PROPOSED MOKOLO AND CROCODILE RIVER (WEST): WATER AUGMENTATION PROJECT (MCWAP)

PHASE 1
AUGMENT THE SUPPLY FROM MOKOLO DAM

VISUAL IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

Nemai Consulting was appointed by the Department of Water Affairs (DWA) as the independent Environmental Assessment Practitioner to undertake the Scoping and EIA Process for the proposed Mokolo and Crocodile River (West): Water Augmentation Project (MCWAP), Limpopo.

Axis Landscape Architecture cc was appointed by Nemai Consulting as a sub-consultant to complete a Visual Impact Assessment. This Visual Impact Assessment (VIA) is a specialist study that forms part of the EIA and addresses the visual affects of the augmentation of the water supply from Mokolo Dam on the receiving environment.

Two alternative corridors have been proposed from the Mokolo dam towards the Wolvenfontein Balancing Tanks as well as the MCWAP Phase 1 – Break Pressure Tank.

The study area contains the extent of all the two alternative corridors as well as the Balancing tanks and includes an approximate 5 km buffer area around them.

PROJECT DESCRIPTION

The following project components will occur during the construction and operational phases of the project and are identified as elements that may cause a potential landscape and/or visual impact:

- Construction camp and lay-down yard;
- Access roads;
- Cleared pipeline servitudes and
- Break Pressure Tank.

Of the four project components, the cleared servitude of the pipe line is expected to cause the greatest impacts. A brief description of the reservoir characteristics, the two alternatives and their individual routes are discussed in the following tables.

The Break Pressure Tank will be constructed in the Rietspruitnek on the farm Fancy. The reservoir will have an capacity of 5000m2, the maximum height will be 6 meters and will have an footprint of about 1200m2. It will consist of a concrete tank with a flat roof.

DESCRIPTION OF ALTERNATIVE CORRIDORS	
ALTERNATIVES	**DESCRIPTION**
Alternative A	Alternative A is proposed to run parallel with an existing local road that meanders down the gorge towards the Mokolo dam.
Alternative B	Alternative B is proposed to run from the Wolvenfontein balancing tanks in an eastern direction along a ridge until it meets up with Alternative A towards the Mokolo dam.

DESCRIPTION OF THE AFFECTED ENVIRONMENT

Broadly speaking surrounding study area can be described as bushveld and mountainous. The land cover is mainly made up of bushveld, woodland and some cultivated land. Generally the land use is composed of a mixture of game farming, grazing and agricultural activities as well as residential land use and vacant/unspecified land.

The study area falls within the Waterberg Tourism Region which forms part of the five tourism regions in Limpopo. This region is renowned for exceptional vistas, mountain gorges, clear streams and rolling bushveld hills and rich in indigenous species of plant and animal life.

FINDINGS AND RECOMMENDATIONS

LANDSCAPE CHARACTER SENSITIVITY

The sensitivity of the landscape character is an indication of "…the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002).

The topography around the study areas is typical of the area in general and is strongly rolling. Hills formed by resistant granite with deeply incised drainage lines result in a strongly rolling terrain, often with very steep gradients.

The study areas is characterised by game farming, residential development and some agricultural activities. This gives the area its unique value. The surrounding game farming and tourism activities preserve this unique landscape character.

VIEWER SENSITIVITY

Within the receiving environment, specific viewers (visual receptors) experience different views of the visual resource and value it differently. They will be affected because of alterations to their views due to the proposed project. The visual receptors are grouped according to their similarities. The visual receptors included in this study are:

- Residents;
- Tourists; and
- Motorists.

To determine visual receptor sensitivity a, commonly used rating system is utilised. This is a generic classification of visual receptors and enables the visual impact specialist to establish a logical and consistent visual receptor sensitivity rating for viewers who are involved in different activities without engaging in extensive public surveys.

SIGNIFICANCE OF VISUAL IMPACTS

A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The following tables summarise the visual impacts on residents, tourists and motorists.

VISUAL IMPACTS ON RESIDENTS

VISUAL IMPACT ON RESIDENTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative A	Unsightly views.	Local	Temporary	High	Definite	High	Moderate	High
Alternative B				Moderate	Probable	Moderate	Low	High
Break Pressure Tank				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative A	Negative – The presence of a cleared corridor and reservoir intrudes on existing views and spoils the open panoramic views of the landscape.	Local	Permanent	High	Definite	High	Moderate	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Moderate	Definite	Moderate	Low	High

Generally, the study areas are sparsely populated with the exception of some scattered Residential Estates with higher populations. The majority of residents live in the surrounding farms. The proposed servitudes run through the Sable Hills Eco Estate and will have and visual impact on the existing and future residents of this estate.

The servitude of Alternative A will be highly visible from some vantage points and erven in the Estate. Alternative B will only be visible while driving on the local roads at the end of the servitude next to the dam. During the construction phase the severity and visual intrusion of Alternative A will be high due to the exposed soil and enlarged servitude while Alternative B will be moderate due to the screening of the vegetation and topography. The severity during the operational phase will still be high due to the change in vegetation and exposed rocks but can be mitigated to moderate. The severity for Alternative B will be low due to the topography and vegetation that encloses the major part of this alternative.

The surrounding farm residents will experience limited intrusion on their views due to the presence of the proposed servitudes and reservoir. It is unpractical to discuss all, but they are recognised as the general population of the study area and are identified as affected visual receptors.

VISUAL IMPACTS ON TOURISTS

VISUAL IMPACT ON TOURISTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative A	Unsightly views and spoil the undisturbed views over the landscape.	Local	Temporary	Moderate	Probable	Moderate	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative A	Negative – The presence of a servitude and reservoir intrudes on existing views of the landscape	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Low	Definite	Low	Low	High

The study area is renowned for its biodiversity and Bushveld landscapes. These characteristics provide the basis for the tourism industry which plays a major role in the economy of the Limpopo Province. The entire study area is considered to have a high tourism potential.

VISUAL IMPACTS ON MOTORISTS

VISUAL IMPACT ON MOTORISTS								
Activity	**Nature of Impact**	**Extent of Impact**	**Duration of Impact**	**Severity of Impact**	**Probability of Impact**	**Significance without Mitigation**	**Significance with Mitigation**	**Level of Confidence**
Construction phase								
Alternative A	Negative – Intruding on existing views of the landscape.	local	Short period	Low	Probable	Low	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Low	Probable	Low	Low	High
Operational phase								
Alternative A	Negative – Intruding on existing views of the landscape.	Local	Short period	Low	Probable	Low	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Low	Probable	Low	Low	High

The major route in the study area is the R510 connecting the towns, tourism destinations and farms. The secondary road network in the study area carries a much lower volume of motorists. Many of the roads are gravel roads which are mostly utilised by the local residents. Their duration of views will be temporary and it is expected that the visual intrusion that they will experience will be low.

RECOMMENDED MITIGATION MEASURES

In most cases, the landscape and visual impacts occurring during the construction phase can be mitigated relatively effectively. Rehabilitation of the disturbed areas will prevent the exposure of soil, which may cause a reduction in the visual quality of the study area. Sensitive positioning of the construction camp and lay-down yard should take advantage of the natural screening capacity of the study area by locating the camps outside of the views of sensitive visual receptors.

CONCLUSION

The two alternative servitudes and reservoir have been evaluated against international accepted criteria to determine the impact they will have on the landscape character and the viewers that have been identified in the study area.

The alternative servitudes are rated according to preference by using a two-point rating system in Table 8, three (3) being the most preferred, to one (1) being the least preferred. The preference rating is informed by the impact assessment discussions in Section 5 and the overall performance of each alternative with regards to the impact on the landscape character and the identified viewers.

