TOPOGRAPHIC AND VISUAL IMPACT ASSESSMENT

FOR

UNIVERSAL COAL PLC

Brakfontein Project

25/07/2012

Digby Wells & Associates (Pty) Ltd. Co. Reg. No. 1999/05985/07. Fern Isle, Section 10, 359 Pretoria Ave Randburg Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 789 9498, info@digbywells.com, www.digbywells.com

This document has been prepared by **Digby Wells Environmental**.

Report Title: **Topographic and Visual Impact Assessment for the Proposed Brakfontein Project**

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Name	Responsibility	Signature	Date
Alice McClure	Report Writer		08/08/2012
Bradly Thornton	1st Review		13/08/2012
Stephanie Aken	2nd Review		13/08/2012

EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) was appointed, by Universal Coal Plc, as the independent environmental consultant to conduct the Environmental Impact Assessment (EIA) and associated specialist studies in support of a Mining Right Application (MRA) for the mining of coal at the proposed Brakfontein Coal Mine. The application was lodged with the Department of Mineral Resources (DMR) in 2011 and acknowledgment and report request was received on the 28 March 2012.

The proposed project is located within the Western margins of the Witbank Coalfields within the jurisdiction of the Victor Khanye local and Nkangala district municipalities in Mpumalanga Province. The site is located approximately 16km north-east of Delmas town, 14km and 17km north of Devon and Leandra respectively.

The Brakfontein project area was investigated in terms of the topographical and visual characteristics of the receiving environment. Photographs were taken during a site visit and topographical features (natural and man-made), overall visual resources, the variety of landscape characters and sense of place attributes were noted. At a desktop level, aerial photography was scrutinized to characterise the visual resources, to categorise the land use, landscape character, visual resource and scenic quality, Visual Absorption Capacity (VAC) and potential visual intrusion, potential visual exposure and sensitivity of the potential visual receptors. Viewshed models run using the ArcGIS Spatial Analyst Extension in order to establish the degree of visibility that the proposed project is likely to have.

Vegetation in the area is dominated by the eastern Highveld grasslands but most of the area has been transformed by agricultural and mining activities. The elevation of the project area ranges from 1513 to 1590 metres above mean sea level (m.a.m.s.l) which equates to a range of 77 metres between the lowest and highest points of elevation within the project area. The visual resource of the area is moderate to low as a result of the disturbed landscape and lack of unique natural features. The VAC of the general landscape is high in the context of the existing mine dumps, dams, washing plants, power stations (which contribute towards the landscape character) and sense of place, however, the tall structures associated with mining will be highly conspicuous against the skyline and will contrast the very mildly undulating topography and low-lying grasslands and occasional natural landscape features. The visual intrusion of the proposed infrastructure is therefore likely to be high. The total area of theoretical visibility within a 20 km radius of the proposed project area is 60 556 ha but the visual exposure of the infrastructure is likely to be reduced due to haze that exists as a result of the weather conditions in the area and industrial activities (such as Kendal power station). The highest impacts on the topography and visual landscape of the area are likely to occur during the construction and operational phases of the project. There are also likely to be fairly substantial cumulative impacts to the topographical and visual aspects of the area in light of the expected mining activities that are likely to occur in the foreseeable future.

Dust and rehabilitation monitoring programmes need to be designed and put in place in order to mitigate the impacts to the visual and topographical landscape. Rigorous management plans and mitigation measures also need to be implemented during the construction, operation and decommissioning phases of the Brakfontein project

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF PLANS

ABBREVIATIONS

m	metres
CV	Curriculum Vitae
DEM	Digital Elevation Model
EIA	Environmental Impact Assessment
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWA	Department of water Affairs
GIS	Geographic Information System
Incl.	Including
km	kilometres
m.a.m.s.l	Metres above mean sea level
MRA	Mining Right Application
NEMWA	National Environmental Management Act
T&VIA	Topography and Visual Impact Assessment
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment

GLOSSARY OF TERMS

Aesthetic Value	Based on the emotional response derived from the experience of the environment in the context of its particular natural and cultural attributes. The response can be visual or non-visual and can embrace stimulation of the senses or any other factor that has the potential to impact human thought, feelings or attributes.
Landscape Character	Comprised of the overall sense that is evoked by individual elements within a landscape, including prominent features such as hills, buildings, water bodies etc. The character can usually be easily described.
Landscape Quality	Status of the landscape, based on public perceptions of the contextual landscape character.
Sense of Place (*genius loci**)	The unique value that is allocated to a specific place or area through the cognitive experience of the viewer/user. *'Spirit of the place'*
Visual Resource	Visual attribute of an area – perceived as an environmental resource for a number of reasons (i.e. cultural/aesthetic).
Scenic Quality	The scenic value assigned to a visual resource. "Beauty is in the eye of the beholder"; the rating of scenic quality is highly subjective but there has been proof of some level of consistency in terms of perceptions of scenic quality, especially related to landform, vegetation, water, colour, adjacent scenery, scarcity and cultural associations.
Visual Absorption Capacity (VAC)	The potential that the landscape has to conceal the proposed project.
Landscape Impact	Landscape effects that occur due to changes in the physical landscape, which may give rise to changes in the landscape character and how it is experienced (Institute of Environmental Assessment & The Landscape Institute 1996).
Visual Intrusion	The level of compatibility or congruence of the project within the particular qualities of the area and its sense of place. Based on context and keeping in line with integrity of the landscape or townscape.
Visibility of the Proposed Project	The potential or theoretical geographic area from which the project will be visible, based on topography, aspect, tree cover and visual obstruction.
Visual Exposure	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity; also influenced by weather and light conditions.
Visual Receptor	Item/area/person that is within the zone of potential visual influence and is likely to experience visual impacts.
Viewshed Analysis	A two dimensional spatial pattern created in a GIS that defines areas which contain all possible observation sites from where the structure might be visible.
Visual Impact	Visual effects that relate to the changes that arise in the composition of available views as a result of changes to the landscape, to peoples response to the changes, and the overall effects with respect to visual amenity.
Zone of Potential Visual Influence	The geographic extent of the area from which the project will be visible, taking into account screening by landscape aspects such as trees or buildings.

1 INTRODUCTION

Universal Coal Plc submitted a Mining Right Application to the Department of Mineral Resources (DMR) in November 2011 for proposed coal mining on Portions 6, 8, 9, 10, 20, 26, 30 and the Remaining Extent of the Farm Brakfontein 264 IR. The Prospecting Right for the proposed Brakfontein Project was granted to Unity Rocks Mining (Pty) Ltd on 10 July 2008; the Prospecting Right was issued under the Permit Number MP30/5/1/1/2/1879 PR. Universal Coal has entered into an agreement with Unity Rocks Mining and applied for an extension to the Prospecting Permit in July 2011.

Digby Wells Environmental (Digby Wells) was appointed, by Universal Coal Plc, as the independent environmental consultant to conduct the Environmental Impact Assessment (EIA) and associated specialist studies in support of a Mining Right Application (MRA) for the mining of coal at the proposed Brakfontein Coal Mine. The application was lodged with the Department of Mineral Resources (DMR) in 2011 and acknowledgment and report request was received on the 28 March 2012.

The EIA for the proposed Brakfontein Coal Mine will be submitted to the Department of Water Affairs (DWA) in support of an integrated water use license application and to the national Department of Environmental Affairs (DEA) in support of a waste management license application in terms of the National Environmental Management Act (NEMWA).

2 TERMS OF REFERENCE

Universal Coal Plc. appointed Digby Wells Environmental to undertake the Topography and Visual Impact Assessment (T&VIA) for the proposed Brakfontein Opencast and Underground mining venture.

3 KNOWLEDGE GAPS

Although findings from studies pertaining to perceptions and psychology can be applied, the nature and severity of a visual impact is intrinsically subjective. It is dependent on the subject who is viewing it, for example for some people infrastructure related to the Brakfontein mining project might be indicative of development and, consequently, economic upliftment in an area. This would result in a positive visual impact for the viewer.

The results of the T&VIA are presented based on an expectation of social norms and should therefore encompass visual issues pertaining to, or potentially raised by, the majority of people within the defined study area. However, there is a possibility that the ideas, concerns or opinions of people living within the area (or who are likely to experience a visual impact) whose perceptions deviate from the norm in terms of their perceptions regarding visual, landscape or scenic quality could be excluded, since it is impossible to assess the potential impact to every individual receptor.

Information regarding exact heights of the infrastructure items was also lacking at the time of the study. A blanket statement of “not more than 10m” was therefore utilised as inputs for the viewshed analyses.

4 STUDY AREA

The proposed project is located within the Western margins of the Witbank Coalfields within the jurisdiction of the Victor Khanye local and Nkangala district municipalities in Mpumalanga

Province (Regional Setting – Plan 1). The site is located approximately 16km north-east of Delmas town, 14km and 17km north of Devon and Leandra respectively. The centre co-ordinate of the largest part of the project area is located at 28°51'39.698"E; 26°12'31.237"S. The study area is located on the farm Brakfontein 264R, Portions 6, 8, 9, 10, 30, 20, 26 and R in the Delmas area.

5 EXPERTISE OF THE SPECIALIST

Please see Appendix B for abridged version of topographical and visual specialist CV.

6 AIMS AND OBJECTIVES

A T&VIA was undertaken for the project, with the following objectives:

- To identify the current natural and man-made topography and visual aspects of the study area/ landscape that are relevant to the VIA by carrying out a site visit and defining the various landscape units and visual character attributes;
- To analyse and characterise the topographical aspects of elevation and slope of the landscape using relevant GIS;
- To define the potential viewshed for the proposed Brakfontein project, using relevant GIS software;
- To identify potential receptors that will be impacted on by the proposed project, taking into account visibility aspects;
- To identify the impacts that the project will have on the topographical and visual landscape and to rate the scale, duration, severity and probability of the impacts occurring; and
- To provide recommendations and mitigation measures in an attempt to reduce the negative visual impacts that the proposed project will have. If relevant, a preferred pipeline route will be recommended so to reduce the potential visual impacts of that particular aspect the project.

7 METHODOLOGY

7.1 Qualitative information gathering

The Brakfontein project area was investigated in terms of the topographical and visual characteristics of the receiving environment. Photographs were taken during a site visit and topographical features (natural and man-made), overall visual resources, the variety of landscape characters and sense of place attributes were noted. At a desktop level, aerial photography was scrutinized to characterise the visual resources, to categorise the land use, landscape character, visual resource and scenic quality, Visual Absorption Capacity (VAC) and potential visual intrusion, potential visual exposure and sensitivity of the potential visual receptors.

7.2 Technical procedures

A digital elevation model (DEM) was created using the ArcGIS Spatial Analyst Extension, with contour relief data as an input. This resultant topographical model was used to create slope and aspect models (ESRI, 2010).

The DEM was used as an input to create viewshed models using the ArcGIS Spatial Analyst Extension in order to establish the degree of visibility that the proposed project is likely to have. Literature regarding theoretical visibility and proximity offsets was scrutinised to determine the zone of potential visual influence for the proposed opencast and underground mining project since viewshed modelling in ArcGIS does not take this important aspect into account. The zone was further categorised into various areas based on degrees of probable or potential visibility. The position of potential visual receptors, in relation to the various zones of visibility, was considered and displayed using ArcGIS.

