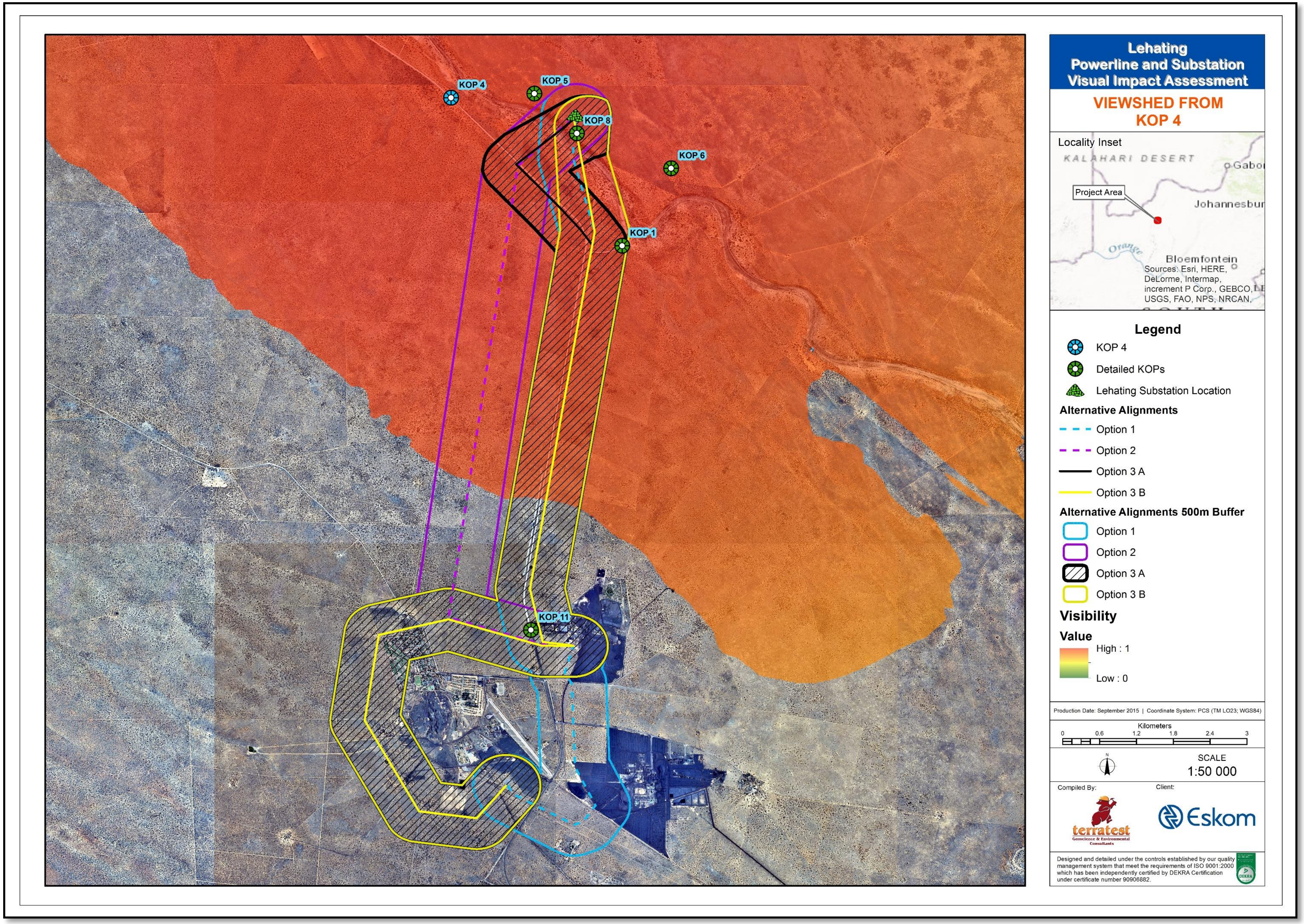
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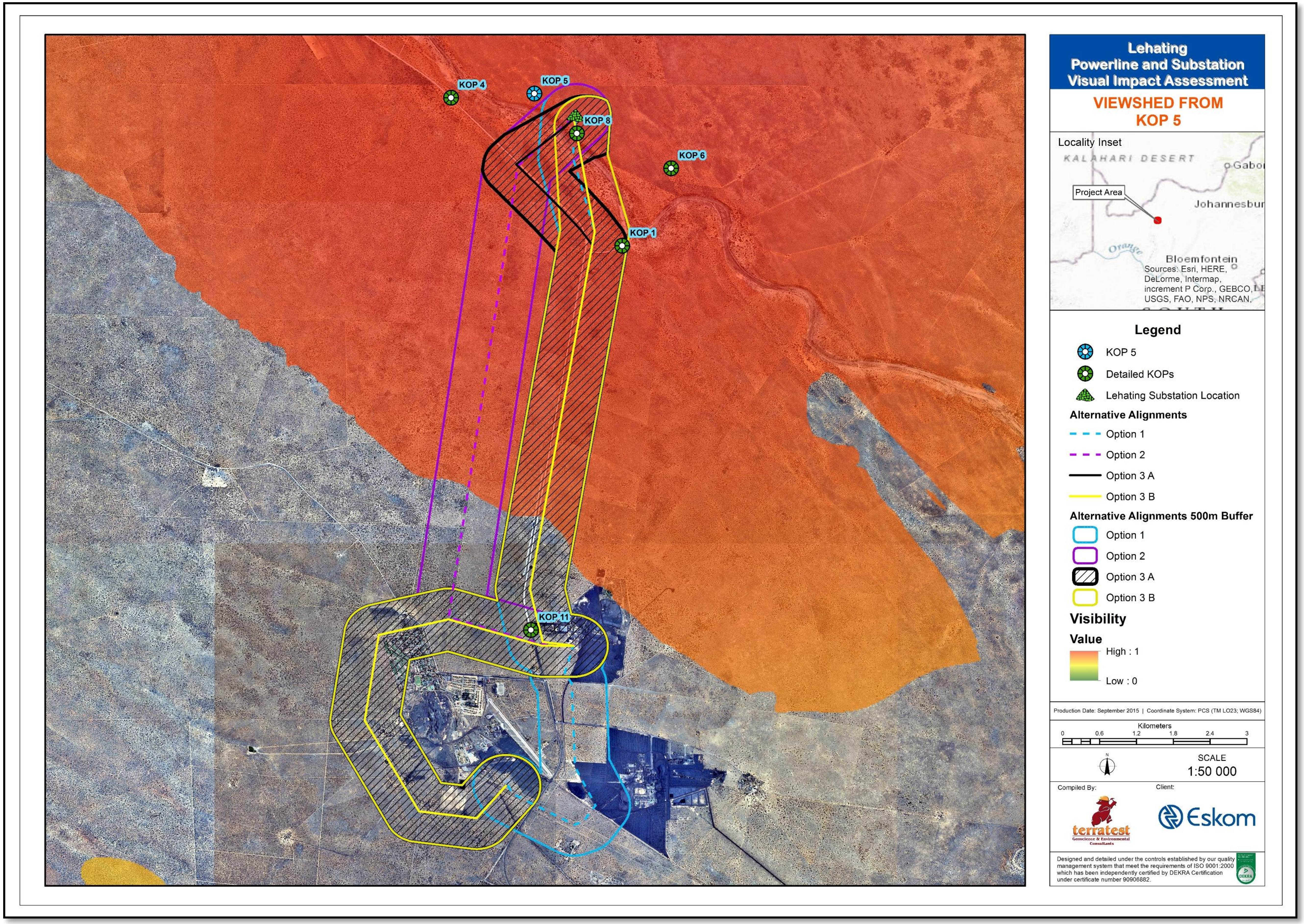
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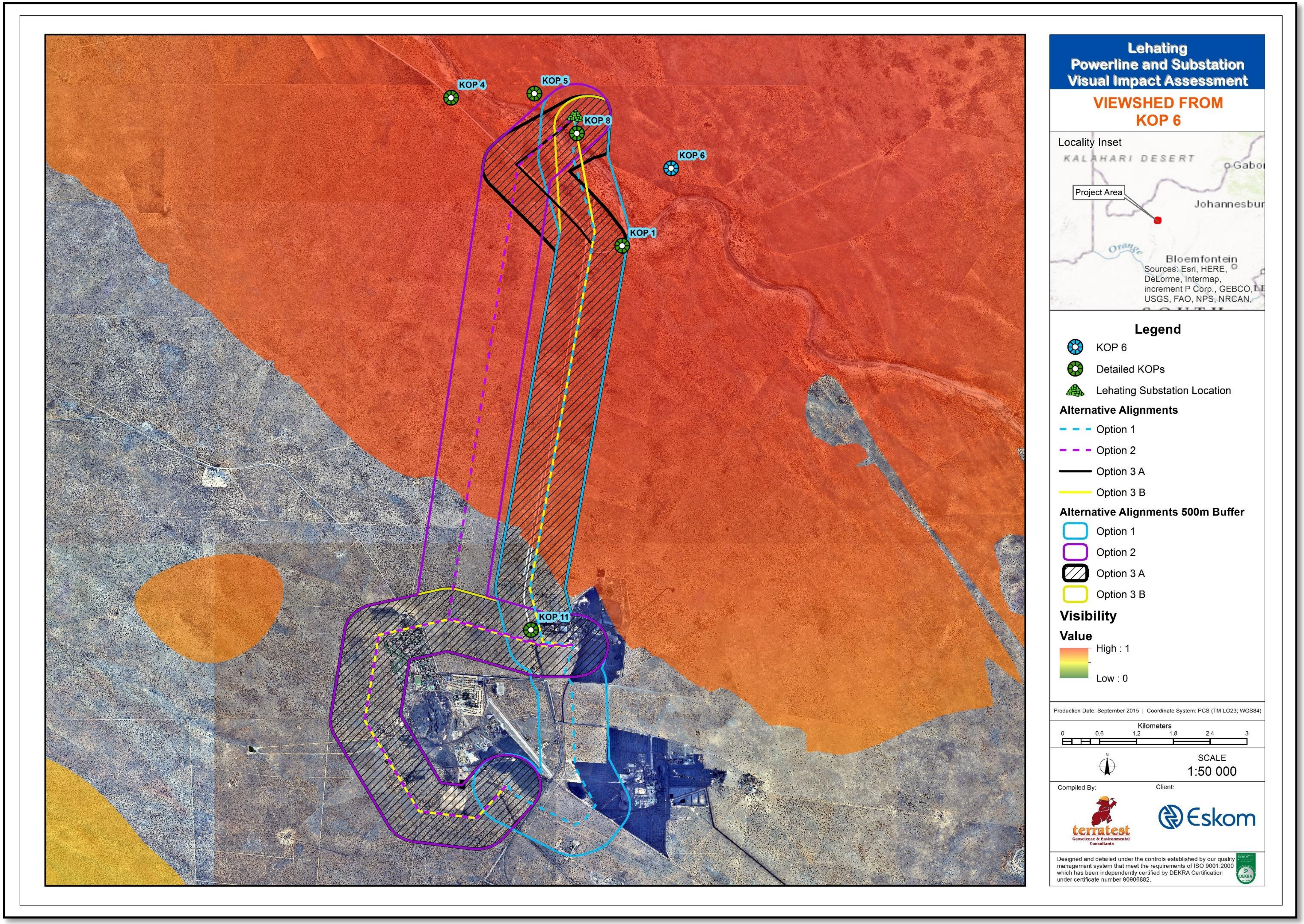