Table 1: Evaluation of alternative alignments

ALTERNATIVES	PREFERENCE RATING
Alternative A	1
Alternative B	2

Alternative B is regarded as the most preferred alternative. Its alignment along the ridge and dense vegetation is considered to cause the least impact on the landscape character due to the visibility of the landscape.

The impact of Alternative B on visual receptors varies between residents, tourists and motorists. Alternative B's great advantage lies in the less significant landscape and visual impact on the residents as compared to the other alternative.

The impact of the Break Pressure Tank is moderately low on the residents, tourists and motorists and the impact can be easily mitigated to low.

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LIST OF ABBREVIATIONS

EIA	Environmental Impact Assessment.
FHWA	Federal Highway Administration of the United States Department of Transportation. The publishers of the guide "*Visual Impact Assessment for High Projects*" 1981.
LCA	Landscape Character Assessment.
LT	Landscape Type
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment.
ULI	Urban Land Institute
ZVI	Zone of Visual Influence.

1. INTRODUCTION

Nemai Consulting was appointed by the Department of Water Affairs (DWA) as the independent Environmental Assessment Practitioner to undertake the Scoping and EIA Process for the proposed Mokolo and Crocodile River (West): Water Augmentation Project (MCWAP), Limpopo.

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Two alternative corridors have been proposed from the Mokolo dam towards the Wolvenfontein Balancing Tanks as well as the MCWAP Phase 1 – Break Pressure Tank.

The study area contains the extent of the two alternative corridors as well as the Balancing tanks and includes an approximate 5 km buffer area around them.

1.1. BACKGROUND AND BRIEF

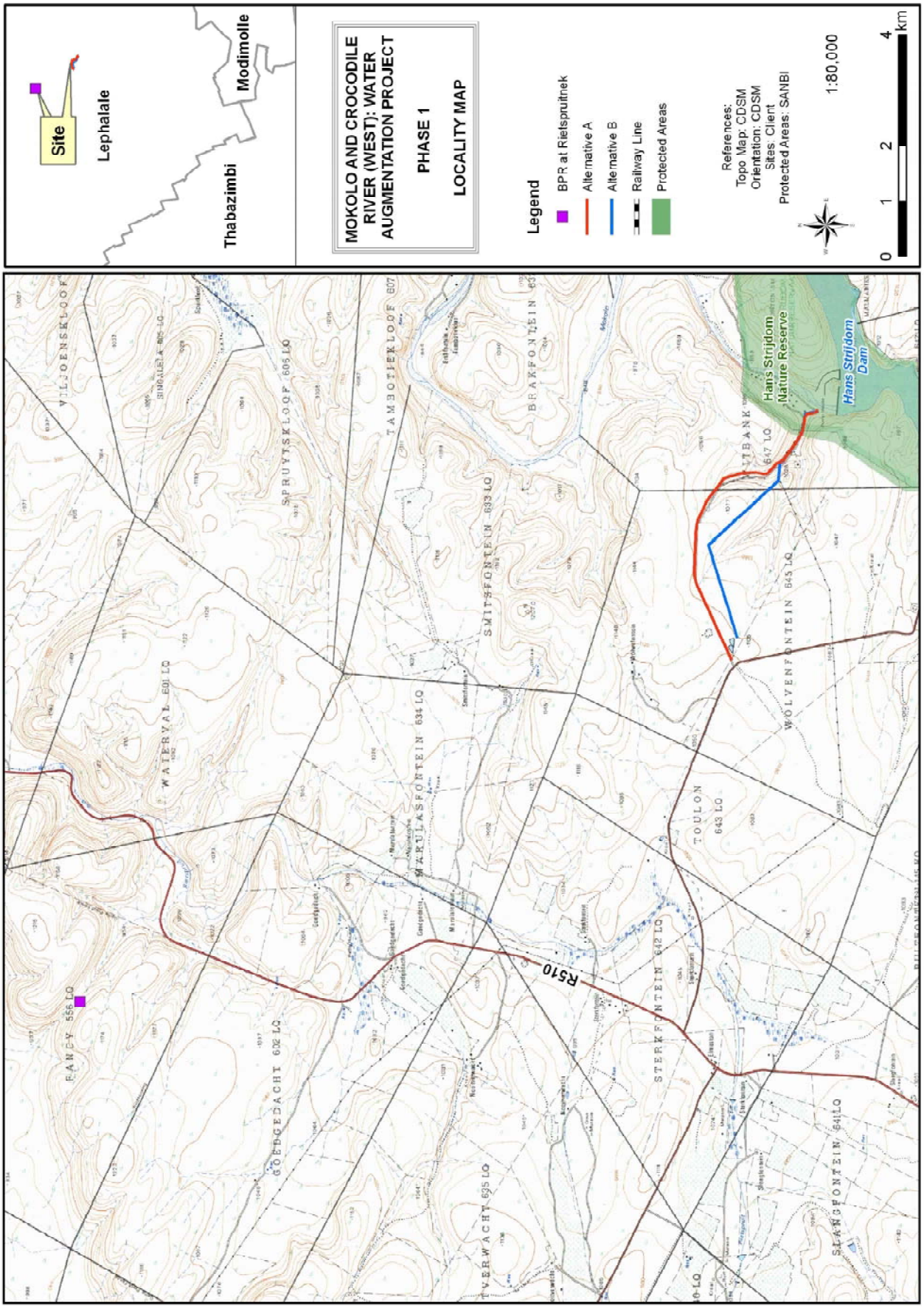
This VIA will conform to the requirements of a level two assessment which requires the realisation of the following objectives (Adapted from Oberholzer (2005)):

- Determination of the extent of the study area;
- Description of the proposed project and the receiving environment;
- Identification and description of the landscape character of the study area;
- Identification of landscape- and visual receptors in the study area that will be affected by the proposed project;
- Brief indication of potential landscape- and visual impacts;
- Brief recommendations of mitigation measures to reduce and/or alleviate the potential adverse landscape- and visual impacts.

1.2. STUDY AREA

There are two study areas. The one study area includes the area covered by the alternative corridors from the Mokolo dam towards the Wolvenfontein Balancing Tanks. The study area fall on the farm Wolvenfontein and Witbank, 10km east of the R510 on a dirt road towards the Mokolo dam. The second study area is around the Break Pressure Tank at Rietspruitnek on the farm Fancy, 7km west of the R510 on the Kuipersbuilt road. (Figure 1).

Figure 1: Locality Plan



2. STUDY APPROACH

2.1. INFORMATION BASE

This assessment was based on information from the following sources:

- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town and ECOGIS (2010) respectively;
- Observations made and photographs taken during site visits;
- Professional judgement based on experience gained from similar projects; and
- Literature research on similar projects.

2.2. ASSUMPTIONS AND LIMITATIONS

This assessment was undertaken during the conceptual stage of the project and is based on information available at the time.

- The exact alignment of the proposed corridor and position of the balancing tank are not yet determined and the alternatives only specify proposed corridors. The visibility results have been generated from the anticipated alignment and may deviate from the route for the final approved alignment. The differences are considered omissible;
- This level of assessment excludes surveys to establish viewer preference and thereby their sensitivity. Viewer sensitivity is determined by means of a commonly used rating system (Table 10).

2.3. LEVEL OF CONFIDENCE

The level of confidence assigned to the findings of this assessment is based on:

- The level of information available and/or understanding of the study area (rated 2); and
- The information available and/or knowledge and experience of the project (rated 3).

This visual impact assessment is rated with a general confidence level of 6. This rating indicates that the author's general confidence in the accuracy of the findings is *high* (Table 9). Where the confidence level of specific findings is not regarded as high, it is noted in the last column of each impact assessment table.