8 RESULTS AND DISCUSSIONS

8.1 Topography, Land Use and Landscape Character

Vegetation in the area is dominated by the eastern Highveld grasslands. The general landscape typical of the Highveld grasslands is that of a gently undulating topography, with dispersed valley bottom wetlands and perennial/non perennial pans. However, much of the landscape within the project boundary has been transformed by agricultural activities with very little natural habitats remaining. Areas of ecological importance include wetlands, one of which is associated with the perennial Wilge River, which flows in a north easterly direction across the project area. A second perennial river flows in an easterly direction in the northern section of the project area.

The elevation of the project area ranges from approximately 1513 to 1590 metres above mean sea level (m.a.m.s.l) which equates to a range of 77 metres between the lowest and highest points of elevation within the project area (Plan 2). The difference in elevation between these points gives rise to a slope percentage of between 0 and 5.5 in most areas, with isolated steeper areas being above 7 percent (Plan 3). This gives rise to a relatively flat project area.

8.2 Visual Resource and Scenic Quality

The study area fits into the context of the surrounding region in that the area, which is predominantly characterized by agricultural activities, interlaced by drainage lines and associated wetlands. There is also evidence of widespread mining activity, including in the immediate vicinity of the project areas (approximately 1.9 km north of the study area, 2.4 km, 1km and directly south of the study area while) while Leeupan Colliery is located ±8.5 km to the northwest of the study area and Stuart Colliery is located ±7.5km in the same general direction (slightly more northern). The town of Delmas is located ±14km to the northwest of the study area and the R50 Arterial route is located ±250m south of the study area. The study area is not near any nature reserves and the area is largely disturbed by agricultural and the aforementioned mining activities (Figure 1).

Figure 1: Landscape character of the general area

There are a number of key factors that are likely to influence the scenic quality value assigned to a landscape and its visual resource (Visual Resource Management System, Department of the Interior and USA Government, Bureau of Land Management). These factors, and how they are expressed within the contextual landscape, are categorised and rated (0 – 5; 0 being non-existent, 1 being lowest and 5 being highest) are indicated in Table 1below.

Table 1: Common key factors of the contextual scenic quality

Key Factor	Description	Rating
Land Form	Low rolling hills, occasional outcrops; no interesting landscape features	2
Vegetation and Land cover	Very little/no variety in vegetation composition	1
Water Features	Flowing rivers, but are not dominant features in the landscape	2
Colour	Subtle colours and soft tones, no visual contrast in colour.	2
Influence of Adjacent Scenery (enhancement)	The direct scenery is mostly homogenous.	2
Scarcity (uniqueness of landscape)	The landscape is typical of the agricultural and mining areas that surround Johannesburg. Mining activities are, however, part of the Gauteng and Johannesburg heritage (Brink 2008)	2
Cultural Associations	No obvious cultural or heritage associations.	2

The scenic quality of the area, based largely on these factors above, is therefore moderate to low.

8.3 Sense of Place

The sense of place (*Genius loci* – Spirit of place) is described by Lynch (1992) as "…the extent to which a person can recognise or recall a place as being distinct from other places or as having a vivid, unique, or at least particular character of its own". It is, in a sense, a quality that is construed by taking into account visual factors such as the scale or magnitude of landscape elements, the colour, texture and landform of a landscape and, in particular, the predominant lad use of the area. In summary, the sense of place can be described as a function of landscape attributes such as scenic quality and uniqueness of the natural, built and cultural landscape.

The sense of place of the Brakfontein area is influenced by the open expanses of agricultural fields and large scale mining operations. The area is already known as a 'mining area' and the ambience that is experienced in the area as a result of increasing mining activities is one of industrial activity, development and possibly even exploitation from some viewpoints (Figure 2). From some viewpoints there are fewer mining activities and more agricultural activities which evokes a more passive and agricultural sense of place (Figure 3).

Figure 2: Mine dumps near the project area

Figure 3: Agricultural landscape near the project area

8.4 VAC and Potential Visual Intrusion

The VAC of the general landscape is high in the context of the existing mine dumps, dams, washing plants, power stations (which contribute towards the landscape character) and sense of place.

Infrastructure such as the overburden dumps or the shaft that is accompanying the underground mining area are likely to be fairly high in some instances. These tall structures will be highly conspicuous against the skyline and will contrast the very mildly undulating topography and low-lying grasslands and occasional natural landscape features.

Although the coarser scale landscape has a higher VAC (in the context of existing mine-related dumps and dams), the VAC of the local natural landscape of mildly undulating grasslands (which will be the context within which most people will experience visual impacts) is lower and the potential visual intrusion of the proposed structure is likely to be **high**.

8.5 Visibility of the Proposed Structure

The visibility of an object is dependent on a number of factors including weather and lighting conditions, landscape characteristics (VAC), distance of viewer from the object and the physical attributes of the object. There is however, based purely on the curvature of the earth and the height of the object, a maximum distance at which an object can be seen from (Pepper, 2003) (Appendix C). The proposed infrastructure is likely to be up to 40m high and might therefore theoretically be seen from approximately 20 km away.

The visual study area for the proposed Brakfontein project was therefore defined by a 20 km buffer around the infrastructure. The visual study area was then further grouped into visibility distance proximity categories as depicted in the Table 2 below (Figure 4 and Plan 4). The results from the viewshed analysis show that area (in hectares) within the different proximity categories which is likely to experience visibility.

Table 2: Visibility of the infrastructure within varying distance proximities

Distance proximity (km)	Area of visibility (ha)
0 - 2	4930.41
2 - 5	9331.34
5 - 10	16056.09
10 - 20	30238.18
Total Area of Visibility within 20km Radius	**60556.02**

The general statistical visibility of the proposed project infrastructure is likely to decrease between the area that falls within the closest distance proximity (a 0 - 2 km distance proximity around the proposed infrastructure) and the area that falls within the farthest distance proximity (a 10 - 20 km distance proximity around the site). Visibility of the infrastructure is limited past 5 km to the west of the proposed site due to the topography of the area.

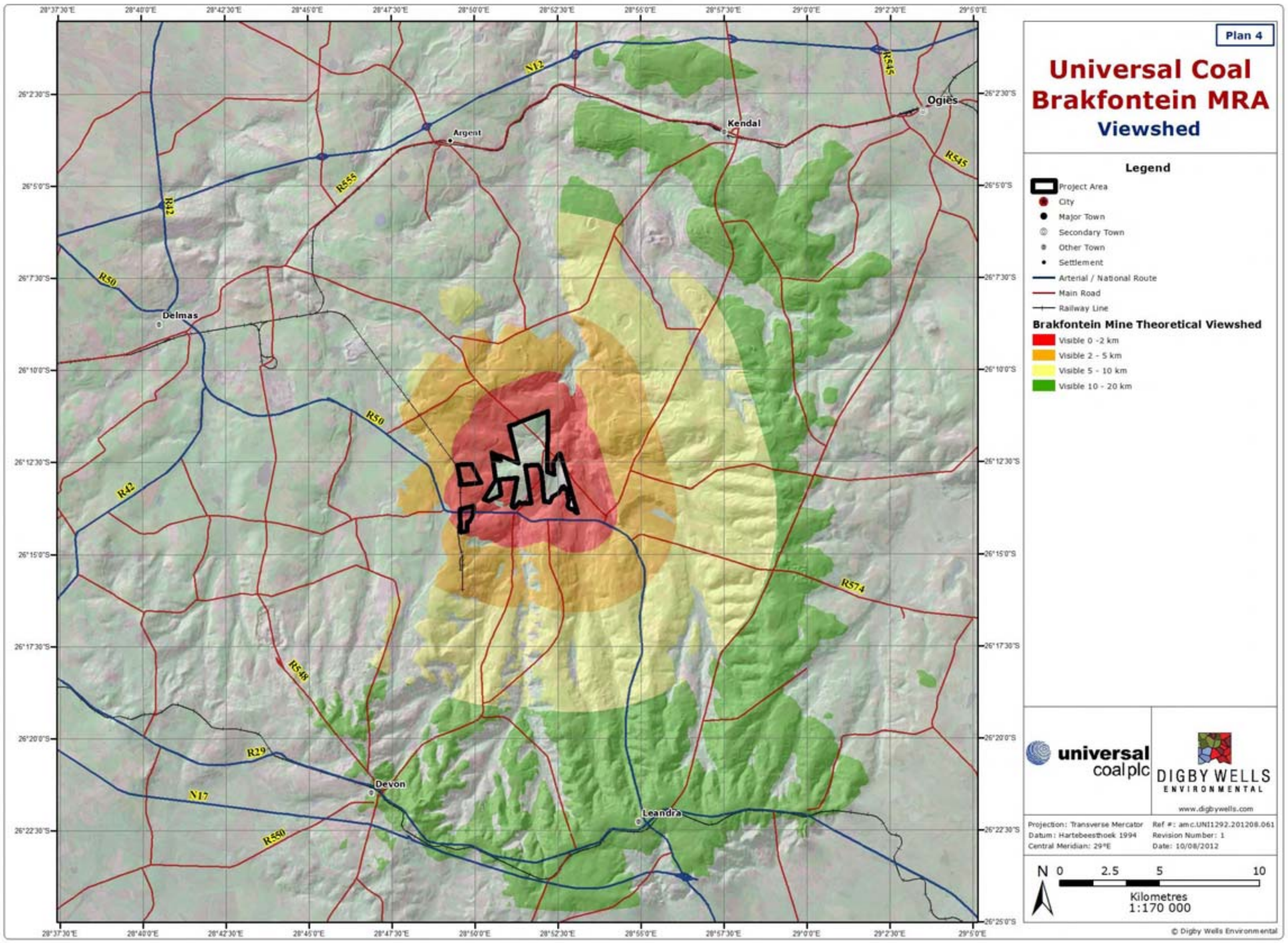

Figure 4: Theoretical Viewshed for Brakfontein Infrastructure

8.6 Visual Exposure and Sensitivity of the Potential Receptors

Visual exposure can be rated using the visibility proximities as increments of magnitude; the distance at which the proposed pipeline routes or TSF will be viewed from will affect the severity of the potential visual impact that will be experienced. Due to the effects of haze, lighting and other weather conditions in a real-world, visual exposure can vary greatly from area to area or even from day to day (Malm 1999). Considering the landscape and environment in which the proposed project infrastructure will be constructed, it is possible that there will be an effect from haze or other weather conditions on visibility during the winter months.

Figure 6 shows the effects of weather conditions on visual exposure. This photograph was taken from the Brakfontein project area; the red circle shows the position of the Kendal Power Station, one of the largest power stations in the world, 17 km away from the project area itself. Kendal power station stands at a height of 165 m (Figure 5) and should therefore, based on the principles of earth curvature, be seen from more than 50 km away (Appendix C), especially since the topography of the area is very flat. The haze that occurs within the area acts as a visual shield and decreases the visual exposure of the infrastructure.

