1	25°23.125'S 27°05.128'E	Late Iron Age: Early Moloko Site (House floors and middens) Significance: High
2	25°23.098'S 27°05.414'E	Late Iron Age: Early Moloko Site (House floors and middens) Significance: High

Topographically the survey area varies greatly from mountainous regions to open grassland. In addition, although a rural area the region has been under development (both farming and residential) since the 1880s, which resulted in extensive infrastructure development. Existing infrastructure developments, therefore, include roads, fences, power lines, houses (including farm sheds), agricultural fields, dams, pipelines and formal and informal settlements. As a result the survey area has been severely disturbed by various private and commercial activities for a number of years. Most of the open grassland areas are old agricultural fields.

Corridor 1

Large areas have been utilised as agricultural fields and the first section of Corridor 1 runs along an existing power line. This trajectory is mostly open and flat, especially the western half.

Corridor 2

Large sections are open grassland with roads and old agricultural field. The eastern section passes through a mountainous area, but the western half is mostly open and flat. The large Iron Age settlement known as Marothodi, which is a Batlokwa capital and the large Late Iron Age (Sotho-Tswana) settlements in and around Pilwe Hill are situated between Corridor 1 and 2.

Corridor 3

This section runs along the Elands River floodplain. Most of the farms have extensive agricultural fields. The area has mostly cotton soils (high in clay) and is generally not favoured by Iron Age people to settle on.


Corridor 4

The area is characterised by rocky outcrops and tense vegetation. The southern section of the trajectory is divided into camps by extensive game fences. The northern section consists mostly of old agricultural fields.


Corridor 5

The area is characterised by rocky outcrops with interspersed open plains. Extensive roads and game fences abound in the area.

Two main types of impacts could occur on heritage resources, namely physical impacts where the construction of power lines impacts directly on heritage resources and a visual impact where power lines affect the aesthetic and visual appearance of historical or natural landscapes. Impacts caused by power lines on heritage sites could be less severe than impacts from more drastic developments such as mining, town development or dam building which have major and permanent effects on the environment.

The large Iron Age settlement known as Marothodi, which is a Batlokwa capital and the large Late Iron Age (Sotho-Tswana) settlements in and around Pilwe Hill are situated between Corridor 1 and 2. The most preferred corridor from the heritage impact perspective is Corridor 3 followed by Corridor 5. Sites C, D, E, and L are preferred substation sites as they occur in open spaces with no associated heritage sites. Two Late Iron Age (LIA) sites are located on a spur at the location of substation Site M. Because the substation is located on top of a spur, mitigation will be difficult, as space for alternative placement is limited. However, the impact of overhead power lines on heritage resources will generally be low as the only footprint left are the towers which cover a limited area; the power lines can be constructed so to avoid heritage

sites and heritage sites can be conserved beneath power lines if pylons are spaced in such a way that they do not affect the sites.