2.4. METHOD

A broad overview of the approach and methodology used in this assessment is provided below:

- The extent of the study area is determined and indicated in Figure1;
- The site is visited to establish a photographic record of the site, views and areas of particular visual quality and or -value;
- The project components and activities are described and assessed as potential elements of visual and landscape impacts;
- The receiving environment is described in terms of its prevailing landscape- and visual character;
- Landscape- and visual receptors that may be affected by the proposed project are identified and described;
- Mitigation measures are proposed to reduce adverse impacts; and
- The findings of the study are documented in this Visual Impact Assessment.

3. PROJECT DESCRIPTION

3.1. OVERVIEW OF DEVELOPMENT

The project involves the construction of a pipeline from the Mokolo dam towards the Wolvenfontein balancing tanks and an Break Pressure Tank at Rietspruitnek, Limpopo Province. The servitude required for the pipeline along the route is 20m wide and the footprint of the Reservoir will be 1200m^2 and 6m high.

3.2. ALTERNATIVE CORRIDORS

Table 2: Description of alternative corridors

ALTERNATIVES	DESCRIPTION (Refer to Figure 1)
Alternative A	Alternative A is proposed to run parallel with an existing local road that meanders down the gorge towards the Mokolo dam.
Alternative B	Alternative B is proposed to run from the Wolvenfontein balancing tanks in an eastern direction along a ridge until it meets up with Alternative A towards the Mokolo dam.

3.3. BREAK PRESSURE TANK

The Break Pressure Tank will be constructed in the Rietspruitnek on the farm Fancy. The reservoir will have an capacity of 5000m^2, the maximum height will be 6 meters and will have an footprint of about 1200m^2. It will consist of a concrete tank with a flat roof.

3.4. PROJECT COMPONENTS AND ACTIVITIES

Each project component and activity will affect the receiving environment differently and is therefore discussed separately. The following project components will occur during the construction and operational phases of the project and are identified as elements that may cause a potential landscape and/or visual impact:

3.4.1. CONSTRUCTION CAMPS AND LAY-DOWN YARDS

Temporary construction camps will be present for the duration of the construction period. The appointed contractor will set up a construction camp along the corridors where practical. The material lay-down yard is expected to be located adjacent the construction camp and will serve as a storage area for the construction material and equipment.

3.4.2. ACCESS ROADS

Where no access roads are available and vehicular access is required, roads will be constructed. Access may be by means of a two-track dirt road or a cleared corridor. It is expected that roads will be rehabilitated after the construction phase or maintained to facilitate access during periodic maintenance visits.

3.5. VISUAL CHARACTERISTICS OF PROJECT COMPONENTS

Visual character is based on human perception and the observer's response to the relationships between and composition of the visible project components. The cleared servitude and build reservoir will be the most visible and permanent project component and is discussed in this section.

The cleared servitude will create a broad linear line element accentuated by disturbed soil, rocks on the edges and low growing grassland vegetation within a homogenous bushveld character with medium to high growing vegetation. The reservoir will have an industrial character enforced by the concrete appearance and shape of the tank. The cleared servitude emphasise the linear character of the pipe line and the size and position of the tank will not be easily absorbed in the background when viewed from distances greater than 1 km.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

Landscape and visual impacts may result from changes to the landscape. A distinction should be made between impacts on the visual resource (landscape) and on the viewers. The former are impacts on the physical landscape that may result in changes to landscape character while the latter are impacts on the viewers themselves and the views they experience.

4.1. VISUAL RESOURCE

Visual resource is an encompassing term relating to the visible landscape and its recognisable elements, which through their co-existence, result in a particular landscape character.

The area surrounding study area can be described as bushveld and mountainous. The land cover is mainly made up of bushveld, woodland and some cultivated land. Generally the land use is composed of a mixture of game farming, grazing and agricultural activities as well as residential land use and vacant/unspecified land.

The study area falls within the Waterberg Tourism Region which forms part of the five tourism regions in Limpopo. This region is renowned for exceptional vistas, mountain gorges, clear streams and rolling bushveld hills and rich in indigenous species of plant and animal life.

4.1.1. LANDSCAPE CHARACTER ASSESSMENT

Landscape Character Assessment (LCA) is concerned primarily with the observable elements, components or features within a landscape that individually and collectively define the landscape characteristics**.**

The topography around the study areas is typical of the area in general and is strongly rolling. Hills formed by resistant granite with deeply incised drainage lines result in a strongly rolling terrain, often with very steep gradients.

The study areas is characterised by game farming, residential development and some agricultural activities. This gives the area its unique value. The surrounding game farming and tourism activities preserve this unique landscape character.

4.1.2. VISUAL CHARACTER

Visual character is based on human perception and the observer's response to the relationships between and composition of the landscape, the land uses and identifiable elements in the landscape. The description of the visual character includes an assessment of the scenic attractiveness regarding those landscape attributes that have aesthetic value and contribute significantly to the visual quality of the views, vistas and/or viewpoints of the study area.

The openness of the landscape is greatly responsible for the simplistic and essentially secluded landscape character. Vast landscapes and vistas are dominated by medium and high growing vegetation. The panoramic landscape is an amenity that greatly contributes to the rural and remote character of the landscape.

4.1.2.1 Visual Quality

Visual quality is a qualitative evaluation of the composition of landscape components and their excellence in scenic attractiveness. Many factors contribute to the visual quality of the landscape and are grouped under the following main categories (Table 3) that are internationally accepted indicators of visual quality (FHWA, 1981):

Table 3: Criteria of Visual Quality (FHWA, 1981)

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 landscape 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 landscape is allocated a rating from an evaluation scale of 1 to 7 and divided by 3 to get an average. The evaluation scale is as follows: Very Low =1; Low =2; Moderately Low =3; Moderate =4; Moderately High =5; High =6; Very High =7;

The regional landscape is assessed against each indicator separately. All three indicators should be *high* to obtain a *high* visual quality. The evaluation is summarised in Table 4.

Table 4: Visual Quality of the regional landscape

VIVIDNESS	INTACTNESS	UNITY	VISUAL QUALITY
5	5	5	Moderately High

The moderately high visual quality can be attributed to areas with less human intervention and with natural features.

4.1.2.2 Visual absorption capacity

Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value. VAC is founded on the characteristics of the physical environment such as:

- Degree of visual screening:
  - A degree of visual screening is provided by landforms, vegetation cover and/or structures such as buildings. For example, a high degree of visual screening is present in an area that is mountainous and is covered with a forest compared to an undulating an mundane landscape covered in grass;
- Terrain variability:
  - Terrain variability reflects the magnitude of topographic elevation and diversity in slope variation. A highly variable terrain will be recognised as one with great elevation differences and a diversity of slope variation creating talus slopes, cliffs and valleys. An undulating landscape with a monotonous and repetitive landform will be an example of a low terrain variability;
- Land cover:
  - Land cover refers to the perceivable surface of the landscape and the diversity of patterns, colours and textures that are presented by the particular land cover (i.e. urbanised, cultivated, forested, etc.);

A basic rating system is used to evaluate the three VAC parameters. The values are relative and relate to the type of project that is proposed and how it may be absorbed in the landscape (Table 5). A three value range is used; three (3) being the highest potential to absorb an element in the landscape and one (1) being the lowest potential. The values are counted together and categorised in a *high*, *medium* or *low* VAC rating.

Table 5: Regional Visual Absorption Capacity evaluation

VISUAL SCREENING	TERRAIN VARIABILITY	LAND COVER	VAC
2	3	3	Moderately high

The VAC of the study area is considered be moderately high and provides screening capacity for this project. The moderately high VAC relates to the topography and predominantly bushveld vegetation. The regular forms and associated vertical posture of the proposed water line and reservoir are unlike the undulating and uniform appearance of the topography.

The less prominent project components such as access roads are expected to be visually absorbed to a greater degree in the landscape. The relative modest scale and extent of the project components are more readily accepted and will not create major alterations to the landscape character.