Figure 5: Kendal power station (17km away from project area)

Figure 6: Effect of atmospheric haze on visual exposure

The visual exposure of objects decreases exponentially as the distance between the receptor and the object of visual concern increases from 0 km to 10 km. Martin (2010) argues that the visual significance of objects decreases so rapidly that at a distance further than 10 km away, the exposure is negligible (Figure 7).

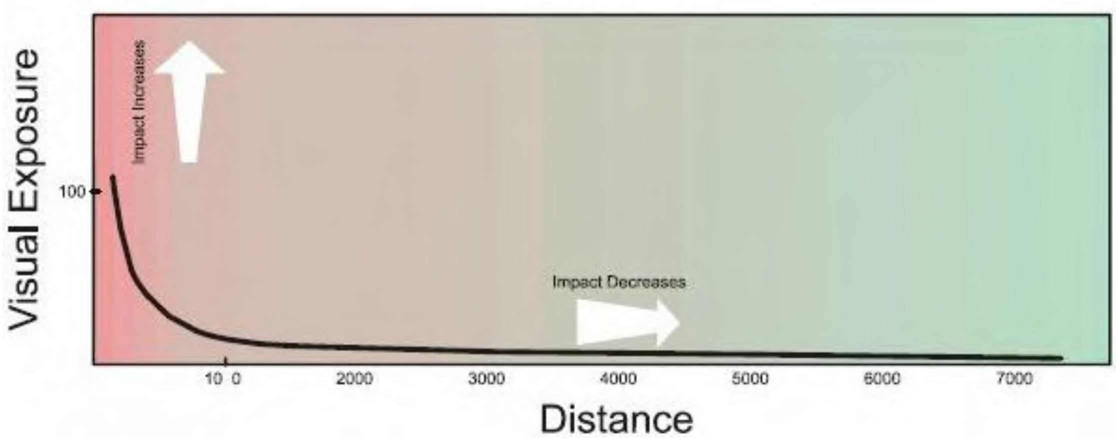

Figure 7: Effect of distance on visual exposure

Based on the assumed heights of the proposed project infrastructure, site visits (during which a number of existing mining operations were viewed) and practitioners opinion, it was decided that the general visual exposure for the specific project will be highest within a 2km radius or distance proximity of the project. Additional distance proximity increments were decided upon at 5 km, 10km and 20km thereafter; since the visual exposure of the proposed project infrastructure is likely to decrease as one will move further away from the project area.

The receptors that have been identified within the visual study area are farms, settlements, roads and railway lines. Landowners that live in dwellings on, or people that work on/utilise any part of the farms listed in Table 3 are likely to experience moderate to significant visual impacts associated with the development of the proposed Brakfontein infrastructure in one way or another. The farms have been divided into those that fall wholly or partially within the 2 km visibility extent of the project, those that fall wholly or partially within the 5 km visibility extent and those that fall wholly or partially within a 10 km visibility extent. Based on the principles of visual exposure, farms that fall beyond the 10 km visibility distance proximity will most likely experience low to none visual impacts associated with the proposed TSF.

Table 3: Potential farm visual receptors within various distance proximities

Distance Proximity	Farm Name
0 – 2 km	BRAKFONTEIN 264 IR
	BRAKFONTEIN 267 IR
	DIEPLAAGTE 262 IR
	VANGGATFONTEIN 251 IR

	HAVERGLEN 269 IR
	HAVEKLIP 265 IR
	RIETKUIL 278 IR
	MIDDELBURG OF MATJEGOEDKUIL 266 IR
	STRAFFONTEIN 252 IR
	KROMDRAAI 236 IR
2 – 5 km	SPRINGBOKLAAGTE 306 IR
	VANGGATFONTEIN 250 IR
	STREHLA 261 IR
	DARWINA LOUW 254 IR
	RIETKUIL 249 IR
	WELGELEGEN 221 IR
	MOABSVELDEN 248 IR
5 - 10km	KORTLAAGTE 67 IS
	VLAKPLAATS 268 IR
	UITVLUGT 255 IR
	BRAKFONTEIN 310 IR
	WELTEVREDEN 307 IR
	ZONDAGSFONTEIN 253 IR
	COUWENBURG 300 IR
	ENKELDEBOSCH 301 IR
	STEENKOOLSPRUIT 302 IR
	LEEUWFONTEIN 219 IR
	GOEDEHOEP 308 IR
	GOEWENBURG 300 IR

Amongst other potential receptors identified in the area are Leandra and Devon Towns (the impact is expected to be minimal if any since these towns fall within the 20 – 30km distance proximity), along with the R574, the R29, the R29, the R548, the R550, the N17, the R50 and the R555 roads.

The sensitivity of the visual receptors towards the infrastructure will vary based on the various landscape units and the consequent 'sense of place' feelings that they evoke. It is prospectively low for people living within the settlements nearby or frequently using the road networks that fall within the viewsheds for the different visibility proximities since it is expected that they work near pre-existing features related to mining, and are therefore accustomed to the large dams and mine dumps that are currently within the landscape. The sensitivity of the land owners who are habituated to the open grazing lands is likely to be higher.

9 SUMMARY TABLE

Table 4 below summarises the findings from the topographical and visual assessments of the Brakfontein project area.

Table 4: Summary Table

Aspect	Summary / Rating
Topography	1513 to 1590 m.a.m.s.l Slope percentage of 0 – 5.5 in most areas
Landscape Character	Agricultural lands, wetlands and mining operations
Visual Resource and Scenic Quality	Moderate to Low, lacking visual diversity
Sense of Place	Related to mining and extensive agriculture, 'progressively developing' (or exploiting?)
Visual Absorption Capacity (VAC) of the landscape	Higher at a coarser scale and in the context of the current mining activities, lower on a local scale
Potential visual intrusion of the proposed infrastructure	High
Visibility of the proposed infrastructure	4930 ha within 0 to 2km of the proposed infrastructure, 9331 ha within 2 to 5km of the proposed infrastructure, 16056 ha within 5 to 10km of the proposed infrastructure 30238 ha within 10 to 20km of the proposed infrastructure
Visual Exposure	High but decreased by atmospheric and industrial haze, likely to be limited to 10km
Sensitivity of the potential receptors	Moderate to low, based on current landscape context

10 IMPACT ASSESSMENT

10.1 Impact identification

The potential topographical and visual impacts associated with the project activities are listed in Table 5 below.

Table 5: Activities associated with the project that are likely to have an impact on the topographical and visual landscape

Phase		Activity	Impacted Environment
Construction	1	Site Clearing: Removal of topsoil & vegetation	Topography and Visual
	2	Construction of any surface infrastructure e.g. haul roads, pipes, storm water diversion berms (including transportation of materials & stockpiling)	Topography and Visual
Operational	3	Operation and maintenance of Infrastructure	Topography and Visual
	4	Removal of overburden and backfilling when possible (including drilling/blasting hard overburden & stockpiling)	Topography
	5	Use and maintenance of haul roads (incl. transportation of coal to washing plant)	Visual
	6	Concurrent replacement of overburden, topsoil and revegetation	Topography and Visual
Decommissioning	7	Demolition & Removal of all infrastructure (incl. transportation off site)	Topography and Visual
	8	Rehabilitation (spreading of soil, re-vegetation & profiling/contouring)	Topography and Visual
	9	Installation of post-closure water management infrastructure	Topography

The topography and visual impacts that are likely to arise due to these activities have been grouped into the broad categories below. How each of the specific activities is likely to impact each or both of these visual aspects is described in the impact rating section (10.2); specific impact ratings are then given for each of the proposed transmission line routes and substations.

10.1.1 Impact on topographical functioning at any scale

Changes to the shape or topography of a surface are likely to bring about changes in the topographical functioning of the landscape, including surface water dynamics. The topographical functioning can be influenced by removing aspects at the very surface of the landscape (i.e. vegetation), or creating areas of unnatural slope. Changes to the topography of larger areas could lead to the change of the topographical functioning of a larger landscape or ecosystem, while smaller topographical changes are likely to lead to changes in local topographical functioning.

10.1.2 Impact on visual resource and scenic quality

The visual impacts that are likely to occur on scenic quality and the visual resource will be as a result of the change, modification or alteration of the current landscape character. The current landscape character is likely to be temporarily modified by noisy and abrasive activities associated with the construction and decommissioning, and altered more permanently by the destruction of current landscape features (such as vegetation) and the erection of new infrastructure. The severity of the impacts associated with the activities is dependent on the value of the current landscape and visual resource.

10.2 Impact Rating

The topography and visual impacts are explained and assessed below. Noticeable visual impacts are expected to occur throughout the construction, operation and decommissioning phases, while noticeable topography impacts are likely to only occur during construction and decommissioning phases when the landscape and topographical features are altered, with very slight topography impacts occurring during the operational phase. The topographical changes that occur during the construction phase are likely to persist during the operational phase but it is unlikely that any new major topography impacts are introduced.

The severity, spatial scale and duration of the potential visual impacts were rated using Table 6 below. The significance of each impact was then measured based on their scores of consequence and probability (Table 7). Once a score was assigned to each of the impacts, they could be categorised as either a Major, Moderate, Minor or Negligible impact, based on the classification systems in Table 8.

Table 6: Severity, Spatial Scale, Duration and Probability Categories

Rating	Severity	Spatial scale	Duration	Probability
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage.	<u>International</u> The effect will occur across international borders	<u>Permanent: No Mitigation</u> No mitigation measures of natural process will reduce the impact after implementation.	<u>Certain/ Definite.</u> The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat or ecosystem.	<u>National</u> Will affect the entire country	<u>Permanent:</u> <u>Mitigation</u> Mitigation measures of natural process will reduce the impact.	<u>Almost certain/Highly probable</u> It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several	<u>Province/ Region</u> Will affect the entire province or region	<u>Project Life</u> The impact will cease after the operational life span of the project.	<u>Likely</u> The impact may occur.

Rating	Severity	Spatial scale	Duration	Probability
	years to rehabilitate			
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year	Municipal Area Will affect the whole municipal area	Long term 6-15 years	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month.	Local Local extending only as far as the development site area	Medium term 1-5 years	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur.
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants.	Limited Limited to the site and its immediate surroundings	Short term Less than 1 year	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures
1	Limited damage to minimal area of low significance, (e.g. ad hoc spills within plant area). Will have no impact on the environment.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month	Highly unlikely/None Expected never to happen.

Table 7: Significance scores based on consequence and probability

Significance									
	Consequence (severity + scale + duration)								
Probability / Likelihood	1	3	5	7	9	11	15	18	21
1	1	3	5	7	9	11	15	18	21
2	2	6	10	14	18	22	30	36	42
3	3	9	15	21	27	33	45	54	63
4	4	12	20	28	36	44	60	72	84
5	5	15	25	35	45	55	75	90	105
6	6	18	30	42	54	66	90	108	126
7	7	21	35	49	63	77	105	126	147

Table 8: Impact categories based on significance scores

Significance		
High (Major)	**108- 147**	
Medium-High (Moderate)	**73 - 107**	
Medium-Low (Minor)	**36 - 72**	
Low (Negligible)	**0 - 35**	

The relevant impacts associated with the construction, operation and decommissioning phases of the project are discussed below and mitigation measures are suggested.

