8 IDENTIFICATION OF POTENTIAL IMPACTS

8.1 Introduction

Scoping is widely recognised as a critical step in the Environmental Impact Assessment (EIA) process. This Scoping Study has two-fold objectives, 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 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 continuous ashing project; 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, and provide mitigation. 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 Identification of Potential Biophysical Impacts

8.2.1 Geology and Geohydrology

Potential geological issues that should to be taken into consideration are as follows:

- Impacts related to the construction-related earthworks
- Impacts related to the pollution in case of spillage/leakage of hydrocarbon and other hazardous material from storage facilities

Potential groundwater issues that should to be taken into consideration are as follows:

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

8.2.2 Soil and agricultural potential

During the construction and operational phases of the proposed ash disposal facility a number of environmental impacts and issues with reference to soils and agricultural potential will take place. Potential impacts on soils and agricultural potential could include:

- Pollution of soil due to handling, use and storage of hazardous substances during construction and operation.
- The loss of available top soil.
- 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 disposal facility.
- The loss of viable agricultural land.

8.2.3 Avifauna

- ***Predicted Impacts of Ash Disposal Facilities***

The greatest predicted impacts of ash disposal facilities on avifauna are the destruction of habitat and disturbance of birds during construction and operation. However, both of these impacts can be minimized and mitigated to some extent by avoiding more sensitive areas where possible. Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of lower significance than habitat destruction. Leachate from fly ash disposal facilities 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 disposal facility, away from wetlands, dams and water bodies, will help to mitigate this impact.

In addition to the continuous disposal of ash at the of the ash disposal facility, the project may 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, access roads, conveyors, stacker system, roads, etc. The impacts of such associated infrastructure on avifauna are predicted to be minimal, so long as the infrastructure is within the proposed ash disposal facility footprint. Infrastructure outside of the proposed footprint will be assessed in the EIA phase of the project. If any additional linear infrastructure, especially power lines, is to be constructed, the EWT will assess the impact thereof, once the routings have been made known. Below follows a brief description of impacts that may be associated with powerlines (should these be required as part of the proposed project):

- ***General description of impacts of power lines on birds***

Because of its size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger 1983; Verdoorn 1996; Kruger 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

- *Electrocutions*
  Because of its size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger 1983; Verdoorn 1996; Kruger 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

- *Collisions*
  Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the medium term or even in the long term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

- *Habitat destruction*
  During the construction phase and maintenance of substations and power lines some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes, as well as clearing vegetation at the substation site. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat.

- *Disturbance*
  Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities.

8.2.4 Surface Water

Impacts on the aquatic ecology may be summarised under three main drivers: (1) alteration to surface water quality, (2) alteration to hydrology, and (3) alteration in geomorphology. Changes to any of the abiotic drivers, due to activities related to the proposed continuous ashing project, will elicit biological responses in the receiving aquatic communities. The potential impacts identified consider five main impacts which are listed and discussed below:

- Impacts on surface water quality;
- Impacts on hydrology;
- Impacts related to erosion and sedimentation;
- Impacts on aquatic biota; and
- Impacts on aquatic ecosystem services.

- ***Impacts on Surface Water***

- *Heavy Metal Contamination*

  The contents of coal ash may vary depending on where the coal was mined and the ash may potentially contain toxic metals, which include arsenic, lead, mercury, cadmium, chromium and selenium (Gottlieb et al., 2010). These contaminants may enter the receiving environment via leachate from ash disposal facilities and the leaching rate may be affected by a number of factors, namely:
  - the size and depth of the disposal ponds, and the pressure created by the waste;
  - the underlying geology;
  - the slope of the landscape; and
  - the most vital factor being whether the disposal site is lined (Gottlieb et al., 2010).

- *Increases in Sediment Loads and Turbidity*

  The implication of increased sediment loads may directly or indirectly be the result of construction and/or operational activities for the proposed ash disposal facility. Ash may become airborne and find its way into the aquatic ecosystems in the area, changing the pH of the water and smothering the substrate. Even though the increase in sediment loads will impact on water quality, it will also result in changes in the in-stream and riparian habitat templates. Increased sediment loads act as an abiotic driver that alters water quality and aquatic habitat. Increased turbidity, total suspended solids and siltation in the aquatic ecosystem, stemming from the increased sediment deposition due to construction activities is considered an issue.