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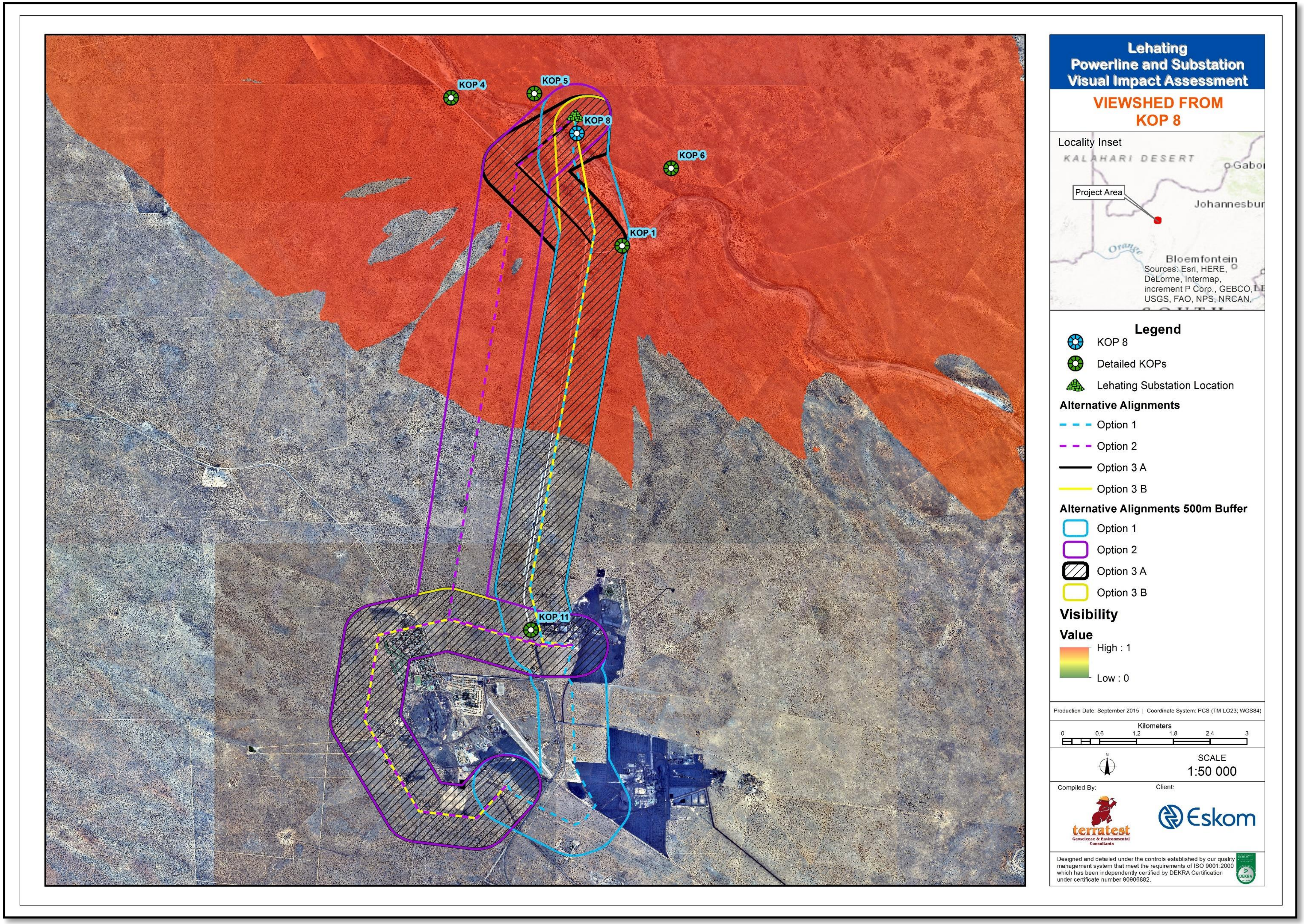
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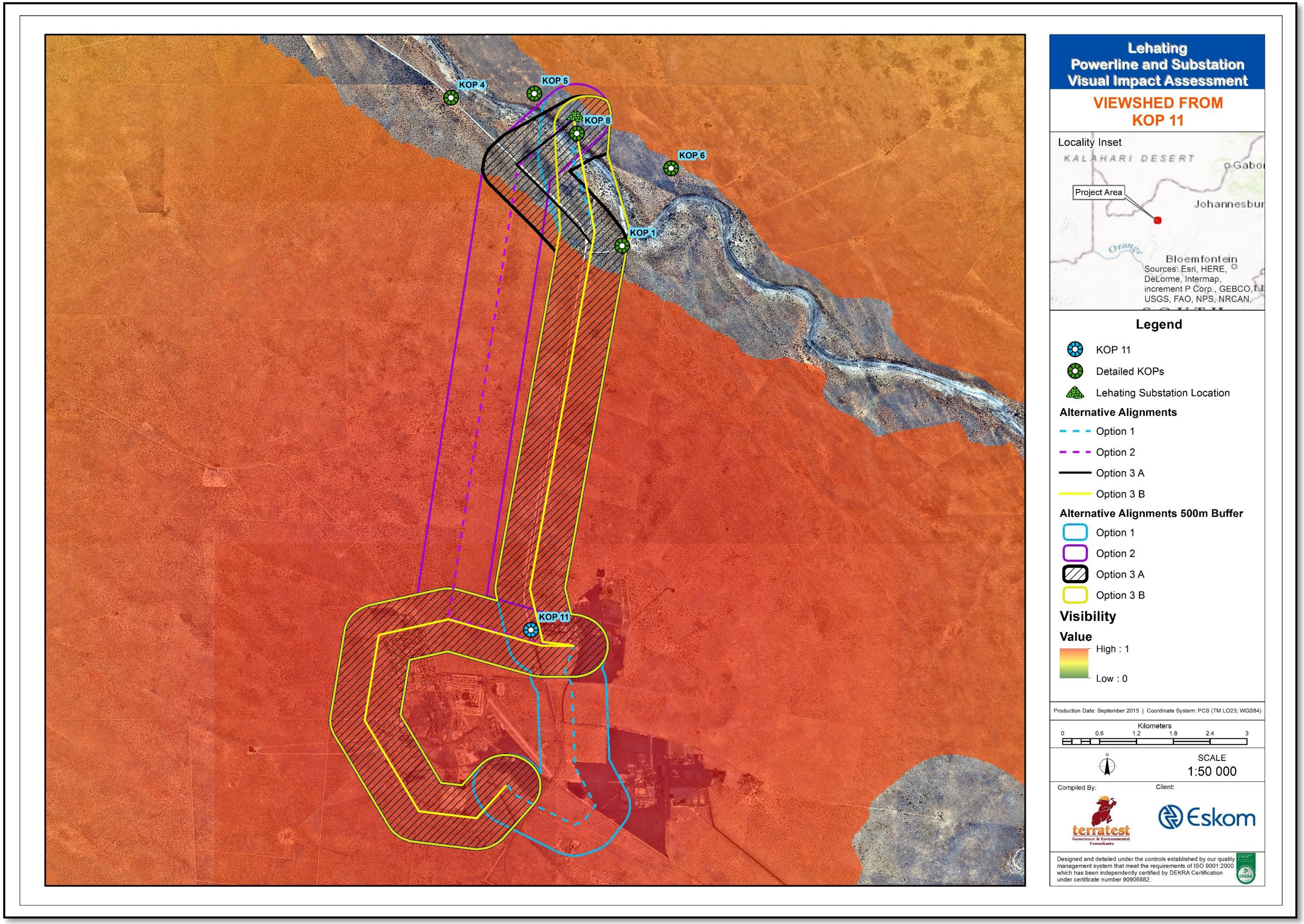

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Powerline and Substation
Visual Impact Assessment
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Alternative Alignments
Option 1
Option 2
Option 3 A
Option 3 B
Alternative Alignments 500m Buffer
Option 1
Option 2
Option 3 A
Option 3 B
Visibility
Value
High : 1
Low : 0
Production Date: September 2015 | Coordinate System: PCS (TM LO23; WGS84)
Kilometers
0 0.6 1.2 1.8 2.4 3
N
SCALE
1:50 000
Compiled By:
Client:
terratest
Eskom
Designed and detailed under the controls established by our quality management system that meet the requirements of ISO 9001:2000 which has been independently certified by DEKRA Certification under certificate number 90906882.