

8 POTENTIAL IMPACTS AND SITE SELECTION

8.1 Introduction

Scoping is widely recognised as a critical step in the Environmental Impact Assessment (EIA) process. This Scoping Study is two fold as it identifies significant issues that require further investigation as well as identifying the preferred site/s that will go through for further investigation. These issues and sites will be carried forward into the EIA phase and subsequently the Environmental Management Plan.

The scoping of all environmental issues was assessed according to the following factors:

- the nature of the proposed activities and the receiving environment;
- the legal, policy and planning context of the proposed new ash dam; and
- the socio-economic and environmental priorities of the Interested and Affected Parties (I&APs).

The focus of an EIA ultimately narrows down to a judgement on whether the predicted impacts are significant. Significance is, however, relative and must always be set in a context, e.g. competition for resources, social sensitivity or the scale and rate of development.

8.2 Alternative Site Selection

8.2.1 Alternative Site Ranking Criteria

In order to identify which of the alternative sites are deemed preferred for further investigation during the EIA Phase, the specialist were requested to rank the alternatives sites according to a site ranking methodology.

The evaluation and nomination of a preferred site involves a highly interdisciplinary approach. The approach undertaken has involved a number of specialist studies which examine a number of different issues. In order to evaluate sites and determine a preferred site, the studies need to be comparative and therefore a site rating matrix was developed. The site preference rating system is applied to each discipline, and the rating of each site was conducted according to the following system:

- 1 = Not suitable for development / No-Go (impact of very high significance - negative)
- 2 = not preferred (impact of high significance - negative)
- 3 = acceptable (impact of moderate significance - negative)
- 4 = Preferred (impact of low or negligible significance - negative)

While each specialist study was required to have the Site Preference as an outcome, how they evaluated each site varied from discipline to discipline and the description of their specific approaches are outlined in each specialist report (refer **Appendix K to P**).

The site preference results for each site from each specialist study were entered into a matrix and added together. The site with the highest value is then considered the most preferable.

Table 8.1 outlines each specialist studies criteria for each of the site preference ratings.

Table 8.1: Specialist Criteria for Site Preference Ratings

Site preference Rating	Criteria
Biodiversity	
Preferred (4)	the site and immediate surrounds are regarded to comprise of low sensitivity habitat and potential impacts are unlikely to result in significant and/ or severe impacts on terrestrial biodiversity attributes
Acceptable (3)	the site and immediate surrounds comprises limited areas of sensitivity and, although impacts on terrestrial biodiversity attributes are expected to occur, these impacts are regarded manageable
Not Preferred (2)	the site and immediate surrounds comprises extensive areas of sensitive habitat types. Impacts associated with the proposed development are expected to result in significant and severe impacts on the terrestrial environment. The implementation of significant mitigation measures are expected to result in limited protection for these environments
No-Go (1)	aspects of high sensitivity are known to be present within the proposed area. Severe and significant impacts are expected to result in irreversible and permanent impacts on the area as well as sensitive biodiversity attributes. Mitigation of potential impacts are not expected to be successful in limiting impacts
Surface Water	
Preferred (4)	Site falls completely or mostly beyond the boundaries of the allocated buffer zones. No or only single, relatively small non perennial watercourse crossing required. Moderately to seriously modified PES.
Acceptable (3)	Site infringes only on a relatively small area falling in the allocated buffer zone. A single relatively small lentic system requires spanning, or multiple non perennial systems. Moderately to seriously modified PES. Receiving watercourses, in direct catchment, are of limited or no importance and sensitivity.
Not Preferred (2)	Site infringes on relatively small permanent wet areas, or relatively large seasonal and temporary wet areas. A relatively small perennial lotic system or relatively large lentic system or multiple smaller lentic systems require spanning. Or, PES falls in a Largely natural or moderate category. Or, receiving watercourses are considered to be ecologically important and sensitive. Their biodiversity may be sensitive to flow and habitat modifications. Functional benefits associated with receiving watercourses are likely to be present.
No-Go (1)	Site infringes on relatively large permanent wet areas. A single, relatively large perennial system or multiple smaller perennial systems require spanning. Or the PES of the site is in an unmodified state. Or, receiving watercourses are considered ecologically important and sensitive on a national or even international level, with biota sensitive to flow and habitat modifications. Functional benefits associated with receiving watercourses are very likely to be present.

Ground Water				
Preferred (4)	Distant from surface water and wetlands (250 m buffer) and other groundwater users, topographically high (maximum depth to groundwater), and adjacent to the existing ash dam. Not close to existing open cast or underground mining operations.			
Acceptable (3)	Distant from surface water and wetlands (250 m buffer), and other groundwater users, and close to the existing ash dam. Not close to existing open cast or underground mining operations.			
Not Preferred (2)	Close to either surface water and wetlands, or other groundwater users. Close to existing open cast or underground mining operations			
No-Go (1)	Adjacent or overlapping surface water and wetlands, or other groundwater users.			
Avifauna				
Preferred (4)	Approximately 100% of site is in Low sensitivity area. Site is near to Power station. Site is smallest of alternatives. Site is furthest from wetlands. No roosting/nesting sites of red listed species observed			
Acceptable (3)	Approximately 80% - 100% of site is in Low sensitivity area. Site does not border wetlands. No roosting/nesting sites of red listed species observed			
Not Preferred (2)	Approximately 20% - 50% of site is in High sensitive area. Site is close/adjacent to wetlands. Site is furthest from Power Station. Possible presence of nesting/roosting red listed species			
No-Go (1)	Approximately >50% of site is in high sensitive area. Confirmed presence of roosting/nesting red listed species			
Social				
Preferred (4)	no impact on any population			
Acceptable (3)	density low and close to existing ash dam			
Not Preferred (2)	Higher density, farming communities but further away from old ash dams			
No-Go (1)	New ash dams close to high density residential – likelihood of impact high for longer duration			
Visual				
	<i>Proximity to power station</i>	<i>Extent of visual exposure</i>	<i>Presence of high viewer incidence</i>	<i>Sensitive visual receptors</i>
Preferred (4)	Close (8)	Small (4)	Few (4)	Few (4)
Acceptable (3)	Med close (6)	Med small (3)	Mod (3)	Mod (3)
Not Preferred (2)	Med far (2)	Med large (2)	Significant (2)	Significant (2)
No-Go (1)	Far (1)	Large (1)	Most (1)	Most (1)

8.2.2 Alternative Site Discussion

- **Biodiversity**

In order to present an opinion on the suitability of a site for the proposed development, the following is taken into account:

- Presence/ absence of natural and sensitive habitat types within the boundaries of the site;
- Perceived ecological status;
- Known regional/ local sensitivities;

- Areas/ habitat of sensitivity within the immediate surrounds that might also be affected; and
 - Habitat types that might be affected by infrastructure, pipelines and access roads that will be required for the proposed development.
- *Alternative A*

Comprise mostly agricultural fields with mining activity to the west. Extensive grassland and riparian habitat located to the east and north of this site is a concern, but could potentially be protected by means of strict mitigation measures. The suitability of this site for the proposed development is therefore regarded medium.
 - *Alternative B*

Although this site comprises extensive agricultural fields, some parts are characterised by wetland habitat that was not previously captured on the database and only observed during the brief site investigation. As a result of the presence of these scattered wetlands, the suitability of the site for the proposed development is regarded medium, also considering the distance to the power station.
 - *Alternative C*

This site comprises exclusively of agricultural fields and no habitat of sensitivity is present within the proposed boundaries. A riparian habitat is located to the east of the site and this habitat will need to be crossed by the required pipeline infrastructure. In addition, extensive natural grassland and riparian wetland is present to the south and east of this site, rendering the suitability of this site for the proposed development is regarded as medium-low.
 - *Alternative D*

Similar to Site A, this site comprises extensive agricultural areas, but grassland and riparian habitat is located to the immediate east and west of the site. The perceived ecological status of the wetland areas to the west was estimated to be relative low as a result of mining activities. Ultimately, the suitability of the site for the proposed development is regarded as medium, mainly as a result of the presence of extensive areas of natural grassland habitat located to the east of the site.
 - *Alternative E*

The presence of wetland and grassland habitat that was not captured in the existing database, within this site was confirmed during the site investigation. The position of this site in close proximity to the power station implies that no sensitive habitat needs to be crossed by the required infrastructure. Surrounding habitat is similarly low in sensitivity. The suitability of the site for the proposed development is regarded as medium. This site is furthermore entirely isolated by means of road infrastructure and mining development.