- *Toxicants*

  Construction material, hydrocarbons (oil, diesel, etc.), solvents and other pollutants spilling/leaking from construction machinery and equipment during the construction phase may have a severe impact on the receiving aquatic environment.

- ***Impacts on Hydrology***

The proposed ash disposal facility will result in the loss of the MAR associated with the surface area of the area covered by the ash disposal facility and associated infrastructure. Subsequently, the seasonal hydrological patterns in associated streams and rivers will be disrupted. Changing the hydrology of a river or stream also results in other environmental problems, and is usually accompanied by increased rates of erosion, decreased substrate diversity, channel incision and uniform velocity-depth classes (Rosgen, 1993; Simon & Thorne, 1996; Rosgen 1996; Johnson, 2006).

- *Altering Environmental Flows*

  In a study carried out by Lloyd et al. (2004) ecological responses to flow modifications in rivers were examined, where 86 % of the studies recorded ecological changes in community structure. In a similar study by Poff & Zimmerman (2010) 92 % of the studies examined had reported negative ecological changes in response to a range of different types of flow alterations. In addition, fish consistently responded negatively to changes in flow, irrespective of whether the magnitude of the flow increased or decreased (Poff & Zimmerman, 2010).

- *Alterations in Base Flows*

  The hydrological regime associated with the rivers/streams in the study area are characterised by peak flows during the summer months and lower base flows during the winter months. The continuous ashing at Tutuka Power Station may possibly result in lowered base flows in the receiving systems due to the loss of the catchment area. Base flow is important as it defines habitat availability.

- ***Impacts Related to Erosion and Sedimentation***

Changes in the rates of erosion and sedimentation are often associated with changes in land use. Typical sources of sediment during the construction phase are in-stream activities, stockpiles, excavation and clearing of vegetation. Changes to erosion and sedimentation rates, during the operational phase, are more related to alteration in hydrology. Increased turbidity and sedimentation resulting from erosion have several adverse effects on the aquatic environment. Sedimentation will alter the water quality (increased turbidity) and substrate composition of the receiving aquatic environments, as well as the marginal habitats due to excessive reed growth and alien vegetation encroachment as a result of the deposited sediment.

- *Increases in Turbidity*

  Suspended sediment will result in an increase in turbidity. This, in turn, will result in a decrease in primary production, increased bacterial activity and a decrease in oxygen saturation. Fine sediment suspended within the water column can potentially reduce the rate of photosynthesis; affect macroinvertebrate community structures; decrease the feeding efficiency and growth rates of fish populations and increase the incidence of disease (CMA, 2008). Studies have shown that an increase in turbidity impedes fish reproduction, particularly where breeding requires visual mate recognition and visual stimuli for breeding behaviour (Bash et al., 2001; Zeynep, 2007). Similarly, some predators require clear water for hunting and might be adversely affected by decreased visibility due to increased turbidity. This might have a significant impact on aquatic ecology, as changes in predation pressure will alter aquatic communities.

- *Decreases in Habitat Diversity*
  Any sediment that is more than the natural sediment transport capacity of a watercourse will be deposited. This depositing process is called sedimentation and might smother more suitable habitat structures, such as woody debris or cobble sections. A loss in habitat diversity, due to sedimentation, will inevitably translate into a loss of aquatic organisms with specific habitat requirements. Conversely high-velocity water, from discharge structures or flood water management systems, may scour natural substrates downstream of receiving watercourses, degrading habitat for fish and other wildlife.

- *Impacts on Aquatic Biota*
  Aquatic biota consist of in-stream communities (periphyton, macrophytes, invertebrates and fish) and riparian and wetland communities. Impacts on aquatic biota may manifest in a number of different ways, but will nearly always be the result of alteration in natural hydrology, water quality or geomorphology. Some exceptions are alien introduction, as well as direct removal of riparian- and wetland vegetation (Dudgeon et al., 2006).