10.3 Construction Phase

10.3.1 Topography

Activity 1: Site Clearing: Removal of topsoil and clearing of vegetation

Impact Description

Before construction takes place, the project site will need to be prepared by clearing vegetation (mostly crops in the agricultural landscape) and removing topsoil where infrastructure is going to be built and opencast mining is going to take place. The footprints of the dumps, dams, opencast mining activities and other areas (which will be cleared of any vegetation) will likely have an impact on the drainage line and surface water dynamics.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Local	3	Local	3
Severity (7)	Serious	4	Moderate	3
Likelihood (7)	Certain / Definite	7	Likely	5
Significance	Moderate	84	Minor	55

Mitigation Description

Topographical functioning needs to be kept intact by minimising soil erosion and topsoil loss. This will be done by ensuring that the bare minimum area for the sites is cleared (i.e. no additional/unnecessary vegetation or topsoil is removed). The removal of the smallest required area of vegetation and topsoil (i.e. the proposed servitudes and infrastructure footprints) will reduce the spatial scale of the impact, the severity and the likelihood of the impact occurring.

Activity 2: Construction of any surface infrastructure e.g. haul roads, pipes, storm water diversion berms (including transportation of materials & stockpiling)

Impact Description

The current topography may require levelling or cut and fill surfaces on any of the proposed infrastructure during the construction phase, which may have an impact on the local topographical functioning. The construction of these features might also have an impact on the topography by altering drainage lines and changing surface water dynamics. However, the landscape is relatively flat and will therefore not necessitate extensive cut and fill activities.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Local	3	Local	3
Severity (7)	Serious	4	Moderate	3
Likelihood (7)	Likely	5	Probable	4
Significance	Moderate	60	Minor	44

Mitigation Description

Topographical functioning needs to be kept intact by carrying out best practices that ensure minimal soil erosion and topsoil loss; most importantly, the topsoil that is removed during site clearing and preparation needs to be stored away from the surface water and drainage lines so that erosion does not take place.

10.3.2 Visual

Activity 1: Site Clearing: Removal of topsoil & clearing of vegetation

Impact Description

Clearing of vegetation will occur for surface infrastructure such as offices, washing plants, housing areas and linear transport routes such as the roads and conveyor servitudes. Excessive vegetation clearing could result in a lack of visual screening by the vegetation. Linear tracts of land that will be cleared for road and conveyor servitudes could introduce new lines of sight

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Limited	2	Limited	2
Severity (7)	Minor	2	Limited	1
Likelihood (7)	Certain / Definite	7	High Probability	6
Significance	Minor	63	Minor	48

Mitigation Description

It is important that the vegetation clearing activities are strictly guided by the servitude boundaries and there should be an effort to ensure that no additional vegetation is cleared. The severity of the vegetation clearing activities associated with the infrastructure will be reduced if this activity is monitored.

Activity 2: Construction of any surface infrastructure e.g. haul roads, pipe lines, storm water diversion berms (including transportation of materials and stockpiling)

Impact Description

During the construction phase of the opencast mining complexes, cut and fill, grading and other activities will need to occur for the construction of the infrastructure. These activities are likely to have an impact on the local topography and landscape character if aspects are not shaped to blend in with the existing topography and if the areas are left bare and stark. The landscape is relatively flat and will therefore not necessitate extensive cut and fill activities.

There will also be an increase in vehicular activity and abrasive construction activities within the landscape which will influence the overall sense of place. However, the severity of the visual impact will be limited in the context of the already industrial area. The creation of dust plumes along the dirt roads will add to the visual impact on the receiving environment. If construction activities occur at night time, there are likely to be visual impacts associated with the unintended receptors of light sources.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Medium Term	3	Medium Term	3
Scale (7)	Limited	2	Limited	2
Severity (7)	Minor	2	Limited	1
Likelihood (7)	High Probability	6	High Probability	6
Significance	Minor	42	Minor	36

Mitigation Description

Construction activities should be guided by best practices and relevant standards and should be carried out as quickly and efficiently as possible; in order to reduce visual impacts during construction, dirt roads should be wet frequently so to decrease dust plume creation and activities should take place during daylight hours so that no additional lighting is needed. Construction activities should only take place during daylight hours so to mitigate against additional visual impacts associated with light sources.

10.4 Operational Phase

10.4.1 Topography

Activities 3 and 4: Operation and maintenance of infrastructure (including all housing and dumps) and removal of overburden and backfilling where possible

Impact Description

The dumps associated with the opencast mining activities will expand throughout project life while some of the overburden will be removed and backfilled. There will be slight changes or impacts to the local topography due to these changes in the natural lie of the land and slope direction and percentages. Changes to the percentage and direction of slopes increases the possibility of erosion and run-off occurring, which might disrupt the natural drainage network as surface water flow dynamics are altered.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Local	3	Limited	2
Severity (7)	Serious	4	Moderate	3

Likelihood (7)	Certain	7	Certain	7
Significance	Minor	70	Minor	63

Mitigation Description

It is important that the mining follows a stipulated design that mitigates excessive erosion. A comprehensive dump design and storm water management plan needs to be created by the engineers of the facility and surface water specialists. Temporary discard and other dumps should be designed and sloped adequately, from the very beginning of their creation, to ensure that they are rather flatter, covering a larger surface area than steep, jarring aspects within the landscape at the end of their lifetime. The milder slopes of the permanent dumps will also allow for easier vegetation establishment so that the dumps are not left bare.

Activity 6: Concurrent replacement of overburden, topsoil and revegetation

Impact Description

Replacement of overburden, topsoil and revegetation will have a positive impact on the local topographical functioning since it is possible for the original contouring of the land (or a near natural state) to be achieved which will restore surface water flow dynamics.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Enhancement	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Local	3	Local	2
Severity (7)	Very serous	4	Serious	3
Likelihood (7)	Likely	5	Probable	4
Significance	Minor	60	Minor	40

Enhancement Description

The most effective enhancement measure is to ensure that the activities take place (concurrent replacement of overburden, topsoil and revegetation) as quickly and effectively as possible.

10.4.2 Visual

Activity 3: Operation and maintenance of mining infrastructure (including all housing and dumps)

Impact Description

The receiving environment will be negatively affected by the presence, operation and maintenance of the mining infrastructure, since the landscape character (within limited areas) will be altered and the overall visual resource will be reduced. The tall infrastructure will be silhouetted against the skyline and it is likely that a number of receptors will be able to see the mining activities. Additional visual impacts are likely to be experienced at night time due to bright lights that are associated with mining infrastructure.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	More than local	4	More than local	4
Severity (7)	Very serious	5	Serious	4
Likelihood (7)	Certain	7	Certain	7
Significance	Moderate	98	Moderate	91

Mitigation Description

The infrastructure could be painted (where possible) to give it a natural or matt finish which might decrease the visibility slightly within the neutral-toned landscape (this recommendation is theoretical and based on the research carried out by the visual specialist; its applicability/possibility needs to be checked with pipeline engineer). Maintenance activities should be guided by a regulated plan and should not lead to additional vegetation (grass) clearing, unless where imperative. Where bright lights are needed at light, the sources need to be pointed directly at the area of infrastructure of interest and shields or light 'blinker's should be installed onto light sources so to concentrate the light source onto the wanted receptor and to shield the lighting away from unintended receptors.

Activity 3: Operation of opencast Mines

Impact Description

During the operational phases, large areas of land will be subject to opencast mining; these areas will take a long time to rehabilitate and will very likely lead to landscape scarring as these expanses of land will be incompatible with the surrounding landscape. The visual impacts will be associated with each of the opencast mining areas as they are sequentially mined- they will therefore be restricted to the individual areas and the viewing points of these areas.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Local	4	Local	4
Severity (7)	Moderate	5	Limited	4
Likelihood (7)	Highly likely	6	Highly likely	6
Significance	Moderate	84	Moderate	78

Mitigation Description

Ensure that concurrent replacement of overburden, topsoil and revegetation occurs quickly and effectively

Activity 5: Use and Maintenance of haul roads (including transportation of coal to washing plant)

Impact Description

The receiving environment will be negatively affected by an increase in traffic, especially that which is transporting coal and is therefore slow and bulky. The sense of place and landscape character will be negatively affected by an increase in vehicular activity, dust plumes and exhaust fumes

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Municipal	4	Municipal	4
Severity (7)	Serious	5	Moderate	4
Likelihood (7)	Likely	5	Probable	4
Significance	Moderate	70	Moderate	52

Mitigation Description

Vehicular activity should be restricted to hours that do not coincide with the traffic caused by local people and activities (if possible).

Activity 6: Concurrent replacement of overburden, topsoil and revegetation

Impact Description

Replacement of overburden, topsoil and revegetation will have a positive impact on the visual environment since areas will be returned to a visually more natural and aesthetically pleasing state.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Enhancement	
Duration (7)	Project Life	5	Project Life	5
Scale (7)	Local	3	Local	2
Severity (7)	Very serous	4	Serious	3
Likelihood (7)	Likely	5	Probable	4
Significance	Minor	60	Minor	40

Enhancement Description

The most effective enhancement measure is to ensure that the activities take place (concurrent replacement of overburden, topsoil and revegetation) as quickly and effectively as possible.

10.5 Decommissioning Phase

10.5.1 Topography

Activities 7 and 8: Demolition and rehabilitation of Brakfontein project site

Impact Description

After the project life of the Brakfontein, the infrastructure will be demolished and the sites will be rehabilitated. This could have a positive impact on the overall topographical functioning of the landscape; the impact is likely to be minor since the topography of the landscape will not change substantially during and after rehabilitation (i.e. the basic shapes of the dumps will remain within the local topography).

Impact assessment

Parameter	Impact Pre-Enhancement		Impact Post-Enhancement	
Duration (7)	Permanent	7	Permanent	7
Scale (7)	Limited	2	Limited	2
Severity (7)	Minor	2	Limited	1
Likelihood (7)	Likely	5	Probable	4
Significance	Minor	55	Minor	40

Enhancement Description / Mitigation

If best practice rehabilitation methods are employed, it is more likely that the landscape will be returned to a functioning state. The dumps will likely have a slope gentle enough to ensure stability and will be able to accommodate vegetation growth; adequate reshaping (ideally even a gentler slope than the bare minimum requirements for vegetation growth) will aid in transforming the infrastructure from one that is highly visible and contrasts against the skyline to one that assimilates the natural topography of the landscape. This will also aid in ensuring topographical functioning that is as natural as possible. Ideally, the dumps would be shaped (during construction phase) in such a way that levelling is not required during the closure phase of the project so that time, money and other resources are conserved during the rehabilitation phase.

Vegetation of the infrastructure will require intensive rehabilitation of the footprint and adequate, pioneer plant species need to be chosen that grow quickly and reduce the chance of erosion and encourage more natural surface water dynamics.