Overall

It should be noted that each of the site alternatives have strong and weak selection points for the proposed development. The presence of small and isolated sensitive habitat within the boundaries of some of the sites, compared to the presence of larger, sensitive habitat within the immediate surrounds of other sites ultimately renders the difference between the various site alternatives relatively small. While the loss of some small areas of sensitive habitat could be debated as a significant impact, impacts of the proposed development on surrounding areas of sensitive habitat could potentially be of similar significant nature. These impacts could however potentially be mitigated in order to render the likelihood of occurrence relatively low.

It is ultimately concluded that sites comprising some sensitive parts (Sites B, D, E) are regarded slightly lower in suitability for the proposed development, compared to sites that comprises mostly of low sensitivity habitat, but with sensitive habitat in the immediate surrounds (Sites A, C).

- **Avifauna**

As all five alternative sites are within the same QDGS, the SABAP1 data could not be used as a criterion to differentiate sites. However, by identifying the red-listed bird species in the study area, and then by looking at the available Bird Micro-habitats of each site, a site preference ranking was possible. Comparing the position of the alternative sites relative to sensitive areas and available microhabitats assisted in this regard.

- *Alternative A*

This exact location of this alternative was not accessible during the site visit. A long distance view of the area was obtained (from observation points A1 and A2 in Figure 10) and revealed that the site is mostly farmlands and maize fields. A desktop review also found that this site has a medium to low sensitivity. Site Preference Ranking: Acceptable (3).

- *Alternative B*

The area was accessible during the site visit and consists of primarily cultivated lands ("mielie fields") A black shouldered kite was observed hunting at this site (Fig 10- Observation point B2), indicating the possible presence of a rodent population. The Northern end of the site is bisected by an existing power line, while east of the site a small dam (Observation Point F) was observed with various bird species present. Site Preference Ranking: Acceptable (3).

- *Alternative C*

This exact location of this alternative was not accessible during the site visit. A long distance view of the area was obtained from the rail bridge observation point (Fig 10 – C1) and revealed that the site is mostly farmlands and maize fields. Farm dams were also visible in proximity to this site while little other infrastructure (e.g. houses, roads and power

lines) was observed in the area. For this reason, and the distance of the site from the Power Station, this site is not preferred. Site Preference Ranking: Not Preferred (2)

○ *Alternative D*

This site was in close proximity to a prominent drainage line and a large dam to the West and South of the site. It is also near to a mining area ("Total Tumela Mine") and the predominant microhabitat appears to be cultivated lands with some natural grassland areas. Various water birds were observed at observation point D2, from where the photograph in Figure 5 was taken. Site Preference Ranking: Not Preferred (2)

○ *Alternative E*

This site is situated closest to the Power Station, and is also the smallest of the proposed alternatives. There were no visible water bodies nearby, and it consists primarily of cultivated lands ("mielie fields"). It has many disturbed areas such as roads and powerlines in close proximity. Site Preference Ranking: Preferred (4).

• **Surface Water**

Table 8.2 shows the scores assigned to the factors considered in the alternative site ratings. Alternative D yielded the highest score. This was largely due to extensive wetland infringement and the probable requirement for watercourse crossings associated with infrastructure development. Alternative D and A, reflected a lower PES than the other alternative sites and was allocated a higher score for this factor. The lower PES for these sites is mostly the result of extensive bed, bank, channel and hydrological alteration of the East Woestalleenspruit. Alternative C and E yielded the lowest factor rating scores overall. It is expected that these alternatives will impose the smallest environmental risk relative to the other sites. Drainage lines linked to these sites are smaller in extent than other sites and in both cases wetland infringement is marginal. Concurrently, additional ash transporting infrastructure will probably not require water course crossings. It should however be mentioned that the catchment associated with both of these alternative sites drains into the West Woestalleenspruit which is currently largely not impacted by mining activity, for this reason these alternatives were assigned a lower PES factor score.

Table 8.2: Ratings for respective factors considered for each alternative.

Alternative	Wetland Infringement	Water Course Crossings	Desktop PES	Desktop EIS	Score /18	Score %
Alternative A	0	5	3	3	9.8	54.44
Alternative B	5	0	2	2	8.2	45.56
Alternative C	2	2	2	2	7.2	40.00
Alternative D	5	5	3	3	14.8	82.22
Alternative E	3	0	2	1	5.4	30.00

- **Ground Water**

The five potential sites for a new ash storage facility at Hendrina power station have been evaluated in the light of a conceptual hydrogeological model of the area, built up by studying available data and by visiting the site.

All sites are located on very similar geology and aquifer type as well as at similar topographic elevations. No major groundwater abstractions are shown on the DWA 1:500 000 scale hydrogeology map of the area (Sheet 2526 Johannesburg) in the area.

According to the available data, site 1 is the preferred site. The site is not within any surface water buffer zone and additionally in close proximity to the existing active ash storage facility, therefore minimising groundwater monitoring and pumping efforts.

While the hydrogeological setting of Alternative B is very similar, it is less preferred due to its potential impacts on two water courses in close proximity in comparison to Alternative C, which is likely to impact on only one.

Alternative E and D fall partially within the 250 m buffer zone around surface water features (wetlands and water bodies in the area) and are therefore not preferred. Alternative D is furthermore in close proximity to an open cast mine.

Alternative A is adjacent to an existing open cast mine and as a result also not preferred.

- **Social**

The following criteria were used to assess the alternative sites:

- Distance from proposed ash dam – In general terms and in a way linked to the quality of life that includes perceptions etc. would suggest that this criteria be considered a medium sensitivity issue due to the context including mining and heavily disturbed areas to the north of the power station;
- Settlement type – linked to the above, distance but has distinctive issues. Residential will normally include schools and all other community supporting facilities. Therefore residential areas are considered to have a higher sensitive.
- Settlement farms – distinguished between one farm house and a small community, farm house as well as employee housing etc. This also includes the so-called informal settlements of those that are normally economic and otherwise marginalized.
- Health risk (Including Dust Pollution) – also somewhat related to distance but has distinct features which do not necessarily relate to distance. It can be accepted that the ash dam could impact one's health within a radius of approximately 3 km will.
- Visual impact – direct line of sight – a low sensitivity is linked to this issue due to the fact that these are is heavily changed due to mining and the power station.

- Economic impact – the sterilisation of agricultural land is seen as sensitive due to the potential economic loss of 209 ha. This issue can be explored on an individual, regional and national context.

Criteria proposed:	Impact rating		
	High	Medium	low
Distance from proposed ash dam:	500 - 1000 meters	1000 - 1500 meters	1500 - 3000 m
Settlement type: Has direct correlation to number of people affected Residential will also cater for schools and other amenities	Residential	Informal community	Single housing
Settlement farms:	Community	Farm house	No housing
Health risks - air quality	Risk within radius	Maybe risk	low risk
Correlates with distance - proposed ash dam	500 - 1000 meters	1000 - 1500 m	1500 - 3000 m
Dust pollution - visibility/health/quality	Above legal standard	Within limits	Below legal standard
Visual impact - quality of life Proximity to major roads and housing - direct visual line	Within 1000m	Within 1500m	Within 3000m
Economic impact agric: Natural veldt - still existing is therefore sensitive	Private farmland	Eskom land but farmed	Denuded land

The methodology to be used is commonly applied to various projects and no new methodology needs to be developed for this project. The aspects identified e.g. pollution, will be rated according to the methodology below.

Distance from the proposed ash dam is a common denominator used for determining the severity of the possible impact. For example: if the proposed ash dam is close to a high density populated or urban area, the impact is likely to be high on health, visual and discomfort index. The higher the population that might be affected the higher impact.

The sites were first rated on distance as well as population density and then on possible health and possible economic impact. The economic impact is from an agricultural point of view in that land is sterilised for agricultural purposes.

Residential and population density – the further away and the lower the population density the more preferable the site:

Severity – Social – population density	
5	Irreparable damage – Town and Urban facilities
4	Serious social issues – Farming communities
3	Moderately important social issues – Farm housing
2	Impacts on the local population – only temporary residing
1	Insignificant social issues – no residential

- Site A: 1;
- Site B: 5;
- Site C: 4;
- Site D: 4;
- Site E: 2.