- *Decreases in Habitat Diversity and Habitat Fragmentation*
  The direct loss of river and wetland areas through clearing of riparian and wetland habitat will result in a complete, but localised, loss of aquatic habitat. Aquatic habitat fragmentation may be the result of chemical (water quality) or physical (hydrology, erosion and sedimentation) migration barriers. Any of the impacts listed under water quality, hydrology and erosion and sediment might result or contribute to habitat fragmentation.

- *Alterations in Aquatic Community Structure*
  The alteration in aquatic community structures might directly be attributed to changes in water quality, quantity and timing, or indirectly, due to changes in habitat availability. Changes in community structures are typically characterised by a decrease in diversity and higher abundances of more tolerant species. Specialised species (like rheophilic fish and niche feeders) are the first to respond negatively to changes in the aquatic environment.

- *Acute and Chronic Toxicity*
  Hazardous and toxic compounds might enter surface water systems at acute toxicity concentrations. The prolonged exposure of aquatic biota to sub lethal contaminants that may find their way into surface water systems might result in chronic toxicity and may manifest itself through a number of different ways i.e. carcinogenic, mutagenic and teratogenic effects on exposed communities.

- *Alien Encroachment and Infestation*

  In places where wetland and riparian habitats may be removed, opportunistic alien pioneers might encroach. Alien vegetation increases biomass, fire intensity and evapo-transpiration, decreases river flows, surface water run-off and groundwater recharge (Görgens & Van Wilgen, 2004; Chamier et al., 2012).

- *Removal of Riparian and Wetland Vegetation*

  Riparian and wetland vegetation provides cover, breeding habitat and migration corridors for wildlife, serves to trap sediment and fine silt, and helps with energy dissipation during flood events (Levick et al., 2008; Howe et al., 2008). The proposed activities, particularly during the construction phase, will impact on riparian and wetland vegetation. Disturbances of the riparian and wetland areas will lead to a decrease in ecosystem services and will also lead to the possible establishment of alien vegetation. In addition, the removal of riparian vegetation may increase the amount of sediment entering the system. Vegetation removal may lead to some specific issues, which are:
  - Compaction of soils;
  - Dispersal of exotic plant species;
  - Decrease water infiltration, resulting in increased flow volumes and peak run-off rates;
  - Acceleration of erosion rates; and
  - Solar radiation could result in an increase in water temperature, thus affecting primary production (Kleynhans et al., 2007b).

- *Species with Conservation Status*

  Species that may potentially occur within the rivers and wetlands associated with the study area (Cook, 2011) include:
  - Giant Bullfrogs (Pyxicephalus adspersus) are Near Threaded (NT) in South Africa (Minter et al. 2004) due to anthropogenic activities resulting in habitat loss.
  - Grey Crowned Cranes (Balearica regulorum) are listed as Endangered according to the IUCN database (IUCN, 2012) and inhabit wetlands (Hockey et al., 2005), riverbanks (Meine & Archibald, 1996), shallowly flooded plains (Urban et al., 1986) and temporary pools (del Hoyo et al., 1996).
  - Wattled Cranes (Bugeranus carunculatus) are listed as Vulnerable (V) according to the IUCN database (IUCN, 2012). In South Africa B. carunculatus breed on undisturbed permanent wetlands (small) that are surrounded by grassland (Hockey et al. 2005) where disturbance from humans are minimal (Archibald & Meine, 1996). They may opportunistically breed on ephemeral/seasonal wetlands which may also be used essential post-breeding dispersal areas (Archibald & Meine, 1996).

  No fish with conservation status are expected to occur in the study area, however, B. neefi and B. pallidus are moderately intolerant to alterations in water quality and are expected to occur in the study area (Refer to Section 4.3.2). In addition, macroinvertebrates with a low tolerance to alterations in water quality may potentially occur in the study area (Refer to Section 4.3.1).

- ***Impacts on Aquatic Ecosystem Functions and Services***

The degree to which impacts, discussed in previous sections, will influence aquatic ecosystem functions and services will depend on the nature of the impact and the nature of the receiving watercourse (i.e. the ability to provide a particular service, which is different for lakes, wetlands and streams) (Kotze et al., 2009). Some services are indirectly beneficial to local society and pertain to sustaining ecological functionality, such as flood and erosion control, water purification, biodiversity and carbon storage.