Figure 2: Photo Reference Map

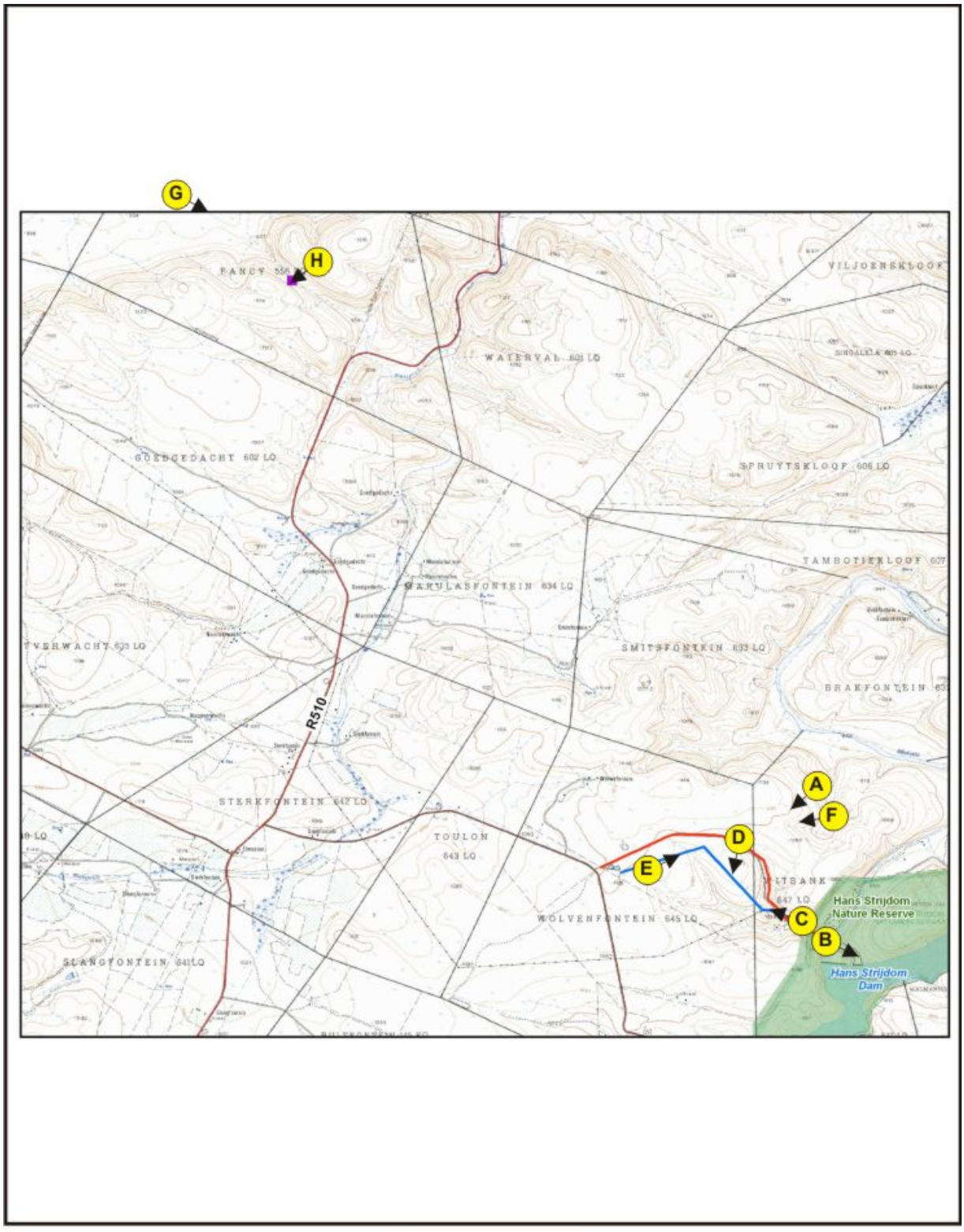


Figure 3: Photo plate 1

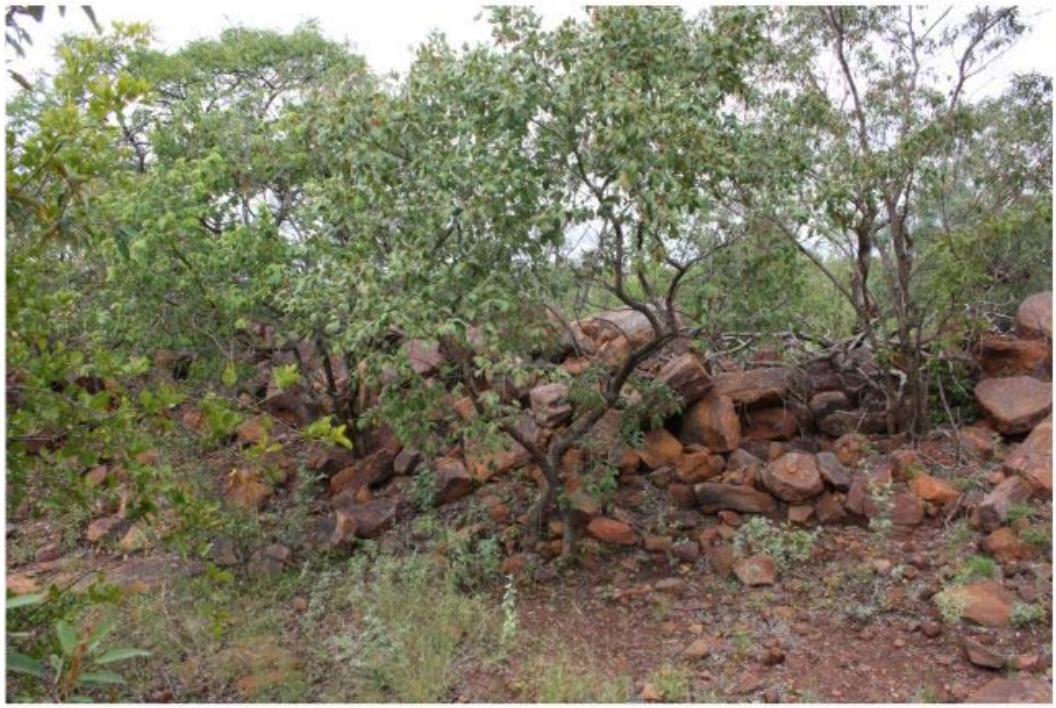
VIEW A: BUSHVELD LANDSCAPE CHARACTER

VIEW B: VIEW TOWARDS MOKOLO DAM, NOTE THE EXPOSED ROCK AND SLOW REHABILITATION

SITE CONTEXT PHOTO'S PROPOSED MOKOLO AND CROCODILE RIVER (WEST): WATER AUGMENTATION PROJECT (MCWAP)	Compiled for: Nemai Consulting Reference:MCWAP2010- LANDS TYPES-A4.cdr Date: 2010-02-11	AXIS LANDSCAPE ARCHITECTURE

Figure 4: Photo plate 2

VIEW C: VIEW FROM LOCAL ROAD TOWARDS ALTERNATIVE B COMING DOWN THE NECK



VIEW D: VIEW OF EXISTING PIPELINE, ROCKS CREATE A BARRIER IN THE LANDSCAPE

SITE CONTEXT PHOTO'S PROPOSED MOKOLO AND CROCODILE RIVER (WEST): WATER AUGMENTATION PROJECT (MCWAP)	Compiled for: Nemai Consulting Reference:MCWAP2010- LANDS TYPES-A4.cdr Date: 2010-02-11	AXIS LANDSCAPE ARCHITECTURE