Purely from a residential type which reflects the population density, site A is the preferred site followed by site E.

Health, visibility and air quality – adding to distance and population density possible duration and likelihood:

During the EIA phase statistics from the power station will be verified in order to determine the assumptions made under this heading. The assumption is that the closer a residential type is to the source of pollution the higher the impact depending on the possible duration of dust pollution in relation to possible health impact. This is also related to the overall wind direction in relation to the ash dam and population area.

Duration	
5	Permanent – every day
4	Long Term – most of the year
3	Medium Term – every month for 15 days or more
2	Medium-Short Term – some days some months
1	Short term – during dry season so now and then

Results:

- Site A: 1 – no impact on any population;
- Site B: 4 – New and old ash dams close to high density residential – likelihood of impact high for longer duration;
- Site C: 3 – lower density, farm house but old and new proposed ash dam.
- Site D: 3 – Higher density, farming community but further away from old ash dams.
- Site E: 2 – Single farm house, density low and close to existing ash dam.

Result: From this perspective site A is the preferred site followed by site E. From an agricultural point of view all site do have an impact on agricultural land. But according to proposed criteria site E belongs to Eskom and is therefore rated as a medium impact. All other sites are private farms.

The concluding social point of view is as follows:

- Site A: Is situated in an area where no residential area exists. This is mainly agricultural land with no houses and it is therefore seen as the best site for the ash dam. This will be verified during the EIA phase.
- Site B: This site is situated close to Pullens Hope as well as some agricultural settlements. The population density is therefore the highest for all the alternative sites.
- Site C: Further away but still in close proximity to agricultural settlements.
- Site D: The same as for the above.
- Site E: This site is close to the existing ash dam sites. It also borders on some settlements but might just fall outside the red area indicated on the sensitivity map.

With the above discussion the combined result is that the preferred site is Alternative A with Alternative E as the second best from a social point of view with the criteria used. This must be verified during the EIA phase as well as the criteria used was sufficient to come to this conclusion in the scoping phase. The impacts will be investigated separately and described in more detail in the EIA report.

- **Visual**

Anticipated issues related to the potential visual impact of the proposed ash dam include the following:

- The visibility of the infrastructure to, and potential visual impact on observers travelling along national and arterial roads (i.e. the N11 and R542) as well as secondary roads within the study area.
- The visibility of the facility to, and visual impact on farms and homesteads within the study area.
- The visibility of the infrastructure from and potential visual impact on tourist access routes (i.e. the N11 and R542) within the study area.
- The potential visual impact of the infrastructure on the visual character and sense of place of the study area, with specific reference to the rural and agricultural nature of the greater region.
- The potential visual impact of ancillary infrastructure (i.e. conveyors, access roads, fencing and security lighting etc.).
- The potential visual impact of lighting of the infrastructure in terms of light glare, light trespass and sky glow.
- The potential cumulative visual impact of the proposed infrastructure, which will contribute to the existing industrial visual character of the power station and immediate surrounds. This is relevant in context of the largely rural and agricultural nature of the greater region.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

These anticipated visual impacts should be assessed in greater detail during the EIA phase of the project as this report is only focussed on defining the potential visual exposure of the proposed development and identifying the potential issues associated with the visibility of the proposed ash dam.

The viewshed analyses for the 5 alternative sites take into account the scale of the proposed infrastructure, calculated at 44m above ground level, and cover the entire footprint area of each site.

This was done to determine the general visual exposure of the area under investigation, simulating the anticipated ash dam at its full height. It must be noted that the viewshed analyses do not include the effect of vegetation cover or existing structures on the exposure of the proposed ash dam, therefore signifying a worst-case scenario.

- *Alternative A*

The result of the preliminary viewshed analysis for the proposed ash dam, should this be located on **Alternative A**, is shown on **Figure 8.1**. The following is evident from the viewshed analysis:

- The proposed ash dam will have a large core area of potential visual exposure on the site itself, and within a 2,5km offset. Almost the entire area within 2,5km is likely to be visually exposed. Exceptions are small patches in the north, west and south.

This core area includes a number of homesteads and farms (i.e. Bosmanskop and Bosmansfontein) and a few pans and dams. In general, the actual drainage lines are not exposed, due to their incised topography.

A short stretch of the N11 falls within this zone, as does part of the secondary road to the south east of the site.

- Potential visual exposure is somewhat reduced in the medium distance (i.e. between 2,5 and 5km). Areas in the west, beyond the existing ash dam, as well as to the east and south west will be visually screened.

The main receptors that are likely to be exposed to potential visual impact include users of the N11 to the north of the site and secondary roads to the north, south west, east and south. The farms and homestead of Bosmanskop falls within the viewshed and will be exposed to potential visual impact.

A few non-perennial pans also fall within the zone of potential visual exposure.

- In the longer distance (i.e. beyond 5km), visual exposure is further reduced, with the main areas of potential visual exposure lying to the north, south west and far north west of the study area.

Receptors exposed to potential visual exposure include the farms and homesteads of Roodepoort, Oranjia and Driefontein. Short stretches of the N11 (north of the study area) fall within the zone of potential visual exposure, as do limited lengths of secondary roads in the south and north west of the study area.

The total area of potential visual exposure for this site alternative is 157,4km².

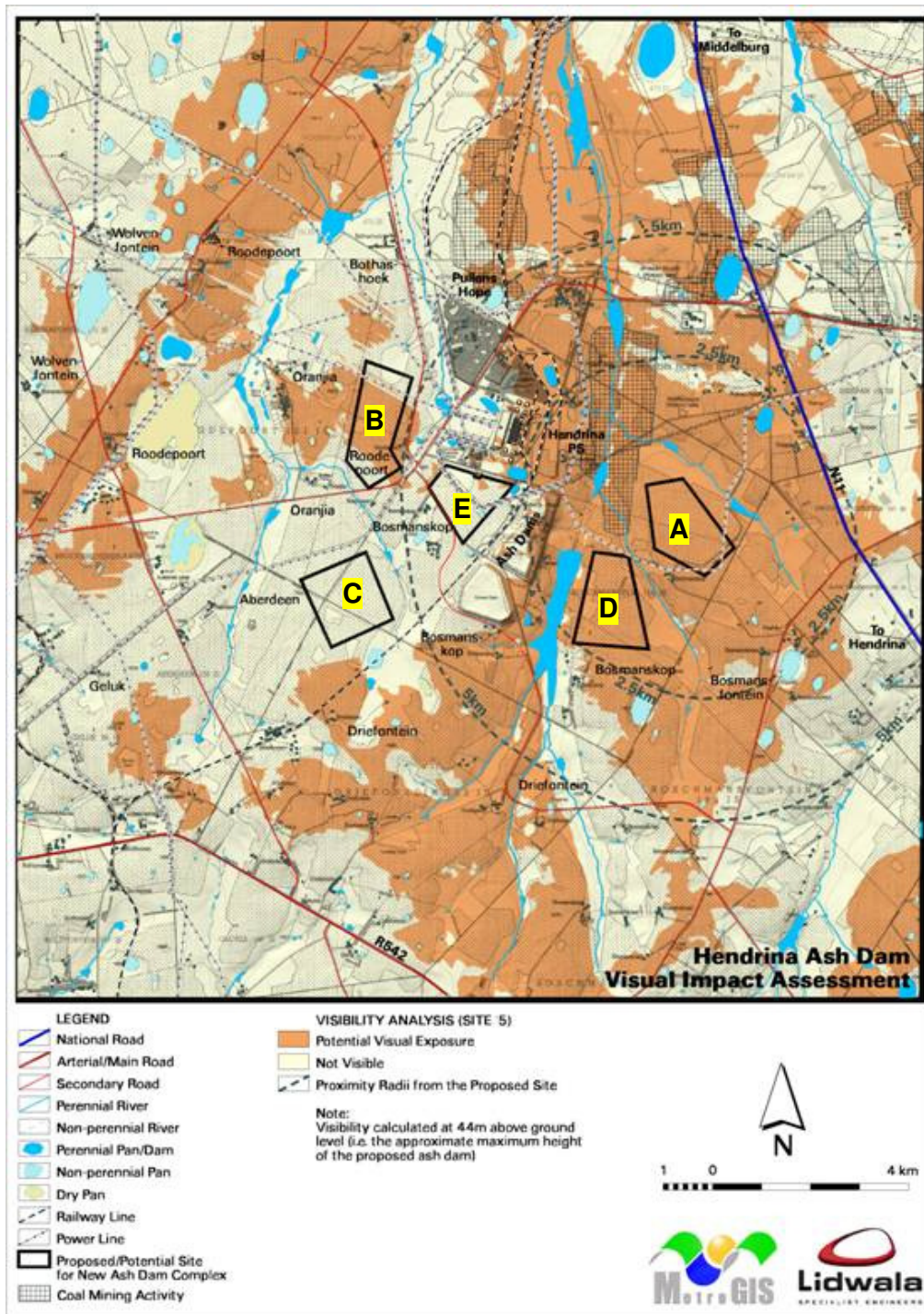


Figure 8.1: Potential visual exposure for Alternative A.