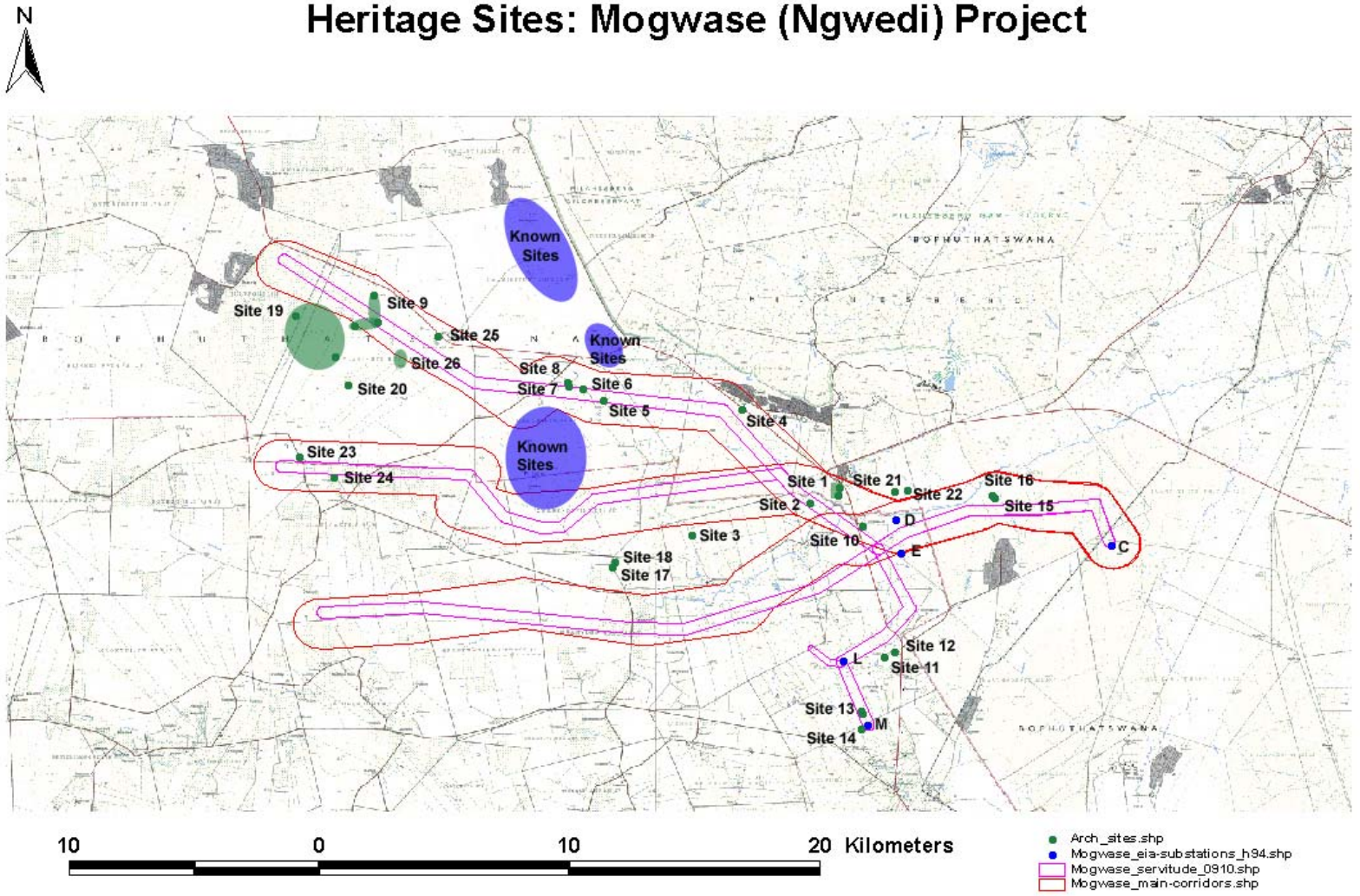

Figure 25: Known Archaeological Settlements within Study Area

6.9. SOCIAL

(See Appendix 7 for the Social Impact Assessment Report)

Electricity plays a key role in the attainment of social security and welfare as it supports economic and social development. The proposed Ngwedi substation will provide additional power to the Rustenburg/Pilanesberg area and surrounds that may enable previously un-serviced households to receive electricity.

Bojanala Platinum DM is said to be the economic engine of the North West Province and within this DM the largest contributor is Rustenburg LM, which had increased its Gross Domestic Product (GDP) from 51% in 1996 to 64.5% in 2003 with a total of approximately R12 Billion.[17] During the same period the contribution from the other two LMs namely Moses Kotane and Kgetlengrivier had decreased from 9.5% to 6% and 0.37% to 0.30% respectively. The main economic drivers in the province are mining, tourism, community services, trade and agriculture. Mining is the dominant sector of employment in both Rustenburg LM and Moses Kotane LM with 44.8% and 24.7% respectively. Mining opportunities include platinum, gold, diamonds, nickel and slate. 45% of the tourism destinations in the province are found in Bojanala Platinum DM with two of the most visited areas found in the study area, Sun City and Pilanesberg National Park.[30] Tourism and conservation areas are considered areas of high impact since electrical infrastructure would impact negatively on visual aspects and sense of place which invariably reduce attractiveness to potential tourists.