Activity 9: Installation of post-closure water management infrastructure

Impact Description

The installation of post-closure water management infrastructure will have a positive impact on the local topographical functioning by promoting more natural surface water flow dynamics

Impact assessment

Parameter	Impact Pre-Enhancement		Impact Post-Enhancement	
Duration (7)	Permanent with mitigation	6	Permanent with mitigation	6
Scale (7)	Limited	2	Limited	2
Severity (7)	Minor	2	Limited	1
Likelihood (7)	Probable	4	Probable	4
Significance	Minor	40	Minor	36

Enhancement Description / Mitigation

A comprehensive and defendable post-closure water management plan needs to be designed and effectively implemented.

10.5.2 Visual

Activity 7: Decommissioning, demolition and removal of infrastructures

Impact Description

Decommissioning and demolition will require noisy and abrasive activities that will affect the sense of place and the visual resource of the Brakfontein project area. Most of the infrastructure will undergo decommissioning activities. The appearance of 'broken' structures, rubble and other demolition material has a negative visual impact however, the demolition activities should occur over a relatively short while, after which the rubble should be removed and the area rehabilitated. The severity of the visual impacts should not be significant since visual impacts are experienced and interpreted by the user of the visual environment/landscape, and in this case the receptors are likely to be familiar with noisy mining-related activities or might be relieved to see the infrastructure being demolished, regardless of the abrasive activities.

Impact assessment

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Duration (7)	Short Term	2	Short Term	2
Scale (7)	Limited	2	Limited	2
Severity (7)	Moderate	3	Minor	2

Parameter	Impact Pre-Mitigation		Impact Post-Mitigation	
Likelihood (7)	Highly Probable	6	Likely	5
Significance	Minor	42	Negligible	30

Mitigation Description

Demolition and decommissioning activities need to be factored into the financial planning of the mining related facilities from the beginning of the project and the plans need to be audited regularly in order to ensure that enough funds are available at the end of the project to demolish and remove the infrastructure efficiently and completely.

Activity 8: Rehabilitation

Impact Description

After the demolition phase has been carried out and the rubble has been removed, it is likely that the landscape character of the Brakfontein area will be more favourable. Rehabilitation of the site post closure is likely to have a neutralising visual impact such that it will decrease the severity of visual impacts associated with an operational mine that has been part of the visual landscape for a number of years.

Impact assessment

Parameter	Impact Pre-Enhancement		Impact Post-Enhancement	
Duration (7)	Permanent	7	Permanent	7
Scale (7)	Limited	2	Limited	2
Severity (7)	Moderate	3	Minor	2
Likelihood (7)	Highly Probable	6	Likely	5
Significance	Minor	72	Minor	55

Enhancement Description / Mitigation

Rehabilitation of the area should comprise of transforming the remaining dumps to those that are visually less intrusive than operational dumps (i.e. a fairly gentle slope). Rehabilitation activities need to be factored into the financial planning of the mining related facilities from the beginning of the project and the plans need to be audited regularly in order to ensure that enough funds are available at the end of the project to demolish and remove the infrastructure efficiently and completely. Rehabilitation plans should be carried out using up-to-date best practice methods. Revegetation of the area will require intensive rehabilitation of the footprint and adequate, pioneer plant species need to be chosen that grow quickly and reduce the visual impact of the bare areas.

11 CUMULATIVE IMPLACTS

This section considers and assesses the possible cumulative topographical and visual impacts that may occur due to the incremental effects of the proposed Brakfontein project when considered concurrently with the effects of existing infrastructure and other projects within the project area. The effects or impacts that are considered may be related to past, present or future activities (within the reasonably foreseeable future). It is important to establish whether visual effects from other projects within the vicinity will overlap or have overlapped in terms of time or geographic extent and whether the effects of the proposed pipeline project will interact with or intensify effects from other developments (BrightSource, 2011). A comprehensive definition of cumulative impacts, developed by the Washington State Department of Transportation (2008), is given below:

"Cumulative impacts are the summation of impacts on a resource resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes those actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

The table below defines, summarises and compares the characteristics of relevant impacts associated with project developments.

Table 9: Impact types and characteristics

Impact Characteristics	Direct Impacts	Indirect Impacts	Cumulative Impacts
Nature of impact	Predictable/inevitable	Reasonably foreseeable/probable	*Reasonably foreseeable/probable*
Cause of impact	Project	Project's direct and secondary impacts	*Projects direct and secondary effects AND impacts of other activities*
Timing of impact	Project construction and life	Sometime after direct impacts	*At time of project construction or in the foreseeable future*
Location of impact	Within project area	Within boundaries of resources and other systems impacted on by project	*Within boundaries of systems affected by the project*

Source: Oregon Department of Transportation and Federal Highway Administration (2001)

In order to analyse the cumulative impacts associated with a project or development, the following steps should be carried out (Adapted from Washington State Department of Transport 2008):

1. The geographic scope of the cumulative impact resource or environmental aspect analysis needs to be defined, based on the potential areas within which impacts from other present or future projects could combine with the project in question.
2. The combined effects of the proposed project in combination with past, present and future projects or activities need to be analysed in terms of the potential cumulative impacts within the relevant geographical extent.

The visual resource of the proposed project has been described previously in this report; this current context defines the baseline for predicting or assessing cumulative impacts that might occur within the foreseeable future. Actions and activities that have been identified to possibly introduce incremental impacts within the area are displayed and described in Table 10 below.

Table 10: Actions/activities within the landscape that could introduce/aggravate potential cumulative impacts

Action/Activity	Nature of Potential Visual Impact
Agriculture	Vegetation disturbance
Mining	Vegetation disturbance, dust plumes, change in topography, use of heavy machinery
Power Generation	Vegetation disturbance, dust plumes, change in topography, use of heavy machinery
Vehicular Activity	Dust plumes
Urban Development	Vegetation disturbance, change in landscape character

Adapted from: URS Corporation 2011

The predicted or potential topography cumulative impacts that are associated with the proposed mining project are related to landscape level changes in surface water dynamics and topographical functioning. As industrial, agricultural and mining related activities continue to occur simultaneously within the landscape, habitat fragmentation will increase as will erosion and surface water run-off. The topographical functioning of the landscape in its entirety will be subject more and more to the influences of man-made structures that change the elevation, slope and landscape features. The cumulative impacts associated with topography are depicted in Table 11.

Table 11: Potential topography-related cumulative impacts

Identified Relevant Impact	Other Action	Cumulative Impact	Predicted Significance of Cumulative Impact
Clearing of vegetation for during construction – impacts surface water dynamics	Agriculture, mining, urban development and other industrial expanding activities:	Landscape level changes to surface water dynamics and erosion	Moderate to High

Identified Relevant Impact	Other Action	Cumulative Impact	Predicted Significance of Cumulative Impact
	clearing of vegetation		
Construction and decommissioning of infrastructure – impacts topography	Mining, power generation and urban development: change in topographical features	Landscape level changes to topography and topographical functioning	Moderate to High

The cumulative impacts associated with the visual environment are primarily characterised by changes to the fabric of the landscape, the landscape character as a whole and, subsequently, changes to the visual resource. Activities associated with vegetation clearing will lead to a transformation in overall landscape character as man-made features dominate the landscape more and more, and open expanses of grassland diminish. The construction of the proposed mining infrastructure will bring about noisy, abrasive and dust-creating activities, possibly at the same time and in the same vicinity as other similar activities which will lead to a change in the overall sense of place.

The existence of the Brakfontein project infrastructure will occur in a landscape that is already scattered with mining-related infrastructure and where similar infrastructure is likely to be erected in the foreseeable future. These activities, along with agricultural development activities are likely to lead to an alteration in the fabric of the landscape and, consequently, a further change in landscape character, sense of place and the visual resource. It is predicted that the fabric of the landscape will, in the foreseeable future, be dominated more and more by large-scale and medium-scale human-related activities and the more “natural” aspects of the current landscape character will diminish. The potential cumulative impacts associated with the visual environment are displayed in Table 12.

Table 12: Potential visual-related cumulative impacts

Identified Relevant Impact	Other Action	Cumulative Impact	Predicted Significance of Cumulative Impact
Clearing of vegetation during construction – impacts vegetation composition and landscape character	Agriculture, mining, power generation and other industrial expanding activities: clearing of vegetation	Change in overall landscape character as man-made features dominate the landscape more and more	Low to Moderate
Construction and decommissioning of infrastructure: traffic, heavy machinery, dust plumes – impacts sense of place	Agriculture, mining, power generation, transport: creates traffic, heavy machinery, dust plumes	Change in the overall sense of place	Moderate
Operation and Maintenance of visually obtrusive infrastructure	Agriculture, mining, power generation: change in landscape character and	Change in the fabric of the landscape and, consequently, a change in landscape	High

Identified Relevant Impact	Other Action	Cumulative Impact	Predicted Significance of Cumulative Impact
– impacts landscape character, visual resource and sense of place	sense of place	character, sense of place and the visual resource.	

12 MITIGATION MEASURES AND MANAGEMENT PLAN

Table 13 below is an accessible summary of the mitigation measures and management plans that need to be put in place to reduce the visual impacts associated with the proposed Brakfontein project.

Table 13: Mitigation measures and management plan

Activity	Aspect	Objectives	Mitigation measure	Recommended Action Plan
Clearing of vegetation and removing of vegetation for infrastructure	• Visibility of infrastructural aspects increased	To minimise visual intrusion of clearing of vegetation	• Only the minimum amount of vegetation that is required for the infrastructure should be cleared. An effort should be made to ensure that no additional vegetation is cut down and that the patches of tall standing grass and vegetation are left intact where possible.	• Delineate servitude areas and define which expanses of vegetation are absolutely necessary to be cleared. Stick to these servitudes.
	• Topography of landscape altered	To ensure, as far as possible, natural topographical functioning of the landscape	• Construction activities need to be carried out utilising best practices that aid in reducing topography and visual impacts	• Delineate servitude areas and define which expanses of vegetation are absolutely necessary to be cleared. Stick to these servitudes • Remove topsoil and store away from surface water drainage.
Construction of mining infrastructure and any related surface infrastructure	• Visual intrusion of construction activities associated with infrastructure • Further alteration of agriculture 'sense of place' (what is remaining)	To minimise the visual impact associated with construction activities of the infrastructure	• Construction should be carried out following best practices and standards and in such a way so to reduce the visual impacts (as far as possible).	• Keep frequently used dirt roads wet to reduce dust plumes. • Construction should take place during daylight hours so that no additional lighting is needed. • If possible, build dumps to follow post-closure slope requirements.
	• Topography and drainage systems of landscape altered	To ensure, as far as possible, that the integrity of the natural topography of the landscape is kept intact	• Construction should be carried out in such a way that the natural topographical features are kept intact (as best as possible).	• Roads should be built to follow natural topography (where necessary) • Sufficient drainage features need to be built • Topsoil needs to be stored away from surface water drainage
Presence, operation and maintenance of facilities	• Visual intrusion and visibility of the infrastructure • Use and maintenance of haul roads	To minimise the visual intrusion and exposure of the infrastructure and opencast areas and to decrease, as far as possible, further changes to the agricultural 'sense of place'. Enhance positive concurrent replacement of overburden, topsoil and revegetation actions	• The infrastructure should be maintained in such a way that they have as little negative visual impact as possible. Metal structures could be painted with a matt finish so that they can, in some cases, blend into their surroundings. Manage lighting requirements if necessary • Vehicular activity on haul roads should be monitored and a limit to the number of trucks transporting coal per day should be put in place. If possible, transport of coal should not coincide with the traffic caused by local people and activities. • Concurrent replacement of overburden and topsoil, and revegetation needs to occur quickly and efficiently	• Maintain materials that are less visually obtrusive or paint the features with a matt coat/finish when required. • Do not clear any more vegetation for maintenance activities except where absolutely necessary • If roads are used frequently, they need to be recurrently wet during dry seasons so to reduce dust plumes created by vehicular movement. • If lighting is required for operation or maintenance, ensure that unintended visual receptors are shielded from the lighting. • Initiate traffic monitoring plan. • Initiate rehabilitation plan early on in project life by replacing topsoil and overburden and revegetating disturbed areas
	• Slight and slowly occurring changes to the slope and local topography	To minimise the impacts on local scale topographical functioning. Enhance positive concurrent replacement of overburden, topsoil and revegetation actions	• Consult a well prepared and suitable dump, berm and other relevant infrastructure design • Concurrent replacement of overburden and topsoil, and revegetation needs to occur quickly and efficiently	• Monitor the design and growth of the dumps and ensure that that they relate to acceptable environmental standards in terms of slope and elevation. • Initiate rehabilitation plan early on in project life by replacing topsoil and overburden and revegetating disturbed areas