o *Alternative B*

The result of the preliminary viewshed analysis for the proposed ash dam, should this be located on **Alternative B**, is shown on **Figure 8.2**. The following is evident from the viewshed analysis:

- The proposed ash dam will have a large core area of potential visual exposure on the site itself, and within a 2,5km offset. Almost the entire area within 2,5km is likely to be visually exposed. The exception is the east, beyond the power station, and west beyond Oranjia.

This core area includes a number of homesteads and farms (i.e. Bothashoek, Bosmanskop, Oranjia and Roodepoort) and a few dams and pans. In general, the actual drainage lines are not exposed, due to their incised topography.

The secondary roads giving access to the north, west and south east will also be exposed to potential visual impact.

- Potential visual exposure is somewhat reduced in the medium distance (i.e. between 2,5 and 5km). A large area in the east as well as smaller patches in the west will be visually screened.

The main receptors that are likely to be exposed to potential visual impact include users of secondary roads to the north, north west and west and a number of homesteads and farms. These include Roodepoort, Aberdeen and Driefontein.

A few drainage lines, dams and non-perennial pans also fall within the zone of potential visual exposure.

- In the longer distance (i.e. beyond 5km), visual exposure is further reduced, interrupted in the far north west, north east and east, and by the hills in the south of the study area.

No farms or homesteads are expected to be exposed to potential visual impact, but relatively long stretches of the N11 fall within the zone of potential visual exposure. Short stretches of secondary roads in the west, north and south will be similarly exposed.

The total area of potential visual exposure for this site alternative is 167,2km².

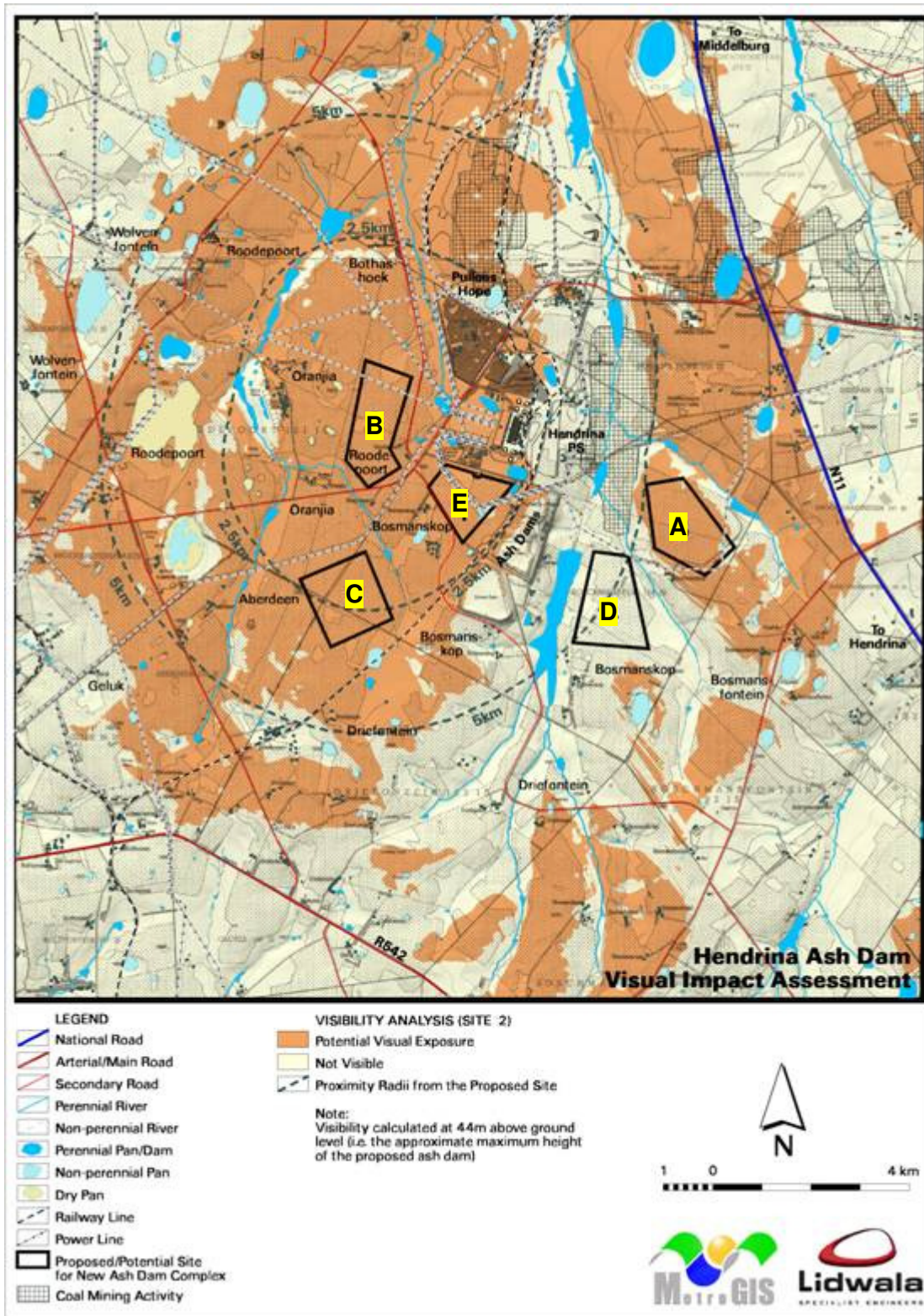


Figure 8.2: Potential visual exposure for Alternative B

o *Alternative C*

The result of the preliminary viewshed analysis for the proposed ash dam, should this be located on **Alternative C**, is shown on **Figure 8.3**. The following is evident from the viewshed analysis:

- The proposed ash dam will have a large core area of potential visual exposure on the site itself, and within a 2,5km offset. Almost the entire area within 2,5km is likely to be visually exposed. The exception is a small area to the east, south west and west of the site.

This core area includes a number of homesteads and farms (i.e. Bosmanskop, Oranjia, Driefontein, Aberdeen and Roodepoort) and a few dams and pans. In general, the actual drainage lines are not exposed, due to their incised topography.

The secondary roads in the north and east will also be exposed to potential visual impact.

- Potential visual exposure is somewhat reduced in the medium distance (i.e. between 2,5 and 5km). Large areas in the east, along the drainage line, will be visually screened. As will smaller patches in the north west.

The main receptors that are likely to be exposed to potential visual impact include users of secondary roads to the north east and north west and a number of homesteads and farms. These include Roodepoort, Oranjia, Driefontein and Bosmanskop.

A few dams and non-perennial pans also fall within the zone of potential visual exposure.

- In the longer distance (i.e. beyond 5km), visual exposure is further reduced, with significant visually screened areas in all directions.

Receptors exposed to potential visual exposure include the farms and homesteads of Roodepoort and Bosmansfontein. Relatively long stretches of the N11 fall within the zone of potential visual exposure, as do interrupted stretches of secondary roads in the north, north west and east of the study area.

The total area of potential visual exposure for this site alternative is 168,8km².