Passing through the Moses Kotane, Kgetleng Rivier and Rustenburg local municipalities, corridors 2 and 3 cross some cultivated land and parts of dryland/irrigated farming around Phatsima. There are also centre pivot irrigation systems along Corridor 3 that may be affected by the proposed development. Corridor 1 does not cross over any cultivated land.

The unemployment rate for the Bojanala DM is estimated at 40%. There is a high level of dependency within households, as the employed sector of the population has to provide for those household members that are unemployed or who are not economically active. The poverty rates in the DM have decreased from 44% (1999) to 36.8% (2003), with the highest poverty levels in Moses Kotane at 53%, followed by Kgetlengrivier at 32% and Rustenburg with 25%. [30]

In terms of access to basic needs, approximately 67% of household consumers in the DM have access to water above RDP standards. Individual household connections are prevalent in Kgetlengrivier (21.8%) and Rustenburg (20.7%) LMs whereas community taps are prevalent in Moses Kotane (50.9%). 61.6% of consumers in the district have access to sanitation that is below RDP standards. Moses Kotane LM has the highest proportion (69.2%), then Rustenburg LM at 45.7% and Kgetlengrivier at 34.1%.[30]

Settlement patterns within the target municipalities are generally on opposite ends of the spectrum, with Moses Kotane LM having scattered settlements, while Rustenburg LM generally has more concentrated settlements. The settlements that are in close proximity to the proposed substation sites are Ledig, Chaneng and Phatsima.

As with many parts of South Africa, unemployment is a problem in the area. In Kgetlengrivier LM and Rustenburg LM it is around 30%, which is higher than the national average (23%). But in Moses Kotane unemployment approaches 50%. Weighted annual income is R45,000, R62,000 and R36,000 respectively. Job creation is closely linked to economic growth, and must therefore be a firm objective of the area.

Despite being one of the more productive districts in the north-west, Bojanala DC contributes only 2.5% of the country's GDP (Demacon, 2009). Mining is the largest sector, contributing over

17% of South Africa's mining GDP and providing almost 35% of the employment in the district. Agriculture is only 1.8% of the national agricultural GDP, and provides only 6.5% of the employment in the district. It plays a relatively minor economic role in the Rustenburg LM and Moses Kotane LM. However, it is a more significant part of the economy of the Kgetlengrivier LM.

Manufacturing in the Bojanala DC is a very small contributor to the national manufacturing sector with little more than 1% coming from the district. However, it provides just over 10% of the total employment in the district (almost 4% more than the Agricultural sector). It is apparent that the sector is closely linked to the mining and agricultural sectors.

The trade sector is similarly dependent on the mining and agricultural sectors, and provides over 15% of the total employment in the district. It also contributes 1.7% towards the national GDP in the trade sector.

The tourism industry is not a well defined economic sector in South Africa as it represented across all the above sectors, but there is no doubt about the significance of its role in the South African economy. In 2008 the contribution to the South African GDP was estimated at 8.5%, and it had grown by 19% in that year. This is expected to level off to around 4.3% per annum over the next 8 to 10 years. Approximately 20% of tourism is from the foreign market, the rest being domestic. The North-West Province is the least visited by foreign tourists, with an average length of stay at just over 3 nights per visit and only around 10% of these are at high end facilities (lodges, hotels, guest houses). Direct spend by foreigners in the North-West is the second lowest in the country at around R1.7 billion. Details of the contribution of tourism in the Bojanala DC to the national tourism sector are not known. However, even though the North-West Province appears to play a relatively small role in the national tourism sector, the Pilanesburg national park and Sun City are still two of the nationally important destinations.

Of the different sectors described above, tourism and agriculture are the most likely to be negatively affected by the new substation and power lines. Although some mitigation is possible to reduce the impact on the agricultural sector, mitigation in the tourism sector is harder as much of the tourism based activities are centred on the wilderness experience. Power lines and substations are clearly not compatible with this. Only careful routing of the lines may mitigated the impact, though this is not always possible.