Figure 5: Photo plate 3

VIEW E: VIEW TOWARDS ALTERNATIVE B ON LOCAL FARM ROAD

VIEW F: VIEW TOWARDS FARM ROAD AND ALTERNATIVE A NEXT TO IT FROM RESIDENTIAL PLOT

SITE CONTEXT PHOTO'S	Compiled for: Nemai Consulting Reference:MCWAP2010- LANDS TYPES-A4.cdr Date: 2010-02-11	AXIS LANDSCAPE ARCHITECTURE
PROPOSED MOKOLO AND CROCODILE RIVER (WEST): WATER AUGMENTATION PROJECT (MCWAP)		

Figure 6: Photo plate 4

VIEW G: VIEW FROM THE FARM FANCY TOWARDS THE RESERVOIR IN RIETSPRUITNEK

VIEW H: PROPOSED POSITION OF THE OPERATIONAL RESERVOIR AT RIETSPRUITNEK

SITE CONTEXT PHOTO'S	Compiled for: Nemai Consulting Reference:MCWAP2010- LANDS TYPES-A4.cdr Date: 2010-02-11	AXIS LANDSCAPE ARCHITECTURE
PROPOSED MOKOLO AND CROCODILE RIVER (WEST): WATER AUGMENTATION PROJECT (MCWAP)		

5. IMPACT ASSESSMENT

The significance of impacts is a comparative function relating to the severity of the identified impacts on the respective receptors. The significance of an impact is considered *high* should a *highly* sensitive receptor be exposed to a *highly* severe impact (Table 6).

Table 6: Significance of impacts

RECEPTOR SENSITIVITY	IMPACT SEVERITY		
	LOW	MEDIUM	HIGH
LOW	No significance	Low	Low
MEDIUM	Low	Medium	Medium
HIGH	Low	Medium	High

5.1. SIGNIFICANCE OF LANDSCAPE IMPACT

5.1.1. LANDSCAPE CHARACTER SENSITIVITY

The sensitivity of the landscape character is an indication of "…the degree to which a particular landscape can accommodate change from a particular development, without detrimental effects on its character" (GLVIA, 2002). A landscape with a *high* sensitivity would be one that is greatly valued for its aesthetic attractiveness and/or have ecological, cultural or social importance through which it contributes to the inherent character of the visual resource.

The majority of the study area is considered to have high landscape character sensitivity due to the relative undeveloped condition of the landscape, the high visual quality and associated tourism value. The terrain variability in the study area is high and thus a moderately high VAC can be expected. Generally the vegetation cover consists of medium to high shrubs and trees, which will provide visual screening for the proposed pipe line and reservoir.

Previous human induced activities and interventions have negatively impacted the original landscape character. In this case, farming and existing infrastructure, including power lines, roads, etc., can be classified as landscape disturbances and elements that cause a reduction in the condition of the affected landscape type and negatively affect the quality of the visual resource.

The assessment of the landscape is substantiated through professional judgement and informed reasoning which is based on the landscape character assessment in Section 4. A landscape sensitivity rating was adapted from GOSW (2006) (Table 7) and applied in the classification of the study area into different sensitivity zones.

Figure 7 to Figure 9 reflects the results of a visibility assessment, carried out using GIS software. . The results provide a clear interpretation of the extent of the visual influence and also provide an indication of the land use that can be expected in the affected areas. Through the integration of different GIS datasets it is possible to identify areas along the alternative corridors and reservoir that may cause higher impacts. It is hover based in the topography and do not take in account the vegetation. Alternative B's greatest advantage is the vegetation cover it gets.

Table 7: Landscape character sensitivity rating (Adapted from GOSW, 2006)

	DESCRIPTION
Low sensitivity	These landscapes are likely to: ◦ Have distinct and well-defined landforms; ◦ Have a strong sense of enclosure; ◦ Provide a high degree of screening; ◦ Have been affected by extensive development or man-made features; ◦ Have reduced tranquillity; ◦ Are likely to have little inter-visibility with adjacent landscapes; and ◦ Exhibit no or a low density of sensitive landscape features that bare visual value.
Moderately sensitivity	These landscapes are likely to: ◦ Have a moderately elevated topography with reasonably distinct landforms that provides some sense of enclosure; ◦ Have been affected by several man-made features; ◦ Have limited inter-visibility with adjacent landscapes; and ◦ Exhibit a moderate density of sensitive landscape features that bare visual value.
Highly sensitivity	These landscapes are likely to: ◦ Consist mainly of undulating plains and poorly defined landforms; ◦ Be open or exposed with a remote character and an absence of man-made features; ◦ Are often highly visible from adjacent landscapes; and ◦ Exhibit a high density of sensitive landscape features that bare visual value.