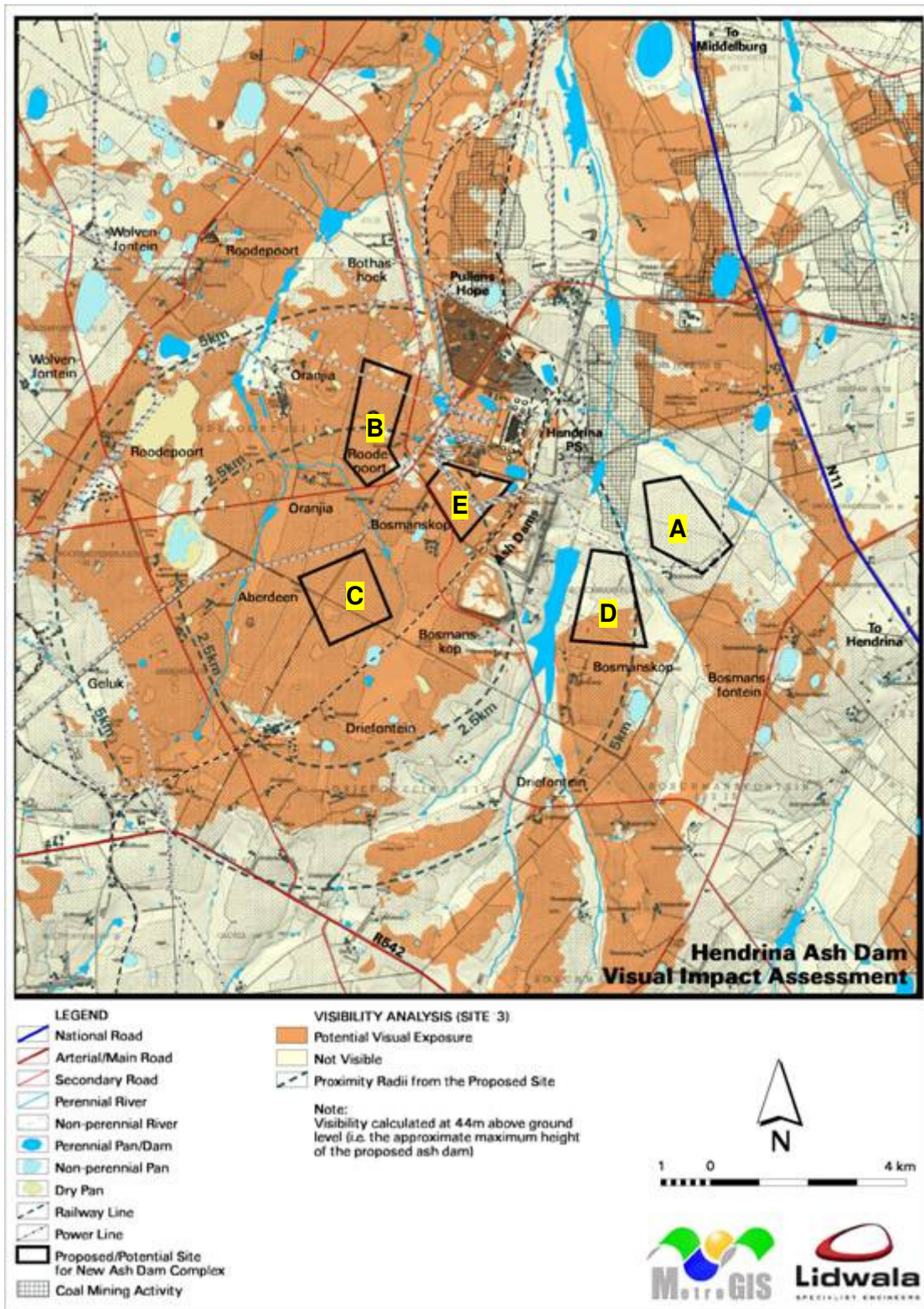


Figure 8.3: Potential visual exposure for Alternative C.

o *Alternative D*

The result of the preliminary viewshed analysis for the proposed ash dam, should this be located on **Alternative D**, is shown on **Figure 8.4**. The following is evident from the viewshed analysis:

- The proposed ash dam will have a large core area of potential visual exposure on the site itself, and within a 2,5km offset. Almost the entire area within 2,5km is likely to be visually exposed. The exception is the west, beyond the existing ash dams and the east.

This core area includes a number of homesteads and farms (i.e. Bosmanskop and Bosmansfontein) and a few pans and dams. In general, the actual drainage lines are not exposed, due to their incised topography.

The secondary road in the south west will also be exposed to potential visual impact.

- Potential visual exposure is somewhat reduced in the medium distance (i.e. between 2,5 and 5km). Areas in the west and south east will be visually screened by existing topography (i.e. ash dams and low hills).

The main receptors that are likely to be exposed to potential visual impact include users of the N11 and of the secondary road in the south. Driefontein is the only homestead or farm which is expected to be visually exposed.

A few non-perennial pans also fall within the zone of potential visual exposure.

- In the longer distance (i.e. beyond 5km), visual exposure is significantly reduced, with only limited areas in the north and south potentially exposed to visual impact.

Receptors within this viewshed are limited to short stretches of the N11 and secondary roads in the north and south. No farms or homesteads are expected to be exposed to visual impact.

The total area of potential visual exposure for this site alternative is 114,2km².

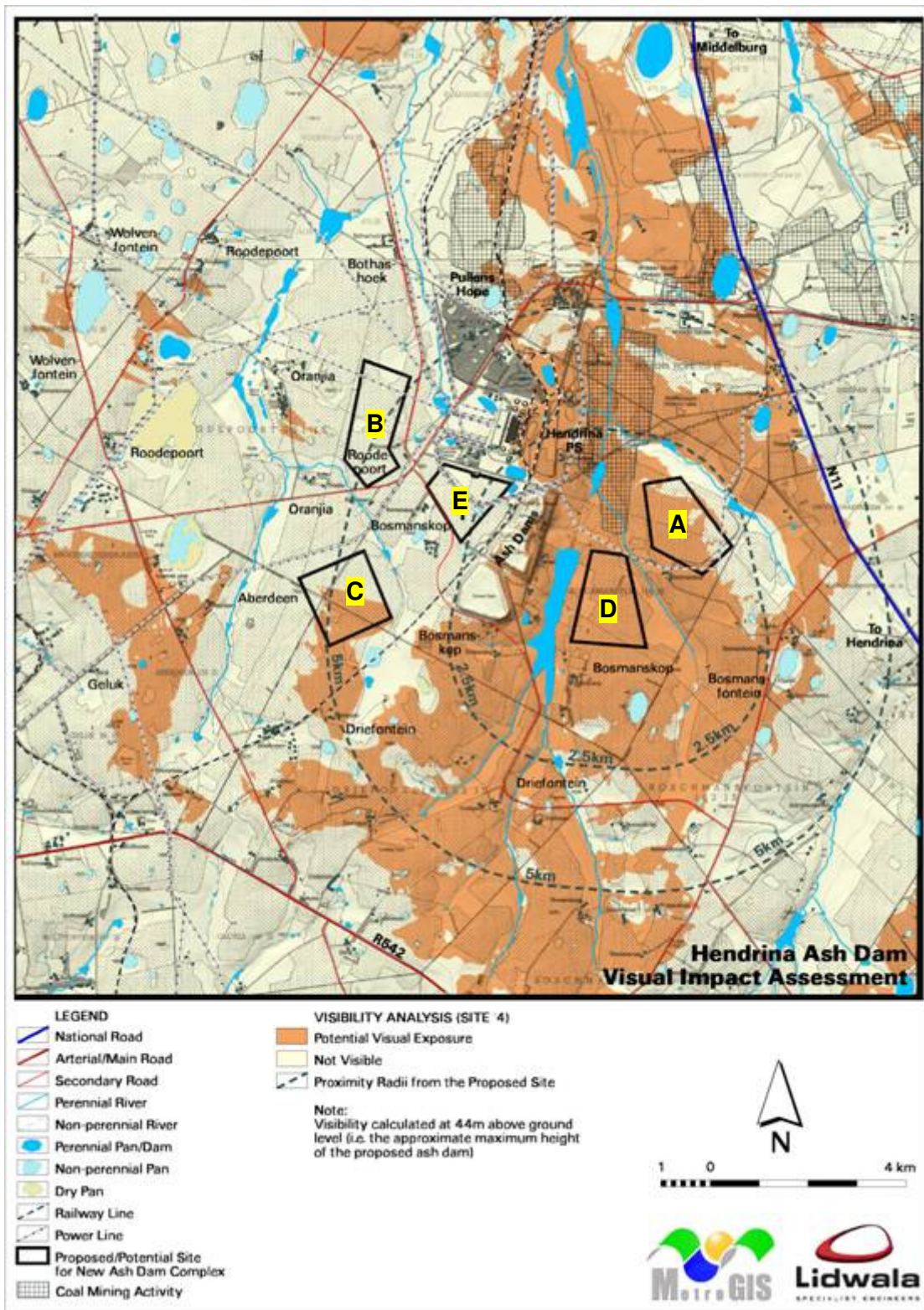


Figure 8.4: Potential visual exposure for Alternative D

o *Alternative E*

The result of the preliminary viewshed analysis for the proposed ash dam, should this be located on **Alternative E**, is shown on **Figure 8.5**. The following is evident from the viewshed analysis:

- The proposed ash dam will have a large core area of potential visual exposure on the site itself, and within a 2,5km offset. Almost the entire area within 2,5km is likely to be visually exposed. The exception is the south east, beyond the existing ash dams.