The other sectors are seen to be likely to benefit from the opportunity of better and more reliable supply of electricity that the substation and power lines will bring into the area. They are also seen to be greater contributors to both the local and national economies, as well as potentially offering greater opportunity for job creation in a region where unemployment levels are well above the national average.[44]

6.10. VISUAL

(See Appendix 8 for the Visual Report)

Aesthetic value is the emotional response derived from the experience of the environment with its particular natural and cultural attributes. The response is usually to both visual and non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings and attitudes.[45] Thus aesthetic value is more than the combined factors of the seen view, visual quality or scenery. It includes atmosphere, landscape character

[44] *Reference for all economic information is made to the report by Demacon, 2009. Delta-Epsilon Power Line Economic Assessment: market Research Findings & Recommendations, June 2009.*

[45] Ramsay, J. (October 1993). Identification and assessment of aesthetic values in two Victorian forest regions. *More than meets the eye: identifying and assessing aesthetic value.* Report of the Aesthetic Value Workshop held at the University of Melbourne.

and sense of place.[46]

Landscape character types are landscape units refined from the regional physiographic and cultural data derived from 1:50 000 maps, aerial photographs and information gathered on the site visit. Dominant landform / land use features (e.g., hills, rolling plains, valleys and urban areas) of similar physiographic and visual characteristics, typically define landscape character types.

The area has a flat to rolling topography and the proposed site is a relatively flat area that is bordered to the north by the Pilanesberg Mountains and to the west are smaller koppies. The Elands River runs between the R556 and the proposed substation alternatives while the Bonwakgogo, Matlapyane and Majapele rivers run between Alternative Site D and Site C.

The vegetation of the area is characterised by the Zeerust Thornveld as described by Mucina & Rutherford (2006). This vegetation type features deciduous, open to dense short thorny woodland with a low herbaceous layer mainly of grasses.

The man-made landscape types that occur within the study area include old agricultural fields, built-up areas (residences), infrastructure such as roads, existing power lines and the existing mining activities. The overall site as well as the turn-in sites can be characterised by the above mentioned landscape characteristics. However, it is important to note that the alternative substation sites differ from each other.

Generally, within the context of the study area the *highest* value is assigned to the mountains, main rivers and the Pilanesberg National Park. The smaller rivers and associated streams as well as the dams are also rated high. The combination of these natural features creates a more natural and rural environment with a strong sense of place. Agricultural activities/ cultivated lands, farmsteads and residential areas have a moderate scenic quality as these areas due to activities such as the removal of plants, erosion and overgrazing have transformed environment. The landscape types with the lowest scenic quality rating are the existing infrastructure, the R566 and R565, local and dirt roads, mining related activities and infrastructure.

The overriding sense of place of the study area is a mixture of mining, residential, tourist and natural landscapes and evokes different feelings when driving through the area. The sense of place continually changes from being characteristically busy to more peaceful. To the south of the proposed sites are different mining and industrial activities as well as existing transmission lines. To the west and the east of the site are a mixture of more natural vegetation areas with the rivers, grassland, mountains and the cultivated lands with farmsteads. This section of the study area is more peaceful with a pastoral sense of place. To the north of the site is the Pilanesberg with all the associated tourist facilities, which creates a more natural setting. When driving on the R565 towards the load centre you get a more urban and active sense of place when passing the different mining activities and townships. This is however different for tourists or motorists travelling on the R556, as this side has a more natural and peaceful feeling to it.

In determining the quality of the visual resource, both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high.

[46] Schapper, J. (October 1993). The importance of aesthetic value in the assessment of landscape heritage. *More than meets the eye: identifying and assessing aesthetic value.* Report of the Aesthetic Value Workshop held at the University of Melbourne.

The landscape can be divided into basic landscape character types, each with its own set of physical, visual and aesthetic characteristics (Table 14). Scenic quality ratings were assigned to each of the landscape units. The *highest* value is assigned to the mountains, main river (Elands River) and the Pilanesberg National Park. The smaller rivers and associated streams (tributaries) as well as the dams are also rated high. The combination of these natural features which is characteristic of the study site and surrounding areas create a more natural and rural environment with a strong sense of place. This scenic quality and sense of place is however diminished by activities with a lower scenic quality such as the towns / townships, infrastructure, mining activities and power lines. The agricultural activities / cultivated lands and farmsteads have a moderate scenic quality.