Figure 7: Alternative A

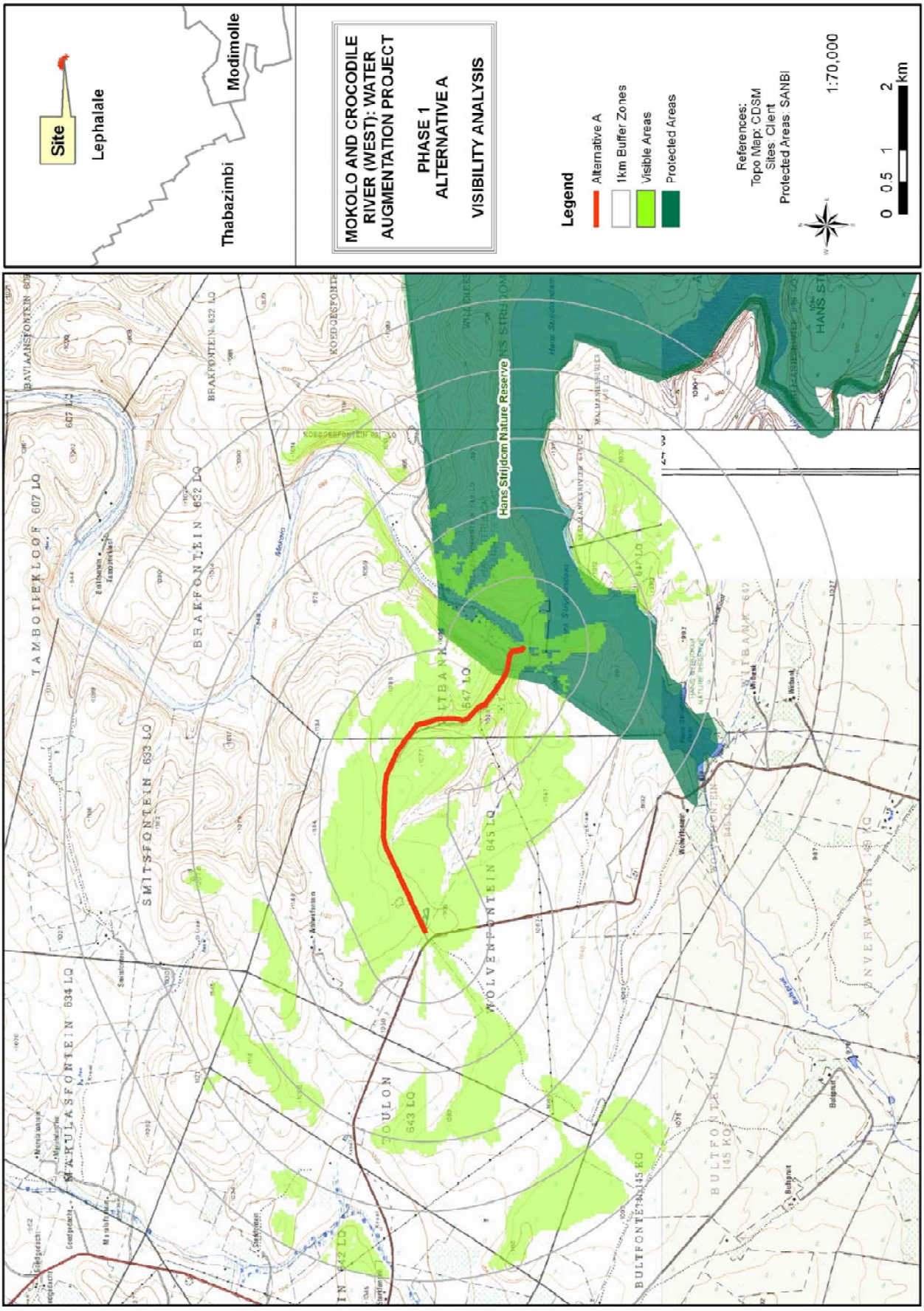


Figure 8: Alternative B

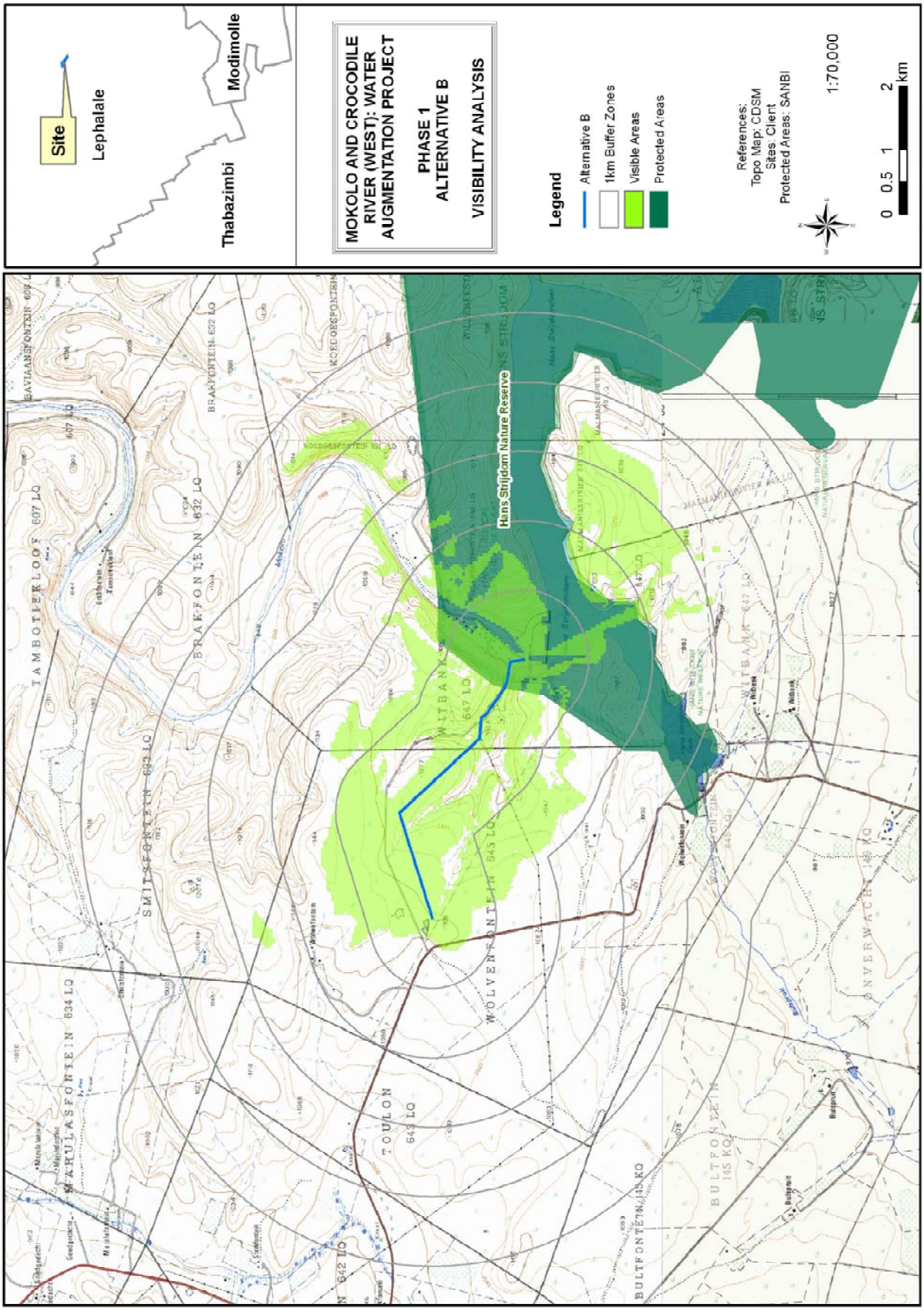
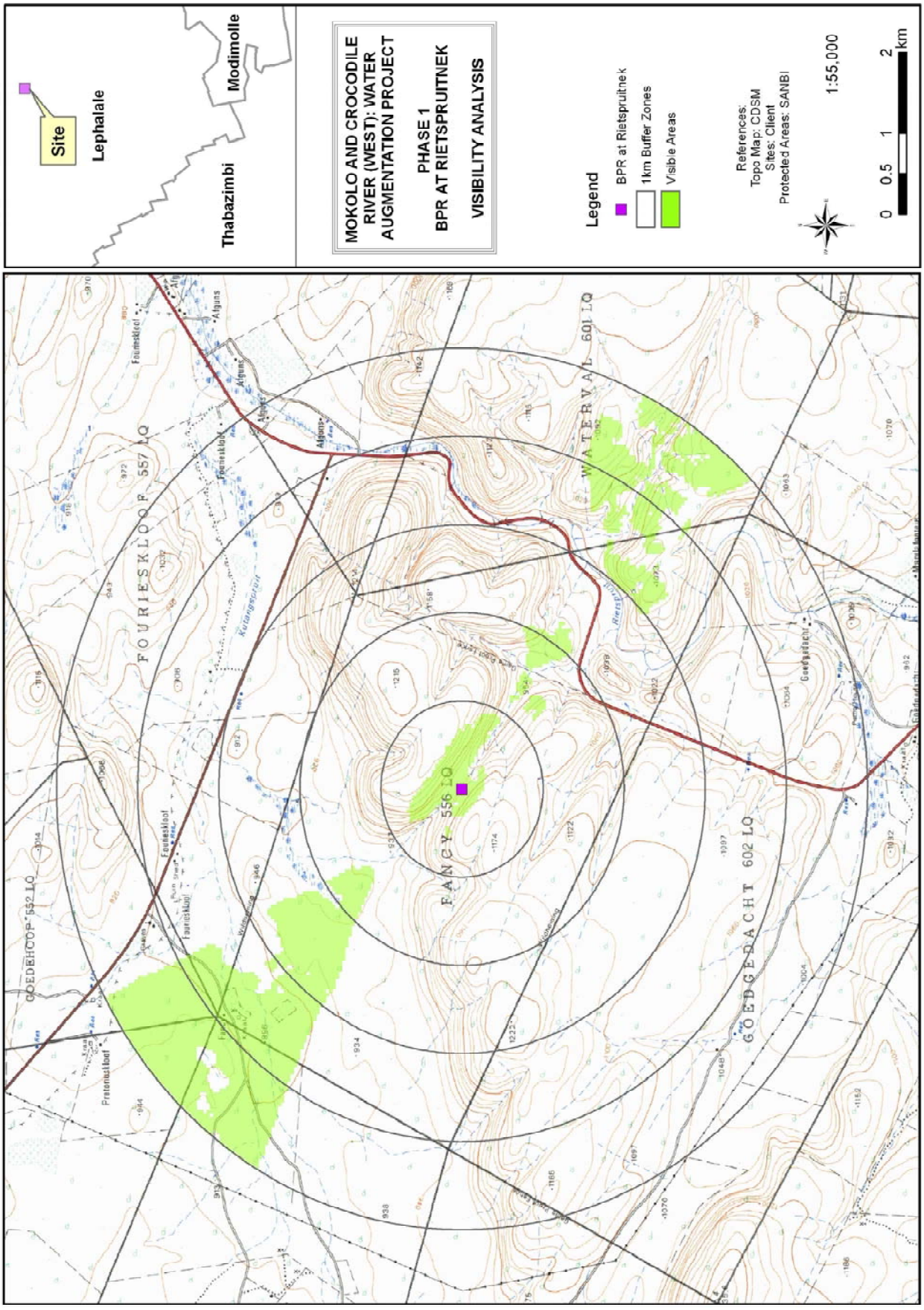


Figure 9: Break Pressure Tank at Rietspruitnek



5.2. SIGNIFICANCE OF VISUAL IMPACTS

5.2.1. VIEWER SENSITIVITY

Within the receiving environment, specific viewers (visual receptors) experience different views of the visual resource and value it differently. They will be affected because of alterations to their views due to the proposed project. The visual receptors are grouped according to their similarities. The visual receptors included in this study are:

- Residents;
- Tourists; and
- Motorists.