This core area includes a number of homesteads and farms (i.e. Bosmanskop, Oranjia and Roodepoort) and a few dams and pans. In general, the drainage lines are not exposed, due to their incised topography.

The secondary roads giving access to the north, west and south will also be exposed to potential visual impact.

- Potential visual exposure is somewhat reduced in the medium distance (i.e. between 2,5 and 5km). Areas in the west and east, along the drainage lines, will be visually screened.

The main receptors that are likely to be exposed to potential visual impact include users of secondary roads to the north, north east and west and a number of homesteads and farms. These include Bothashoek, Oranjia, Aberdeen, Driefontein and Bosmanskop.

A few non-perennial pans also fall within the zone of potential visual exposure.

- In the longer distance (i.e. beyond 5km), visual exposure is further reduced, interrupted in the far north west and north east and by the hills in the south of the study area.

Receptors exposed to potential visual exposure include the farms and homesteads of Roodepoort and Bosmansfontein. Relatively long stretches of the N11 fall within the zone of potential visual exposure, as do relatively continuous lengths of secondary roads in the west, north west and south east.

The total area of potential visual exposure for this site alternative is 188,4km².

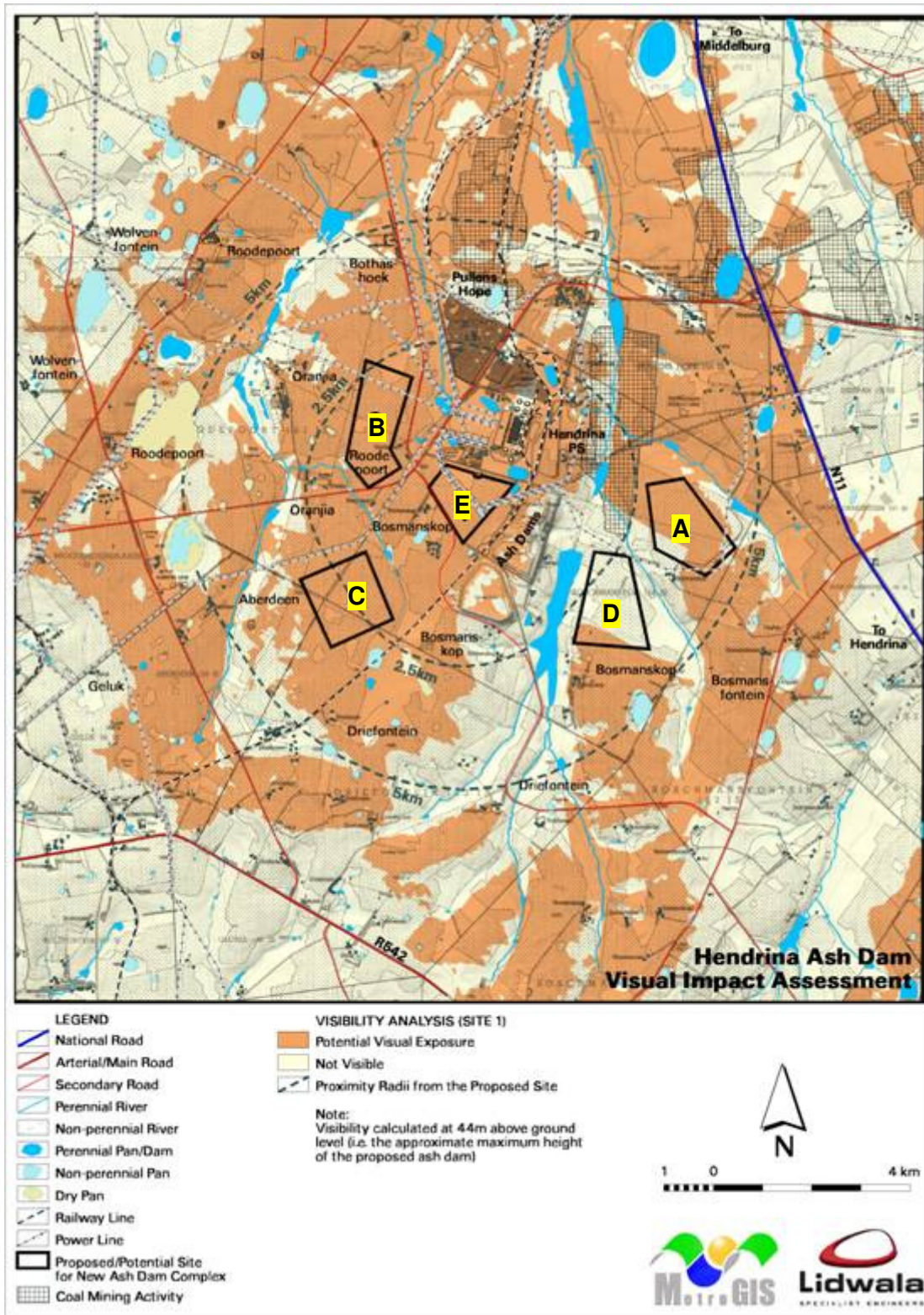


Figure 8.5: Potential visual exposure for Alternative E

- **Design and Technical**

Each site was looked at purely in terms of its physical constraints and topography in relation to the current facilities in choosing its suitability. Of the five sites studied, two present themselves as the most suitable and probably the only two on which it is practically possible to put a new ash facility. It is onto these, that a possible ash dump configuration has been placed. The design input report is included in **Appendix P**. The following criteria have been used to rank the alternative sites:

- Whether there are any physical or natural constraints
- Whether the topography and ground slope is suitable
- Whether the site is close to the existing facilities

The five sites that were identified are discussed briefly below, together with the specific characteristics:

- Site A is situated directly adjacent to the Optimum Mine open cast area and on the “opposite” side of the open cast pit from the power station, and therefore is not considered a viable option.
- Site B is within an existing mealie field, and looks to be the second most suitable.
- Site C is about 3kms from the site.
- Site D is just east of Total coal’s Tumela Mine and on the “opposite” side of the surface water structures (large dam) to the current facilities and the mine and therefore considered to be too inaccessible.
- Site E appears to be the most suitable, because it is close to existing infrastructure with minor improvements, and all other sites would need their own new pollution control dams.

8.2.3 Final Alternative Site Ranking

Table 8.3 Shows the final Site Ranking Matrix

Table 8.3: Final Site Ranking Matrix

Study	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Biodiversity	3	3	3	2	2
Avifauna	3	3	2	2	4
Surface Water	2	2	3	1	4
Ground water	2	3	4	2	2
Social	4	2	2	2	4
Visual	2	3	2	3	4
Design and Technical	2	3	2	2	4
Total	18	19	18	14	24

From the above preference rating results it is clear that Alternative E is by far the preferred site overall with Alternative B as the second most preferred site.

8.2.4 Minimum Requirements for Waste Disposal by Landfill: Fatal Flaws

In addition to the screening process and the above site preference rating exercise, the fatal flaws listed in the Minimum Requirements have also been taken into account in order to ensure that the most preferable site has been identified for further study in the EIA phase of this project.

The Minimum Requirements require that no landfill / disposal site be developed in an area with an inherent fatal flaw. **Table 8.4** presents the situations that may represent fatal flaws in that they may prohibit the development of an environmentally or publicly acceptable waste disposal facility except at excessive cost.