The Tutuka continuous ashing project may result in the alteration or destruction of aquatic habitat and subsequent loss of associated functions, which include flood attenuation; stream flow augmentation; enhancement of water quality and biodiversity. Wetland functions associated with each hydro-geomorphic (HGM) type is summarised in **Table 8.1**. The different HGM types associated with the study area will be determined during the EIA phase.

Table 8.1: Preliminary ratings of the hydrological benefits likely to be provided by wetlands (Kotze et al., 2009)

Wetland HGM	**Regulatory Benefits Potentially Provided by the Wetland**							
	Flood Attenuation		**Stream flow regulation**	**Enhancement of Water Quality**				
	Early wet season	**Late wet season**		**Erosion control**	**Sediment trapping**	**Phosphates**	**Nitrates**	**Toxicants**
Floodplains	++	+	0	++	++	++	+	+
Valley-bottom: Channelled	+	0	0	++	+	+	+	+
Valley-bottom: Un-channelled	+	+	+	++	++	+	+	++
Hillslope seep: Connected to a stream channel	+	0	+	++	0	0	++	++
Hillslope seep: Connected to a stream channel	+	0	0	++	0	0	++	+
Pan / depression	+	+	0	0	0	0	+	+
Rating: 0 Benefit unlikely to be provided to any significant extent; + Benefit likely to be present at least to some degree; ++ Benefit very likely to be present (and often supplied to a high level)								

The sections below provide a general overview of the available and indirect aquatic ecosystem services:

- *Flood Attenuation*
  Floodplain systems provide an important service related to flood attenuation. The importance of the service is a function of the size and location of the floodplain in its

catchment. Valley bottom wetlands, reflecting seasonal variation in wetness might also play a role in flood attenuation, particularly during the early wet season before their seasonal zones become saturated. Flood attenuation services might be impaired or lost through canalisation or any other activity that will inhibit the ability of the watercourse to retain and slowly release flood water.

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- *Stream Flow Regulation*

  In seasonal streams and rivers, surrounding wetlands play an important role in stream flow regulation. The ability of surface water systems, and particularly wetlands, to provide a stream flow regulation service might be inhibited or lost through any activity that will decrease surface roughness (loss of vegetation cover or soil compaction), increase impermeable surfaces or any other activity that will influence the permeability and soil-resident time of surface water run-off.

- *Enhancement of Water Quality*

  This service is mostly limited to wetland systems, where surface water is exposed to a number of purification processes like reduction, adsorption, mineralisation and ion exchange. Natural water purification processes typically require low energy environments with sufficient surface area for adsorption and carbon for reduction. Activities that result in a change in energy of a particular system (i.e. channelisation or entrenchment caused by erosion) will inhibit this ecosystem service.

- *Erosion Control*

  River ecosystems may provide the function of the retention of soil within the ecosystem, thereby preventing the loss of soil by means of the riparian vegetation cover and soil retention (Costanza et al., 1997).

- *Refugia*

  River and wetlands associated with the study area may provide different micro habitat types, cover units, flows and depths, and thus may potentially house different fish and invertebrates with different habitat preferences. Wetland and riparian vegetation is adapted to tolerate reducing environments and play an important role in providing habitat for other aquatic species.

- *Maintaining longitudinal and lateral connectivity*

  Rivers and their associated riparian zones provide migratory connectivity for both aquatic and terrestrial species and thereby maintain both aquatic and terrestrial biodiversity (Costanza et al., 1997).

8.2.5 Biodiversity

- ***Identification of Impacts***

No impacts were identified that could lead to a beneficial impact on the biological environment since the proposed development is largely destructive, involving the alteration of natural habitat.

Impacts resulting from the proposed development on ecological attributes are largely restricted to the physical effects. Direct impacts include any effect on populations of individual species of conservation importance and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of conservation consideration. In addition, impacts on sensitive or protected habitat are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are 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 at a specific moment in time; the extent of the effect is frequently at a scale that is larger than the actual site of impact. A measure of estimation, or extrapolation, is therefore necessary in order to evaluate the importance of 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.