To determine visual receptor sensitivity a commonly used rating system is utilised. This is a generic classification of visual receptors and enables the visual impact specialist to establish a logical and consistent visual receptor sensitivity rating for viewers who are involved in different activities without engaging in extensive public surveys.

5.2.1.1 Residents

Residents of the affected environment are classified as visual receptors of *high* sensitivity owing to their sustained visual exposure to the proposed development as well as their attentive interest towards their living environment.

5.2.1.2 Tourists

Tourists are regarded as visual receptors of exceptional *high* sensitivity. Their attention is focused towards the landscape which they essentially utilise for enjoyment purposes and appreciation of the quality of the landscape.

5.2.1.3 Motorists

Motorists are generally classified as visual receptors of *low* sensitivity due to their momentary view and experience of the proposed development. As a motorist's speed increases, the sharpness of lateral vision declines and the motorist tends to focus on the line of travel (USDOT, 1981). This adds weight to the assumption that under normal conditions, motorists will show *low* levels of sensitivity as their attention is focused on the road and their exposure to roadside objects is brief.

Motorists on the scenic routes in the study area will present a higher sensitivity. Their reason for being in the landscape is similar to that of the tourists and they will therefore be categorised as part of the tourist viewer group.

5.2.2. SEVERITY OF POTENTIAL VISUAL IMPACTS

Severity of visual impact refers to the magnitude of change to specific visual receptor's views and/or experience of the landscape. Severity of visual impact is influenced by the following factors:

- The **viewer's exposure** to the project:
  - Distance of observers from the proposed project;
  - The visibility of the proposed project (ZVI);
  - Number of affected viewers; and
  - Duration of views to development experienced by affected viewers.
- Degree of **visual intrusion** created by the project.

A complex landscape setting with a diverse land cover and topographical variation has the ability to decrease the severity of visual impact more than a mundane landscape (Bishop *et al*, 1985).

The Zone of Visual Influence (ZVI) is determined through a Geographical Information System (GIS). The result reflects a shaded pattern which identifies the areas that are expected to experience views of the proposed alignments. The ZVI is limited to 5 km from the proposed servitudes and reservoir.

5.2.2.1 Potential visual impacts on residents

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative A	Unsightly views.	Local	Temporary	High	Definite	High	Moderate	High
Alternative B				Moderate	Probable	Moderate	Low	High
Break Pressure Tank				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative A	Negative – The presence of a cleared corridor and reservoir intrudes on existing views and spoils the open panoramic views of the landscape.	Local	Permanent	High	Definite	High	Moderate	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Moderate	Definite	Moderate	Low	High

Generally, the study areas are sparsely populated with the exception of some scattered Residential Estates with higher populations. The majority of residents live in the surrounding farms. The proposed servitudes run through the Sable Hills Eco Estate and will have and visual impact on the existing and future residents of this estate.

The servitude of Alternative A will be highly visible from some vantage points and erven in the Estate. Alternative B will only be visible while driving on the local roads at the end of the servitude next to the dam. During the construction phase the severity and visual intrusion of Alternative A will be high due to the exposed soil and enlarged servitude while Alternative B will be moderate due to the screening of the vegetation and topography. The severity during the operational phase will still be high due to the change in vegetation and exposed rocks but can be mitigated to moderate. The severity for Alternative B will be low due to the topography and vegetation that encloses the major part of this alternative.

The surrounding farm residents will experience limited intrusion on their views due to the presence of the proposed servitudes and reservoir. It is unpractical to discuss all, but they are recognised as the general population of the study area and are identified as affected visual receptors.

5.2.2.2 Potential visual impacts on tourists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative A	Unsightly views and spoil the undisturbed views over the landscape.	Local	Temporary	Moderate	Probable	Moderate	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Moderate	Probable	Moderate	Low	High
Operational phase								
Alternative A	Negative – The presence of a servitude and reservoir intrudes on existing views of the landscape	Local	Permanent	Moderate	Definite	Moderate	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Low	Definite	Low	Low	High

The study area is renowned for its biodiversity and Bushveld landscapes. These characteristics provide the basis for the tourism industry which plays a major role in the economy of the Limpopo Province. The entire study area is considered to have a high tourism potential.

5.2.2.3 Potential visual impacts on motorists

Activity	Nature of Impact	Extent of Impact	Duration of Impact	Severity of Impact	Probability of Impact	Significance without Mitigation	Significance with Mitigation	Level of Confidence
Construction phase								
Alternative A	Negative – Intruding on existing views of the landscape.	local	Short period	Low	Probable	Low	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Low	Probable	Low	Low	High
Operational phase								
Alternative A	Negative – Intruding on existing views of the landscape.	Local	Short period	Low	Probable	Low	Low	High
Alternative B				Low	Probable	Low	Low	High
Break Pressure Tank				Low	Probable	Low	Low	High

The major route in the study area is the R510 connecting the towns, tourism destinations and farms. The secondary road network in the study area carries a much lower volume of motorists. Many of the roads are gravel roads which are mostly utilised by the local residents. Their duration of views will be temporary and it is expected that the visual intrusion that they will experience will be low.

6. RECOMMENDED MITIGATION MEASURES

The aim of mitigation is to reduce or alleviate the intrusive contrast between the proposed project components and activities, and the receiving landscape to a point where it is acceptable to visual and landscape receptors.

6.1. GENERAL

- Proceed, if possible, with construction of the pipe line during the off peak tourism season;
- Where areas are going to be disturbed through the destruction of vegetation, for example the establishment of the construction camp, the vegetation occurring in the area to be disturbed must be salvaged and kept in a controlled environment such as a nursery, for future re-planting in the disturbed areas as a measure of rehabilitation;
- Remove rubble and other building rubbish off site as soon as possible or place it in containers in order to keep the construction site free from additional unsightly elements;
- Construct the pipeline and conveyor systems, if possible, during the winter when contrast with the landscape will be least; and
- If construction is necessary during night time, light sources should be directed away from residents and roads as to prevent obtrusive lighting.

6.2. CLEARED SERVITUDES

- Reintroduce some of the excavated rocks in the landscape in a manner that imitate the surrounding exposed rocks, avoid creating heaps and ridges of exposed rocks;
- Avoid a continuous linear path of cleared vegetation that would strongly contrast with the surrounding landscape character Shape the edge of the corridor by widening and narrowing it, creating and organic line for the corridor. Avoid creating a strong linear line at the edges;
- Rehabilitate disturbed areas along the servitude as soon as practically possible after construction. This should be done to restrict extended periods of exposed soil; and
- Retain the existing vegetation cover of the site through selective clearing. Where practical, protect existing vegetation clumps during the construction phase in order to facilitate screening during construction and operational phases.