Activity	Aspect	Objectives	Mitigation measure	Recommended Action Plan
Demolition of infrastructure and management of dangerous materials	• Visual intrusion of waste rubble/demolished structures	To minimise the visual intrusion and exposure of the site waste	• Although the means for demolition are fairly standard, once the structures have been demolished the rubble should be transported quickly and efficiently to the waste site. Trucks and other forms of transportation should therefore collect the rubble as soon as possible after it is decommissioned.	• Ensure an efficient removal system of waste rubble as soon as possible after the infrastructure is demolished. Ensure rubble is removed immediately.
Rehabilitation of pipeline and TSF footprint	• Improvement of the Visual component of the Brakfontein project Site	To strive towards and enhance the positive visual impacts associated with post-closure rehabilitation	• (Enhancement measure) Transform the infrastructure into a landscape feature that has a less severe visual impact by either planning early on (during the construction phase) or sloping and re-vegetating adequately.	• Ideally, shape the dumps at an adequate slope at the commencement of the project. If not, during closure phase, level to a slope that integrates more successfully into the natural topography of the visual landscape. • Chose plant species for re-vegetation that will grow quickly to cover the bare earth
	• Rehabilitation of the topographical functioning of the Brakfontein project Site.	To attempt to mimic natural landscape topography (as much as possible) post-closure rehabilitation	• (Enhancement measure) Obtain adequate slope for rehabilitation and subsequent natural (or more natural) topographical functioning and surface water dynamics either by planning early on (during the construction phase) or sloping and re-vegetating adequately.	• Ideally, shape the dumps at an adequate slope at the commencement of the project. If not, during closure phase, level to a slope that integrates more successfully into the natural topography of the functional landscape. • Chose plant species for re-vegetation that will grow quickly to cover the bare earth and prevent soil erosion.

13 MONITORING PROGRAMME

The following specialist monitoring programmes are required or beneficial to ensure that the topographical and visual impacts of the construction, operation and decommissioning activities of the project are mitigated and reduced. Overviews of the monitoring programmes are given below but it is essential that comprehensive specialist reports and management plans are construed (within the context of the proposed Brakfontein mining operation) for each individual monitoring programmes.

Dust monitoring programme

Dust buckets need to be positioned at adequate points (likely already done) to monitor the dust fallout associated with the project. The buckets need to be tested monthly and if high levels of dust fallout are being experienced, roads need to be wet more frequently. See dust specialist report for a comprehensive description of the monitoring programme

Premature Rehabilitation Programme

It is suggested that the environmental officer on site rigorously monitors the activities that involve removal and consequent backfilling of earth. As soon as possible after disturbance activities have taken place, backfilling of material and soil needs to take place to increase the chances of achieving successful rehabilitation. Once the areas have been filled and topsoil has been put in place, revegetation needs to occur using pioneer species. Since the mining of five different areas will happen sequentially, the backfilling and rehabilitation activities also need to occur in a progressive manner.

Post Closure Rehabilitation Programme

A comprehensive and intensive post closure rehabilitation plan needs to be designed from the onset of the project. The plan also needs to be amended and adapted each year to suite the status of the dumps, earth and topsoil as the mining activities progress. The rehabilitation plan needs to be audited and adequate funds need to be put away each year to ensure that the rehabilitation plan can be carried out immediately after LoM (these funds need to be checked annually).

14 STUDY SUMMARY, RECOMMENDATIONS AND CONCULSION

The landscape character and visual resource of the Brakfontein project area has already been transformed in most areas from natural grasslands to agricultural fields interspersed with mining ventures. The area is very flat with a range of approximately 70m; this gives rise to a slope percentage of between 0 and 5.5 percent (in very isolated areas). The current sense of place is influenced by the disturbed landscape and is therefore somewhat industrial and developmental, although a passive agricultural sense of place is still perceived from some viewpoints. Due to the flat topography, the infrastructure associated with the mining operation is likely to have a high theoretical visibility (60 555 ha within a 20 km radius of the project area), although the atmospheric haze associated with the weather conditions and already existing industrial activities in the area is likely to decrease the visual exposure of the proposed infrastructure somewhat. 29 farms have been identified to likely be impacted to varying degrees by the visual impacts associated with construction, operation and demolition of the proposed mine; 10 of these farms are likely to experience the most severe visual impacts as they are located within 2km of the proposed mining activities. The construction and operational activities are likely to have the highest impacts, both on topographical functioning and impacts to visual resource and sense of place. It is perceived that there will be moderate to high cumulative topographical and visual impacts associated with mining in the area, given the current landscape and land use context. Mitigation measures and comprehensive dust and rehabilitation management plans and monitoring programmes need to be put in place in order to reduce the topographical and visual impacts associated with the proposed Brakfontein mine.

15 REFERENCES

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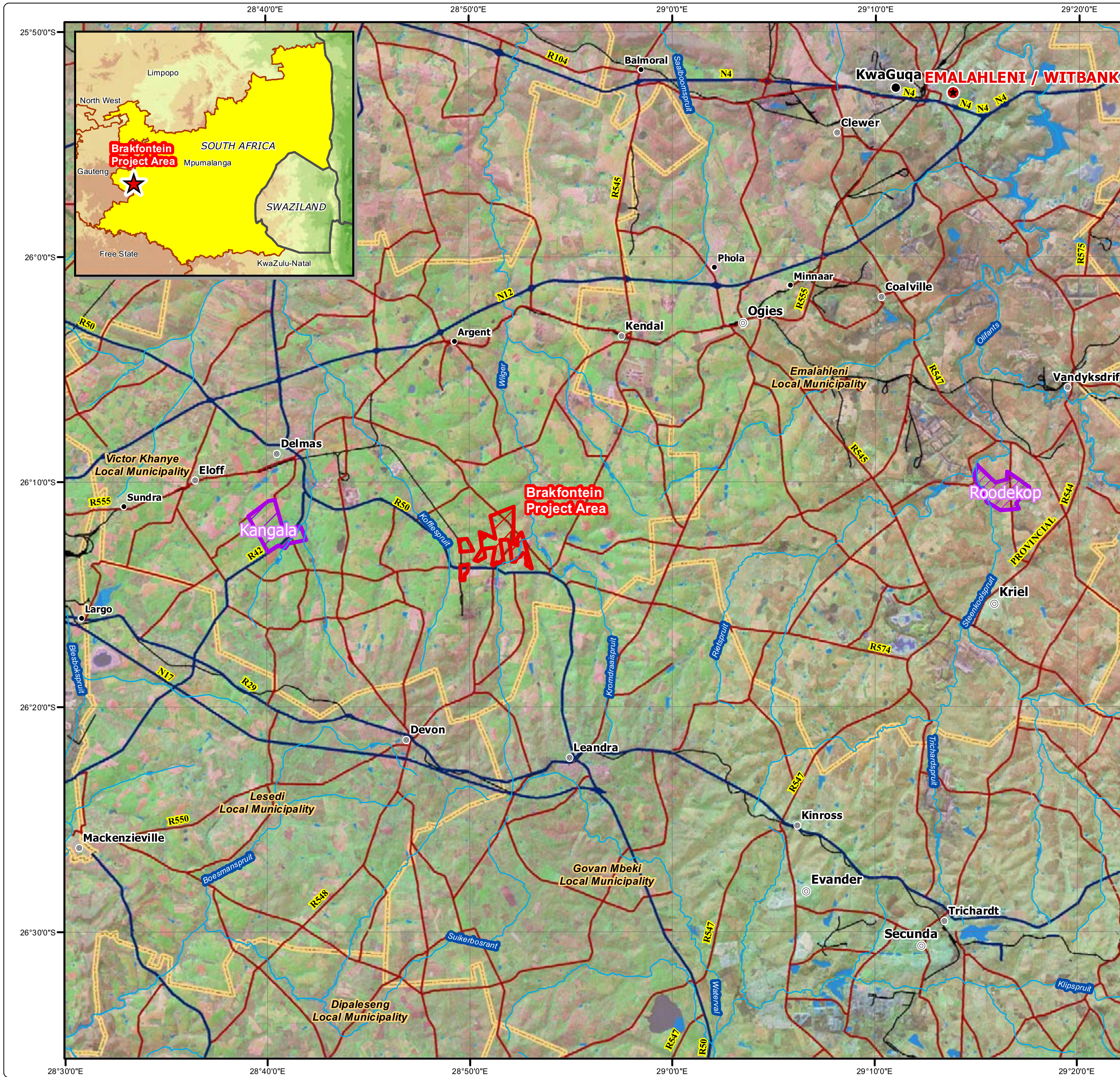
WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. 2008. Guidance on preparing cumulative impact analyses. Available online: http://www.wsdot.wa.gov/NR/rdonlyres/1F0473BD-BE38-4EF2-BEEF-6EB1AB6E53C2/0/CumulativeEffectGuidance.pdf [03/04/2012]