Table 8.4: Minimum Requirement Fatal Flaws

Fatal Flaw	Discussion	Site eliminated
3000 m from the end of any airport runway or landing strip in the direct flight path and within 500m of an airport or airfield boundary	None of the alternatives are affected by this flaw	N/A
Areas below the 1:50 year flood line	This was taken into account during the screening process. All areas below the floodline where marked as high sensitivity areas, eliminating them from the areas available for alternative site choices.	N/A
Areas in close proximity to significant water bodies	This was taken into account during the screening process. All significant water bodies were given a buffer and where marked as high sensitivity areas, eliminating them from the areas available for alternative site choices.	N/A
Unstable areas	No fault zones were identified in the area underlying the various alternative sites	N/A
Sensitive Ecological and/or historical areas	This was taken into account during the screening process. All areas in sensitive ecological and/or historical areas where marked as high sensitivity areas, eliminating them from the areas available for alternative site choices.	N/A
Catchment areas for important water resources	Although the alternative sites are situated in an important catchment area,	N/A

	historic and current land uses have already impacted the area significantly. No site were eliminated on this flaw.	
Areas characterised by flat gradient, shallow or emergent groundwater	The groundwater specialist study did not eliminate any sites on this basis	N/A
Areas characterised by steep gradients, where stability of slopes could be problematic	All alternative sites are on flat or undulating terrain.	N/A
Areas of groundwater recharges on account of topography and/or highly permeable soils	The groundwater specialist study did not eliminate any sites on this basis	N/A
Areas overlying or adjacent to important aquifers	The groundwater specialist study did not eliminate any sites on this basis	N/A
Areas characterised by shallow bedrock with little soil cover	The study area is characterised by deep agricultural soils, shallow bed rock is not considered an issue.	N/A
Areas in close proximity to land uses which are incompatible with landfilling	Land uses incompatible with landfilling include residential areas. Pullenshope is the closest residential area to all the alternatives. However all alternatives are more than 1km from the town. Due to the nature of the surrounding study area none of the alternatives are considered too close to Pullenshope to be deemed unacceptable.	N/A
Areas where adequate buffer zones are not possible	All alternative provide sufficient buffer zone space	N/A
Areas immediately upwind of a residential area in the prevailing wind direction	The prevailing wind is north-east and north and is therefore in the opposite direction of the closest residential areas.	N/A
Areas which because of title deeds and other constraints can never be rezoned to permit a water disposal facility	This is not considered an issue	N/A
Areas over which servitudes are held that would prevent the establishment of a waste disposal facility	Only Alternative E has Eskom servitudes for power lines however this is deemed not to be a flaw as the power lines can be moved.	
Any area characterised by any factor that would prohibit the development of a landfill at prohibitive cost	The Eskom technical team deemed that any alternative located within a 8km radius of the power station could be deemed suitable in terms of cost. However, after ground truthing, the independent engineering input received noted that Site A is situated directly	Alternative A, and D

	adjacent to Optimum Mine's open cast mining operation and Site D is just east of Total coal's Tumela Mine and on the "opposite" side of the open cast workings and a large dam to the existing power station facilities and is therefore considered too inaccessible. These two sites are therefore not considered technically feasible options without excessive expense.	
Areas in conflict with the local development objectives process and regional waste strategy	This is not considered an issue in the area	N/A
Areas overlying viable mineral resource	Although this is not deemed a specific fatal flaw in terms of the minimum requirements – it could be linked to a couple of the above items specifically in terms of incompatible land uses. It is also Eskom's policy, where possible, to avoid sterilising viable mineral resources. The entire area is situated on coal resources, the exact viability of which we are unable to determine for certain at this stage. However, Alternative A and D are directly adjacent to both Optimum's and Total's opencast mining operations and are therefore anticipated to be on a viable resource. During a site visit (for ground truthing) it was noted that there are a number of mining right applications on the go within the study area, one particular application, for Kebrafield (Pty) Ltd (DMR Reference number: 30/5/1/2/2/479MR) is situated over a fairly large area to the west of the power station and includes all the farm portions included in the area identified for alternative B.	Alternative A, B and D

8.2.5 Final Discussion

The preferred sites identified from the site preference rating exercise (**Table 8.3**) include Alternative E and B. The above discussion (**Table 8.4**) with regards to the Minimum requirements fatal flaws excludes alternatives A, D and B for either being deemed technically unfeasible (without excessive expense) or overlying viable coal resource.

Therefore, with the results of the two site selection discussions above only two sites are left for consideration as alternative sites for the proposed ash dam, i.e. Alternatives E and C.

The choice of a preferred site is required to take all aspects of the environment into account, social, biophysical, technical and economic aspects. Alternative C is deemed suitable from a cost perspective as it falls within the 8 km radius of the power station, from a technical point of view it can also be deemed suitable as apart from being a fair distance from site there are no major barriers (from a technical point of view) that would make the site unfeasible. The social study noted that Alternative C was situated close to a number of agricultural settlements and was also found to have the highest visual exposure of all 5 alternatives. From a biophysical point of view Alternative C is considered to be far less preferred than Alternative E as linear infrastructure required such as access roads, power lines and pipelines would be required to traverse at least 3 – 4 km from the power station to the site without the option of not crossing surface water features that were highlighted as higher sensitive areas by the surface water, biodiversity, avifauna and groundwater specialists during the screening phase.

The surface water system in question is a perennial system. Nel et al. (2004) lists a status of critically endangered for all the river signatures associated with the study area, which will include the surface water feature that would need to be crossed by linear infrastructure required for a new ash dam at alternative C. The ascribed river status indicates a limited amount of intact river systems carrying the same heterogeneity signatures nationally. This implies a severe loss in aquatic ecological functioning and aquatic diversity in similar river signatures on a national scale (Nel et al., 2004). Therefore, it is anticipated that the use of Alternative C as a preferred site would increase the risk of pollution and the associated environmental degradation of the system in question.

The above discussion clearly shows that Alternative C is not a recommended alternative. Alternative E due the additional impacts that would occur due to the construction and operation of the linear infrastructure required. Alternative E is considered more favourable due to its close proximity to the existing facilities and due to the fact that this alternative would be able to link in with many of the existing associated facilities therefore reducing the required footprint substantially. In terms of the cost mapping, Alternative E is within the 3km radius which does not require any additional costs for the development of the new ash dam.

In addition to the above discussion the “Max wins” map (taking cost into account – as required in the minimum requirements) from the screening study can be consulted to support the preference for Alternative E. The “max wins” map was developed by keeping all areas deemed sensitive (in all study areas) sensitive (**Figure 8.6**), Alternative E is clearly shown to be situated in one of the few areas deemed acceptable for the placement of the ash dam.

Therefore, this scoping study recommends that Alternative E and the No-go Alternative are carried forward to the EIA phase.

Due to the preferred site, the EIA will also need to assess alternative corridor alignments for the relocation of the power lines that traverse Alternative E.