6.3. BREAK PRESSURE TANK

- Create soil and rock berms that are rehabilitated with salvaged plants and trees around the reservoir to from a visual barrier.

6.4. ACCESS ROUTES

- Make use of existing access roads where possible;
- Locate access routes so as to limit modification to the topography and to avoid the removal of established vegetation;
- Access routes should be located on the perimeter of disturbed areas such as cultivated/fallow lands as not to fragment intact vegetated areas; and
- If it is necessary to clear vegetation for a road, avoid doing so in a continuous straight line. Alternatively, curve the road in order to reduce the visible extent of the cleared corridor.

7. CONCLUSION

The two alternative servitudes and reservoir have been evaluated against international accepted criteria to determine the impact they will have on the landscape character and the viewers that have been identified in the study area.

The alternative servitudes are rated according to preference by using a two-point rating system in Table 8, three (3) being the most preferred, to one (1) being the least preferred. The preference rating is informed by the impact assessment discussions in Section 5 and the overall performance of each alternative with regards to the impact on the landscape character and the identified viewers.

Table 8: Evaluation of alternative servitudes

ALTERNATIVES	PREFERENCE RATING
Alternative A	1
Alternative B	2

Alternative B is regarded as the most preferred alternative. Its alignment along the ridge and dense vegetation is considered to cause the least impact on the landscape character due to the visibility of the landscape.

The impact of Alternative B on visual receptors varies between residents, tourists and motorists. Alternative B's great advantage lies in the less significant landscape and visual impact on the residents as compared to the other alternative.

The impact of the Break Pressure Tank is moderately low on the residents, tourists and motorists and the impact can be easily mitigated to low.

GLOSSARY OF TERMS

Aesthetics	The science or philosophy concerned with the quality of sensory experience. (ULI, 1980)
Horizon contour	A line that encircles a development site and that follows ridgelines where the sky forms the backdrop and no landform is visible as a background. This is essentially the skyline that when followed through the full 360-degree arc as viewed from a representative point on the site defines the visual envelope of the development. This defines the boundary outside which the development would not be visible.
Landscape characterisation/ character	This covers the gathering of information during the desktop study and field survey work relating to the existing elements, features, and extent of the landscape (character). It includes the analysis and evaluation of the above and the supporting illustration and documentary evidence.
Landscape condition	Refers to the state of the landscape of the area making up the site and that of the study area in general. Factors affecting the condition of the landscape can include the level maintenance and management of individual landscape elements such as buildings, woodlands etc and the degree of disturbance of landscape elements by non-characteristics elements such as invasive tree species in a grassland or car wrecks in a field.
Landscape impact	Changes to the physical landscape resulting from the development that include; the removal of existing landscape elements and features, the addition of new elements associated with the development and altering of existing landscape elements or features in such as way as to have a detrimental affect on the value of the landscape.
Landscape unit	A landscape unit can be interpreted as an "outdoor room" which are enclosed by clearly defined landforms or vegetation. Views within a landscape unit are contained and face inward.
Sense of place	That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. A more emotive sense of place is that of local identity and attachment for a place "*which begins as undifferentiated space* [and] *becomes place as we get to know it better and endow it with value*" (Tuan 1977)[1].
Viewer exposure	The extent to which viewers are exposed to views of the landscape in which the proposed development will be located. Viewer exposure considers the visibility of the site, the viewing conditions, the viewing distance, the number of viewers affected, the activity of the viewers (tourists or workers) and the duration of the views.
Viewer sensitivity	The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.
Visual absorption capacity (VAC)	The inherent ability of a landscape to accept change or modification to the landscape character and/or visual character without diminishment of the visual quality or value, or the loss of visual amenity. A high VAC rating implies a high ability to absorb visual impacts while a low VAC implies a low ability to absorb or conceal visual impacts.

[1] Cited in Climate Change and Our 'Sense of Place', http://www.ucsusa.org/greatlakes/glimpactplace.html

Visual amenity	The notable features such as hills or mountains or distinctive vegetation cover such as forests and fields of colour that can be identified in the landscape and described. Also included are recognised views and viewpoints, vistas, areas of scenic beauty and areas that are protected in part for their visual value.
Visual character	This addresses the viewer response to the landscape elements and the relationship between these elements that can be interpreted in terms of aesthetic characteristics such as pattern, scale, diversity, continuity and dominance.
Visual contour	The outer perimeter of the visual envelope determined from the site of the development. The two dimensional representation on plan of the horizon contour.
Visual contrast	The degree to which the physical characteristics of the proposed development differ from that of the landscape elements and the visual character. The characteristics affected typically include: • Volumetric aspects such as size, form, outline and perceived density; • Characteristics associated with balance and proportion such scale, diversity, dominance, continuity; • Surface characteristics such as colour, texture, reflectivity; and • Luminescence or lighting.
Visual envelope	The approximate extent within which the development can be seen. The extent is often limited to a distance from the development within which views of the development are expected to be of concern.
Visual impact	Changes to the visual character of available views resulting from the development that include: obstruction of existing views; removal of screening elements thereby exposing viewers to unsightly views; the introduction of new elements into the view shed experienced by visual receptors and intrusion of foreign elements into the view shed of landscape features thereby detracting from the visual amenity of the area.
Visual impact assessment	A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.
Visual quality	An assessment of the aesthetic excellence of the visual resources of an area. This should not be confused with the value of these resources where an area of low visual quality may still be accorded a high value. Typical indicators used to assess visual quality are vividness, intactness and unity. For more descriptive assessments of visual quality attributes such as variety, coherence, uniqueness, harmony, and pattern can be referred to.
Visual receptors	Includes viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible. The existing visual amenity enjoyed by the viewers can be considered a visual receptor such that changes to the visual amenity would affect the viewers.
Zone of visual influence	The extent of the area from which the most elevated structures of the proposed development could be seen and may be considered to be of interest (see visual envelope).

LEVEL OF CONFIDENCE

Table 9: Confidence level chart and description

CONFIDENCE LEVEL CHART				
	Information, knowledge and experience of the **project**			
Information, and knowledge of the **study area**		3b	2b	1b
	3a	9	6	3
	2a	6	4	2
	1a	3	2	1

3a – A *high* level of information is available of the **study area** in the form of recent aerial photographs, GIS data, documented background information and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.

2a – A *moderate* level of information is available of the **study area** in the form of aerial photographs GIS data and documented background information and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.

1a – *Limited* information is available of the **study area** and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

3b – A *high* level of information and knowledge is available of the **project** in the form of up-to-date and detailed engineering/architectural drawings, site layout plans etc. and the visual impact assessor is well experienced in this type of project and level of assessment.

2b – A *moderate* level of information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.

1b – *Limited* information and knowledge is available of the **project** in the form of conceptual engineering/architectural drawings, site layout plans etc. and/or the visual impact assessor has a low experience level in this type of project and level of assessment. (Adapted from Oberholzer. B, 2005)

VISUAL RECEPTOR SENSITIVITY

Table 10: Visual receptor sensitivity

VISUAL RECEPTOR SENSITIVITY	DEFINITION (BASED ON THE GLVIA 2ND ED PP90-91)
Exceptional	Views from major tourist or recreational attractions or viewpoints promoted for or related to appreciation of the landscape, or from important landscape features.
High	Users of all outdoor recreational facilities including public and local roads or tourist routes whose attention or interest may be focussed on the landscape; Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; Residents with views affected by the development.
Moderate	People engaged in outdoor sport or recreation (other than appreciation of the landscape);
Low	People at their place of work or focussed on other work or activity; Views from urbanised areas, commercial buildings or industrial zones; People travelling through or passing the affected landscape on transport routes.
Negligible (Uncommon)	Views from heavily industrialised or blighted areas

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