The landscape types with the lowest scenic quality rating are the existing infrastructure, the R556 and R565, other local and dirt roads and mining related activities and infrastructure. The towns / townships have a moderate to low scenic quality as these areas do not contribute to a higher visual resource quality but actually have more of a negative impact on the environment through activities such as the removal of plants, erosion and overgrazing. It is clear that they do not contribute to the aesthetic value of the area.

Table 14: Value of the Visual Resource - Scenic Quality

High Mountains, Rivers	**Moderate** Farmsteads, cultivated lands and other agricultural activities	**Low** Towns / townships, transport infrastructure, mining infrastructure
This landscape type is considered to have a *high* value because it is a:	This landscape type is considered to have a *moderate* value because it is a:	This landscape type is considered to have a *low* value because it is a:
Distinct landscape that exhibits a very **positive character with valued features that combine to give the experience of unity, richness and harmony**. It is a landscape that may be considered to be of particular importance to conserve and which has a strong sense of place. It may be sensitive to change in general and may be detrimentally affected if change is inappropriately dealt with.	Common landscape that exhibits **some positive character but which has evidence of alteration / degradation / erosion of features resulting in areas of more mixed character**. It is potentially sensitive to change in general and change may be detrimental if inappropriately dealt with but change may not require special or particular attention to detail.	**Minimal landscape generally negative in character with few, if any, valued features**. Scope for positive enhancement could occur.

Sections that are placed in bold are applicable to the study area.

6.11. FLOODLINES

(See Appendix 9 for the Floodlines Report)

Floodlines report will provide an assessment based on risk by flooding, and potential impact on flood lines for the project. The risk assessment has been done utilising indicative floodlines; developed using a catchment based hydrological assessment, and hydraulic surveys at selected points on the watercourse. Detailed hydraulic analysis of river reaches has not been done. Therefore, it must be noted that the floodlines developed for this report are for planning purposes only, and should not be used for design functions. This level of assessment is seen as appropriate for assessment of potential impacts, but additional detailed hydraulic analysis may be required at critical locations during the design phase of the power lines or substation.

Results from the hydrological model were utilised in the ISIS hydraulic model. These results are presented in table 15 below.

Table 15: Hydraulic Model results.

River (site)	100 Year Flood			
	Peak flood (m^3/s)	Flow depth (m)	Ave. velocity (m/s)	Ave flood width (m)
Site 1:Elands 1				
XS1_1	1280	10.6	2.06	245
XS1_2	1280	10.3	1.43	390
XS1_4	1280	8.7	1.66	400
Site 2: Elands 2				
XS2_1	1220	10.9	2.52	150
Site 6: Elands 3				
XS6_1	1100	10.3	1.68	315
XS6_2	1100	8.8	1.90	220
Site 5: Sandspruit 1				
XS5_1	317	3.6	2.07	115
Site 4: Sandspruit 2				
XS4_1	332	3.3	2.64	95
XS4_2	332	3.3	2.65	85
Site 3: Sandspruit 3				
XS3_1	356	4.9	1.82	135

XS3_2	356	4.7	1.67	150
Site 7: Unknown				
XS7_1	115	1.8	2.22	65
Site 9: Matlopyane				
XS9_1	193	3.8	1.67	145

Calibration data for the hydraulic model were limited and the study did not make provision for searching for observed data. In the period 5-10 February, the northern areas of the North-West Province received rainfall above 100mm and up to 300mm in places, leading to high releases from Hartebeestpoort Dam into the Crocodile River[47]. This would place the February 5-10 rainfall event somewhere between the 20 year to 100+ year return periods. The magnitude for the Elands River catchment in the area of the Pilanesburg has not been investigated in any detail in this study, but it is likely the event was well above the 1:20 year event, possibly closer to the 100 year event.

It must be noted that the indicated position of the 2000 event is on cultivated agricultural lands. Sustained tillage may have resulted in the slope of these being different to that of the surrounding floodplain. The influence of such a localised impact on topography would not be reflected in the 20m contours, on which the floodline joining survey sections was based. A flatter topography would result in the floodwater inundation being greater than that under normal conditions.

[47] Dyson, L.L. and van Heerden, J., 2001. South African Journal of Science 97.