Appendix A: Plans



Plan 1

Universal Coal Brakfontein MRA

Regional Setting

Legend

- Project Area
- Other Universal Coal Project Areas
- City
- Major Town
- Secondary Town
- Other Town
- Settlement
- Rivers
- Arterial / National Route
- Main Road
- Railway Line
- Dam / Lake
- Local Municipal Boundary

universal coal plc

DIGBY WELLS ENVIRONMENTAL

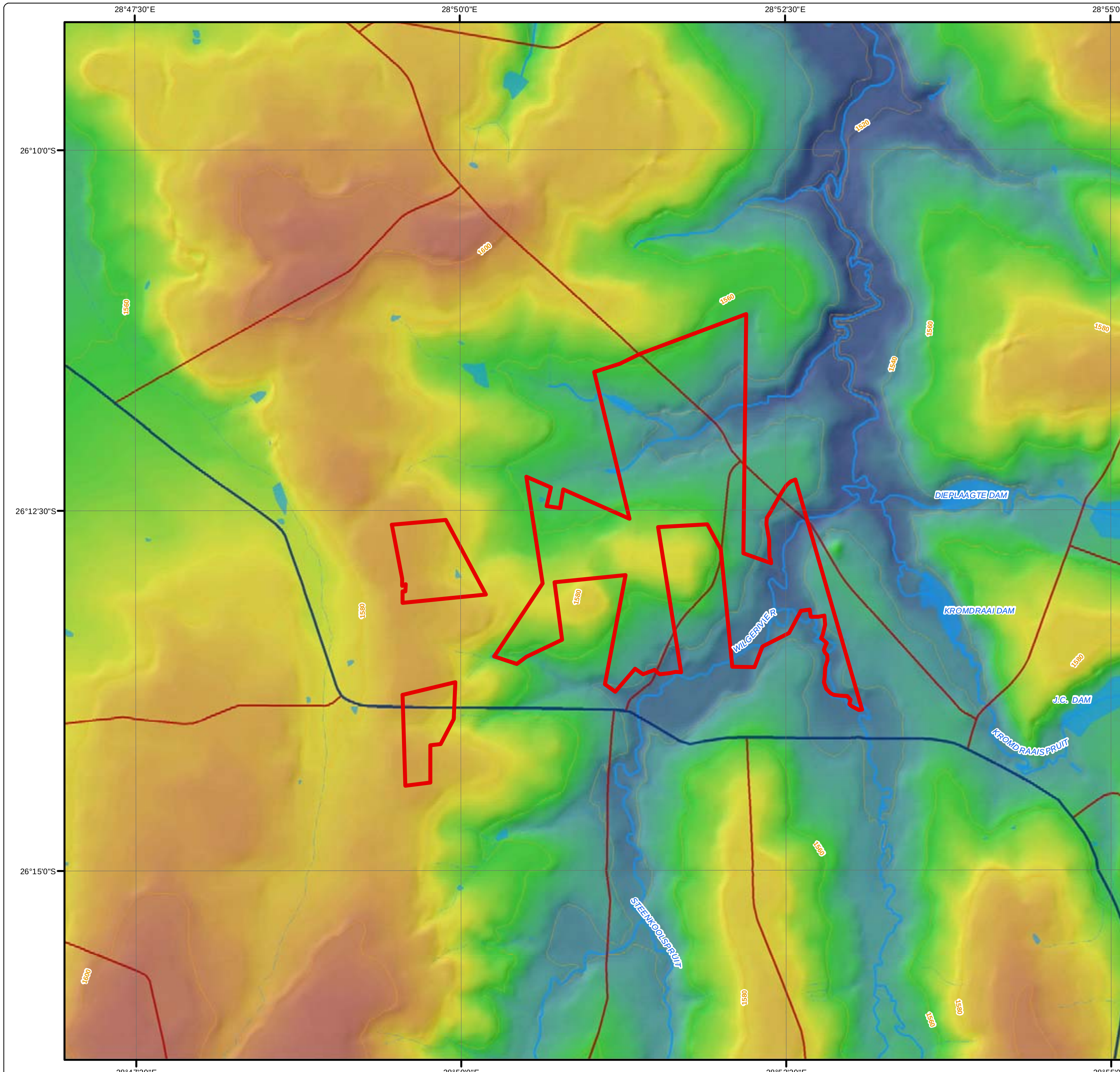
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E

Ref #: tdm.UNI1292.201204.060
Revision Number: 1
Date: 12/04/2012

N

0 2 4 8 12 16
Kilometres
1:320 000



Plan 2

Universal Coal Brakfontein MRA

Topography

Legend

- Project Area
- City
- Major Town
- Secondary Town
- Other Town
- Settlement
- Arterial / National Route
- Main Road
- Contour (20m)
- Non-Perennial Stream
- Perennial Stream
- Dam / Lake

Elevation (m.a.m.s.l)
High : 1613
Low : 1514

universal coal plc

DIGBY WELLS ENVIRONMENTAL
www.digbywells.com

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E

Ref #: tdm.UNI1292.201204.026
Revision Number: 1
Date: 05/04/2012

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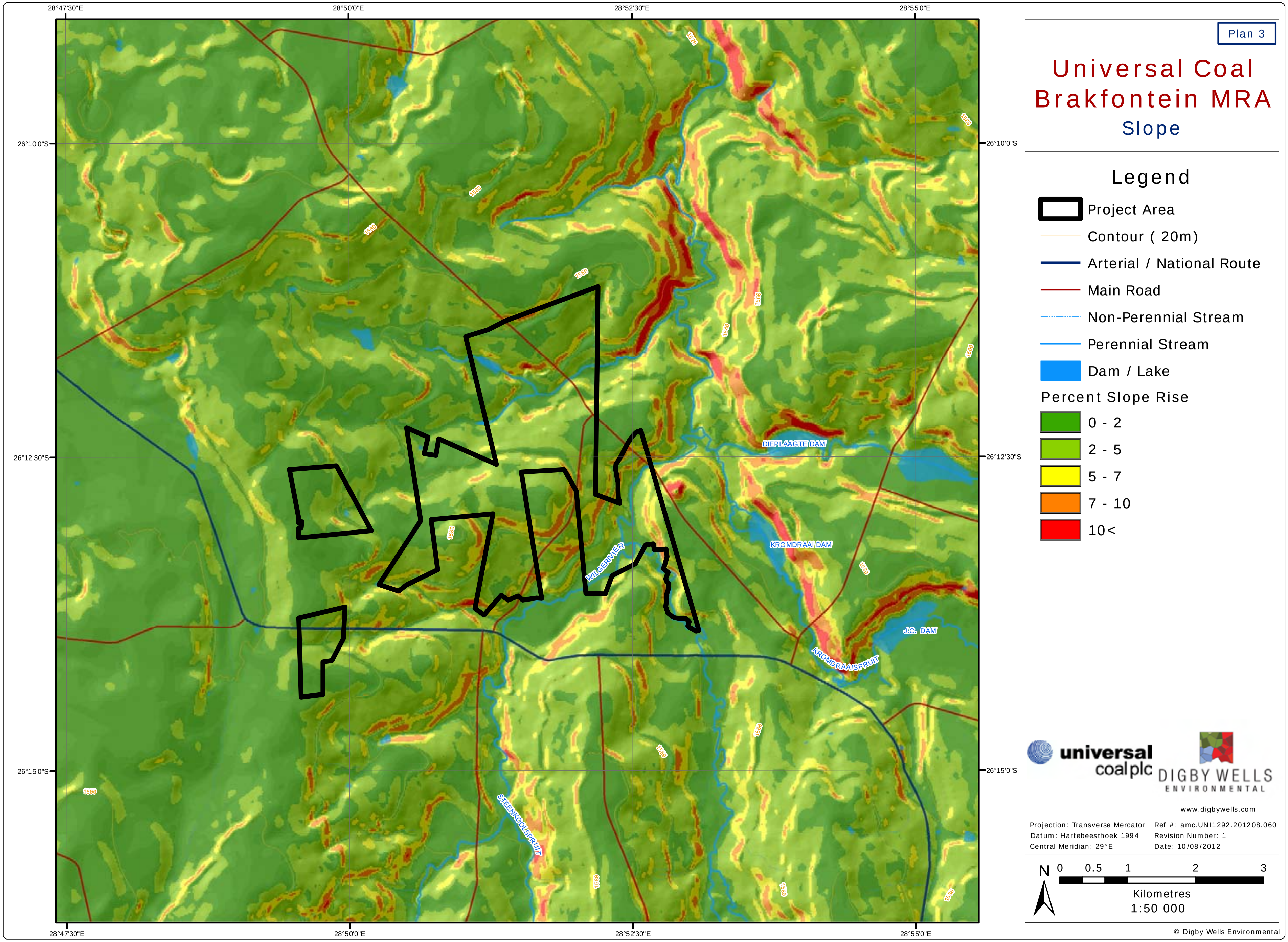
Kilometres
1:50 000



28°47'30"E
28°50'0"E
28°52'30"E
28°55'0"E
26°10'0"S
26°12'30"S
26°15'0"S
DIEPLAAGTE DAM
KROMDRAAI DAM
J.C. DAM
KROMDRAAISPRUIT
WILGERVLEI R
STEENKOOLSPRUIT
Plan 3
Universal Coal
Brakfontein MRA
Slope
Legend
Project Area
Contour (20m)
Arterial / National Route
Main Road
Non-Perennial Stream
Perennial Stream
Dam / Lake
Percent Slope Rise
0 - 2
2 - 5
5 - 7
7 - 10
10<
universal coal plc
DIGBY WELLS ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E
Ref #: amc.UNI1292.201208.060
Revision Number: 1
Date: 10/08/2012
N
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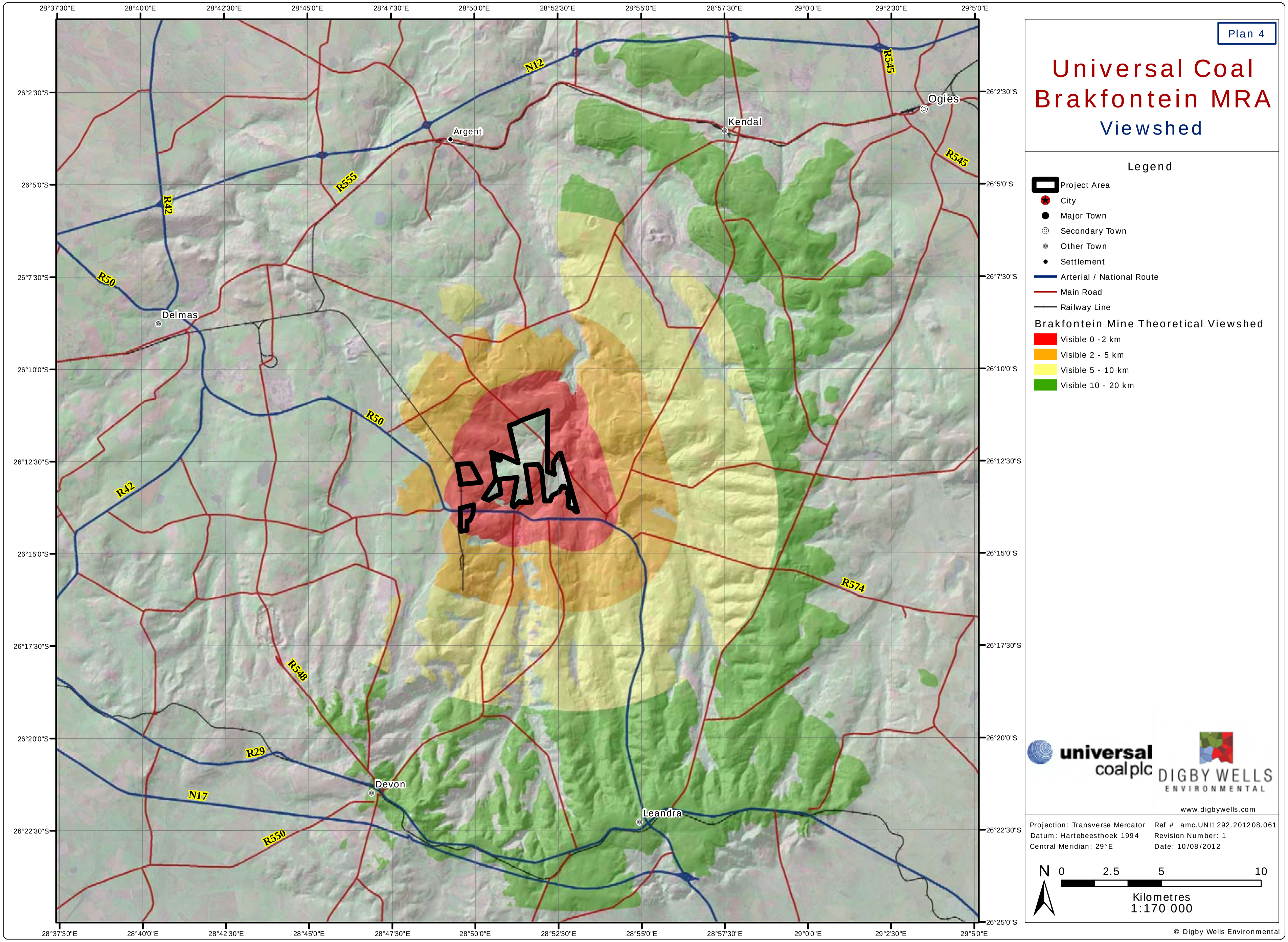
Kilometres
1:50 000