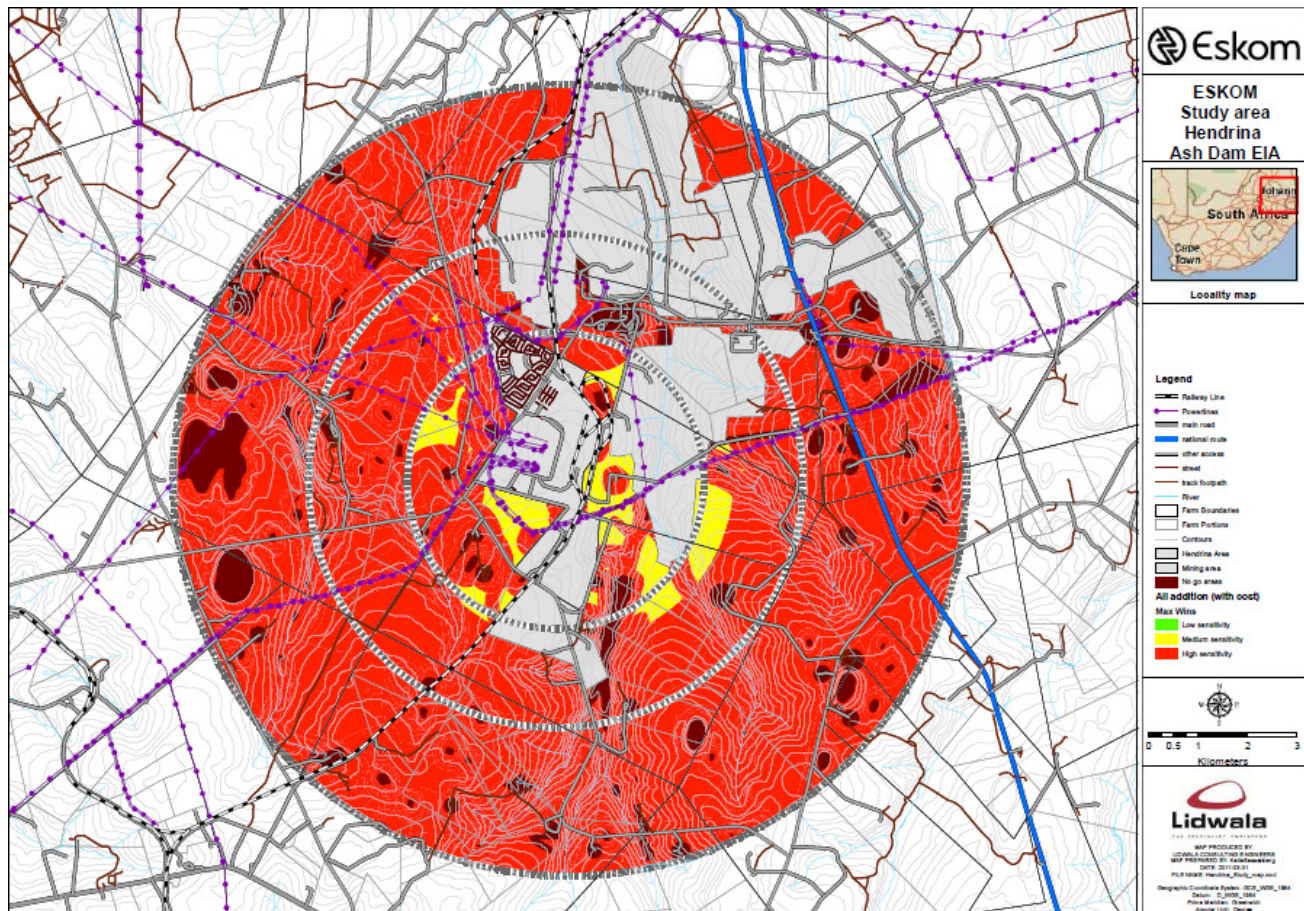


Figure 8.6: Max Wins map (including cost) from the screening study – showing acceptable areas for site choice

8.3 Summary of Significant Impacts Identified During Scoping

The following impacts have been identified for additional study during the EIA phase and are deemed to be issues of potentially **medium to high significance** or those anticipated to require specific mitigation measures:

Biophysical Impacts – Ash Dam:

- **Geology**
 - Impacts related to the construction-related earthworks as well as the pollution of geological features in case of spillage/leakage of hydrocarbon and other hazardous material from storage facilities have been identified as having a medium significance.
 - Mitigation measures are required to be identified.
- **Geotechnical issues**
 - Phase 1 geotechnical study will be undertaken in the EIA phase.

- **Topography**

- Change to drainage patterns due to construction-related earthworks and additional stormwater drainage patterns.
- Mitigation measures are required to be identified.

- **Soil**

- Pollution of soil due to handling, use and storage of hazardous substances during construction and operation.
- The loss of available top soil.
- Mitigation measures are required to be identified.

- **Land Capability**

- Key variables that determine the land capability of the study area such as soil fertility reduced and disturbed due to the potential activities related to the ash dam.
- The loss of viable agricultural land.
- Mitigation measures are required to be identified.

- **Avifauna**

The greatest predicted Impact of Ash dams on avifauna are the destruction of habitat and disturbance of birds during construction. During the construction phase, habitat destruction and alteration inevitably takes place. Habitat destruction is anticipated to be the most significant impact in this study area. However, this can be minimized and mitigated should the smallest alternative be chosen. Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of lower significance than habitat destruction. Leachate from fly ash dams can contain heavy metals (Theism and Marley, 1979) which could result in contamination of surrounding water sources, used by water birds in the study area. Correct placing of the new dam, away from wetlands, dams and water bodies, will help to mitigate this impact.

In addition to the expansion of the ash dams the project will also include the expansion of the relevant infrastructure associated with the ashing system, such as pipelines, storm water trenches, seepage water collection systems, pump stations, seepage dams etc, and may also involve the relocation of certain infrastructure (e.g. power lines) depending on which alternative is chosen. The impacts of such associated infrastructure on avifauna are predicted to be minimal, so long as the infrastructure is within the proposed ash dam footprint. Infrastructure outside of the proposed footprint (i.e. outside of the 5 proposed alternatives), will be assessed in the EIA phase of the project, upon determination of the preferred site.

- **Biodiversity**

No impacts were identified that could lead to a beneficial effect on the ecological environment since the proposed development is largely destructive as it involves the decimation of natural habitat.

Impacts resulting from the construction and operation of an ash dam have permanent and severe physical impacts on biota or the habitat in which they occur. Direct impacts, such as habitat destruction and modifications, are regarded immediate, long-term and of high significance. These impacts are mostly measurable and fairly easy to assess as the effects thereof is immediately visible and can be determined to an acceptable level of certainty. In contrast, indirect impacts are not immediately evident and can consequently not be measured immediately. A measure of estimation is therefore necessary in order to evaluate these impacts. Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities.

Ten impacts were identified that are of relevance to any development in a natural environment. Not all of these impacts might occur, or the extent of impact might be limited; the relevance of these impacts is therefore determined prior to being implemented in the Impact Assessment.

Impacts were placed in three categories, namely:

- Direct impacts:
 - Destruction of threatened and protected flora species;
 - Direct impacts on threatened fauna species;
 - Destruction of sensitive/ pristine habitat types;
 - Direct impacts on common fauna species;
- Indirect Impacts:
 - Floristic species changes subsequent to development;
 - Faunal interactions with structures, servitudes and personnel;
 - Impacts on surrounding habitat/ species;
- Cumulative Impacts:
 - Impacts on SA's conservation obligations & targets (VEGMAP vegetation types);
 - Increase in local and regional fragmentation/ isolation of habitat; and
 - Increase in environmental degradation.

Other, more subtle impacts on biological components, such as changes in local, regional and global climate, effects of noise pollution on fauna species, increase in acid rain and ground water deterioration are impacts that cannot be quantified to an acceptable level of certainty and is mostly subjective in nature as either little literature is available on the topic or contradictory information exist.

The nature and extent of these impacts will be assessed in the EIA phase of the project.

- **Surface Water**

- Contamination of surface water from seepage and run off.
- Loss of aquatic biodiversity.
- Loss of runoff into the catchment.
- The detailed aquatic ecological impact assessment will quantify the significance of possible impacts associated with the preferred site.

- **Groundwater**

- Contamination of ground water due to hydrocarbon spillage and seepage into groundwater reserves, affecting groundwater quality.
- Mitigation measures are required to be identified.
- Further construction of infrastructure and compaction of the area will further contribute to reduced water infiltration rates to replenish groundwater aquifers. Mitigation measures are required to be identified.

- **Noise**

- Change in ambient noise levels during both construction and operation.

- **Air Quality**

- Increase in dust generating activities during construction and operation including exceedances of PM10 concentrations and exceedances of dustfall rates.
- Mitigation measures may be required to be identified if required.

Socio-Economic Impacts – Ash Dam:

- Visual impacts of preferred site
- Disturbance of cultural or historical sites
- Economic benefits through employment
- Continued generation of Electricity over the long term at Hendrina Power Station
- Health risks from elevated PM10 concentrations and dust fall rates
- Loss of groundwater resource to local users (in terms of potential groundwater contamination)
- Inflow of temporary workers.
- Mitigation measures are required to be identified.

Potential Impacts associated with relocating the Powerlines at Alternative E

- Visual impact of the new powerline routes and proposed tower structures;
- Loss of land capability if relocated over agricultural land and the loss of available top soil;
- Loss of aquatic habitat and contamination of surface water ecosystems due to sedimentation;
- Loss of biodiversity and habitats;
- Potential groundwater contamination due to chemical spillage during construction;
- Collisions and electrocutions of birds;
- Disruption of land use and loss of economic potential; and
- Increase in health risk to neighbouring residents due to EMF.

The above mentioned impacts will be investigated in more detail during the EIA phase of the project.