Plan 4
Universal Coal
Brakfontein MRA
Viewshed
Legend
Project Area
City
Major Town
Secondary Town
Other Town
Settlement
Arterial / National Route
Main Road
Railway Line
Brakfontein Mine Theoretical Viewshed
Visible 0 -2 km
Visible 2 - 5 km
Visible 5 - 10 km
Visible 10 - 20 km
universal coal plc
DIGBY WELLS ENVIRONMENTAL
www.digbywells.com
Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E
Ref #: amc.UNI1292.201208.061
Revision Number: 1
Date: 10/08/2012
N
0 2.5 5 10
Kilometres
1:170 000
© Digby Wells Environmental
Ogies
Kendal
Argent
Delmas
Devon
Leandra
N12
N17
R545
R555
R42
R50
R548
R29
R550
R574
28°37'30"E
28°40'0"E
28°42'30"E
28°45'0"E
28°47'30"E
28°50'0"E
28°52'30"E
28°55'0"E
28°57'30"E
29°0'0"E
29°2'30"E
29°5'0"E
26°2'30"S
26°5'0"S
26°7'30"S
26°10'0"S
26°12'30"S
26°15'0"S
26°17'30"S
26°20'0"S
26°22'30"S
26°25'0"S

Appendix B: Curriculum Vitae of Specialist

ALICE MCCLURE

Miss Alice McClure

Specialist: Geographic Information Systems (GIS)

GIS & Air Quality Department

Digby Wells Environmental

1 EDUCATION

- 2005 - 2007: B.Sc Environmental Sciences: Majored in Environmental Science and Entomology (Rhodes University)
- 2008: B.Sc (Hons) Environmental Sciences: Courses in Conservation Planning, Rehabilitation Ecology, Non-timber Forest Product Uses, Geographic Information Systems (GIS), Environmental Impact Assessment (EIA) and a short course in statistics (Rhodes University)
- 2009 – 2010: M.Sc. Environmental Sciences: Proactive conservation planning with a strong social focus using GIS

2 LANGUAGE SKILLS

English, Afrikaans and limited Zulu

3 EMPLOYMENT

March 2011 to present	Digby Wells Environmental
January 2009 – August 2010	Eden to Addo Corridor Inititiative

4 EXPERIENCE

GIS specialist in the Geographic Information Systems (GIS) and Air Quality Department. Graduated with an MSc in Environmental Sciences. The research associated with my master's degree was carried out while I was employed at Eden to Addo and was utilised practically to begin the systematic design of a conservation corridor between Addo Elephant National Park and Tsitsikamma National Park. Special consideration was given to the high social sensitivity of the area and the controversy surrounding conservation in the area. I used GIS to explore the effect and outcomes of incorporating social data into systematic conservation planning using least-cost corridor models. Since employment at Digby Wells, my expertise in ArcGIS processes has grown exponentially and techniques to solve spatial, temporal and analytical problems have been refined.

Responsibilities at Digby Wells Environmental currently include but are not limited to:

- Generation of maps for company projects;

- Compilation of Visual Impact Assessments;
- Assist in the completion of Biodiversity Assessments;
- Assist in compiling Interactive Biodiversity and Land Management Plans
- Assist in the completion of Due Diligence Reports
- Assist in the development of a systematic and efficient tree-relocation plan;
- Assist in the maintenance of the GIS database by storing all electronic files in a well organised structure
- Assist in the completion of Closure Cost Assessments by solving the spatial and analytical queries involved
- Assist in the design and completion of Rehabilitation Plans
- Assist in carrying out air quality assessments
- Produce spatial information in map format; and
- Application of GPS technology, aerial photo and satellite images

5 PROJECT EXPERIENCE

Xstrata Hyperspectral Remote Sensing Project – Xstrata Coal

Date 2011:

Responsibilities

- Assist in the research for and completion of the Xstrata Hyperspectral Remote Sensing report

Xstrata Full GIS Upgrade – Xstrata Coal

Date 2011:

Responsibilities

- Assist in the compilation of the original dataset

Dennilton Transmission Project Basic Assessment Report – PBA International (SA) PTY Ltd. (for Eskom Holdings)

Date: 2011

Responsibilities:

- Assist in the completion of the Biodiversity Assessment

Temo Coal Mine Environmental Impact Assessment and Environmental Management Plan – Temo Coal (PTY) LTD.

Date: 2011

Responsibilities:

- Generate spatial data in the form of maps
- Assist in the Closure Costing by solving spatial queries
- Assist in air quality assessment

Boikarabelo Coal Mine and Rail Environmental Impact Assessment, Nema/NEMWA Application and Waste License Applications – Resource Generation

Date 2011

Responsibilities

- Generate spatial data in the form of maps
- Assist in the design of a Landfill Site

Protected Plants Management Plan - Resource Generation

Date: 2011/2012

- Generate spatial data in the form of maps
- Assist in generating a tree removal/relocation plan

Kangala Coal Mine Closure and Rehabilitation Plan – Universal Coal PLC.

Date 2011:

Responsibilities

- Generate spatial data in the form of maps
- Assist in the Rehabilitation design by solving spatial queries

Kibali River Hydro-Electric Power Stations – Randgold Resources

Date: 2011/2012

Responsibilities

- Generate spatial data in the form of maps
- Analyse spatial data to assist specialist studies
- Compile visual impact assessment report
- Compile topographic report

Continental Coal Due Diligence (Project Kabeljou) – Continental Coal (PTY) LTD.

Date 2011:

Responsibilities

- Assist in the completion of the due diligence report
- Assist in the management of the project

Acid Mine Drainage Project – BKS (PTY) LTD.

Date: 2012

Responsibilities

- Generate spatial data in the form of maps
- Analyse spatial data to assist specialist studies

BSGR Solar PV Project – BSGR Resources LTD.

Date: 2011/2012

Responsibilities

- Generate spatial data in the form of maps
- Analyse spatial data to assist specialist studies
- Compile visual impact assessment report
- Compile topographic report
- Assist in the sensitivity Analyses using spatial information

Geluksdal TSF and Pipeline Project – Rand Uranium

Date: 2012

Responsibilities

- Generate spatial data in the form of maps
- Analyse spatial data to assist specialist studies
- Compile visual impact assessment report
- Compile topographic report

Roodepoort Strengthening Project - Eskom Transmission Division

Date 2011/2012:

Responsibilities

- Generate spatial data in the form of maps
- Analyse spatial data to assist specialist studies
- Compile visual impact assessment report

Mmamabula Optimisation Project – CIC Mining Resources LTD.

Date: 2011/2012

Responsibilites

- Generate spatial data in the form of maps
- Analyse spatial data to assist specialist studies
- Compile visual impact assessment report

6 PROFESSIONAL AFFILIATIONS

Geographic Information Society of South Africa (GISSA)

International Association for Impact Assessment (IAIA)

7 PUBLICATIONS

McClure, A.P. 2011. Opportunity and Connectivity: Selecting Land Managers for Involvement in a Conservation Corridor Linking Two Protected Areas in the Langkloof Valley, South Africa. Dissertation submitted in fulfilment of the requirements for the degree Master of Science, Department of Environmental Science, Rhodes University, South Africa.

8 COURSES ATTENDED

- July 2011: Mining for Non-Miners. Presented by Snowden Group.

Appendix C: Visibility of objects at a distance

Visibility of objects at a distance Seeing The Light

As a result of the curvature of the earth, there is a maximum distance at which an object of a given height can be seen before it disappears beneath the horizon. The chart below shows these distances for structures of heights from 5 feet through 1,000 feet.

This distance is increased when the observer is located at a point above the surface of the earth, and since most aids to navigation are viewed from the deck of a vessel, the maximum distance of visibility is increased. This is represented in the "Plus 15 foot observer" column.

Height in feet	Distance in statute miles	Plus 15 foot observer
5	2.96	8.08
10	4.18	9.30
15	5.12	10.24
20	5.92	11.04
25	6.61	11.73
30	7.25	12.37
35	7.83	12.95
40	8.37	13.49
45	8.87	13.99
50	9.35	14.47
55	9.81	14.93
60	10.25	15.37
65	10.67	15.79

Height in feet	Distance in statute miles	Plus 15 foot observer
70	11.07	16.19
75	11.46	16.58
80	11.83	16.95
85	12.20	17.32
90	12.55	17.67
95	12.80	17.92
100	13.23	18.35
110	13.87	18.99
120	14.49	19.61
130	15.08	20.20
140	15.65	20.77
150	16.20	21.32
200	18.71	23.83

Height in feet	Distance in statute miles	Plus 15 foot observer
250	20.92	26.04
300	22.91	28.03
350	21.75	26.87
400	26.46	31.58
450	28.06	33.18
500	29.58	34.70
550	31.02	36.14
600	32.40	37.52
650	33.73	38.85
700	35.00	40.12
800	37.42	42.54
900	39.69	44.81
1,000	41.83	46.95

http://terrypepper.com/lights/index.htm

1 foot = 0.3048 meters

1 mile = 1.609 km