A list of potential and likely impacts was compiled from a generic list of impacts derived from previous projects of this nature and from a literature review of the potential impacts of this type of development on the natural environment. The following impacts were identified:

- Direct impacts on threatened flora species;
- Direct impacts on protected flora species;
- Direct impacts on threatened faunal taxa;
- Direct impacts on common fauna species/ faunal assemblages (including migration patterns, corridors, etc);
- Human - Animal conflicts;
- Loss or degradation of natural vegetation/ pristine habitat (including ecosystem functioning);
- Loss/ degradation of surrounding habitat;
- Impacts on SA's conservation obligations & targets;
- Increase in local and regional fragmentation/ isolation of habitat; and
- Increase in environmental degradation, pollution (air, soils, surface water).

- ***Nature of Impacts***

  - *Direct Impacts on Threatened Flora Species*

This direct impact results in physical damage or destruction of Red Data species/ communities, areas where these species are known to occur or areas that are considered particularly suitable for these species. Threatened plant species, in most cases, do not contribute significantly to the species richness of an area in terms of sheer numbers, as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they represent an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Changes in habitat conditions resulting from human activities is one of the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this type of impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest limitations in terms of mitigating or preventing this particular impact, is the paucity of species specific information that describe their presence, distribution patterns, population dynamics and habitat requirements. To allow for an accurate assessment, it is usually necessary to assess the presence/ distribution, habitats requirements, etc. associated with these species in detail and over prolonged periods; something that is generally not possible during EIA investigation such as this. However, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, potential impacts will largely be limited.

The likelihood of Red Data flora species occurring within the study area is relatively high and the conservation of these areas is likely to provide protection of plant species of conservation importance.

  - *Direct Impacts on Protected Flora Species*

Data records indicate the presence of some protected plant taxa within the general surrounds. It is therefore reasonable to assume that some of these species could be present within the preferred area. Similar to Red Data plants, these species do not contribute significantly towards the local and regional species richness, but their presence indicates a relatively pristine status of the habitat. Preservation of these species is a social obligation in light of increasing pressure on these species that causes a continuous decline and an eventual inclusion in conservation categories.

- *Direct Impacts on Threatened Fauna Taxa*

The presence of Red Data fauna species cannot be discounted at this stage and any disturbance therefore represents a direct and significant impact on these species. While some species are highly mobile and will ultimately be able to avoid impacts that result from the proposed development, some will not be able to avoid effects of microhabitat destruction. A direct approach, which is likely to be hugely costly, can be implemented in order to capture and relocate some animals to adjacent suitable habitat. Similar to Red Data plants, the presence of Red Data animal species is seen as a significant attribute to the biodiversity of an area. Any impact is therefore viewed as significant. Additional aspects that will be affected include migration patterns and suitable habitat for breeding and foraging purposes.

- *Direct impacts on Common Fauna Species/ Faunal Assemblages*

The presence of diverse faunal assemblages in most areas is accepted. Considering the low levels of habitat transformation and degradation on a local scale, animal species are likely to evacuate towards adjacent areas of natural habitat during periods of high impact. While the tolerance levels of most animal species is generally of such a nature that surrounding areas will suffice in their habitat requirements, some species are not able to relocate, such as ground living and small species. The proposed activity will therefore result in severe impacts on these species.

In light of the low fragmentation and habitat isolation levels of the region, it is reasonable to assume that the animals utilising habitat within the proposed areas will also migrate extensively across the region for various reasons. Foraging, available water, food sources, breeding patterns and seasonal climate changes include some of the more obvious explanations for migration of animals.

While most of the larger mammal species (ungulates) are restricted in their movement by fences, small and medium sized animals, that include predators, burrowing species, small mammals, invertebrate species, reptiles, amphibians, etc. utilises all available natural habitat as either corridors or habitat. The loss of an area as large, as this property, will affect the migration and daily movement patterns of a number of species that are present in the immediate region

- *Human / Animal conflict*

While animals generally avoid contact with human structures, they do grow accustomed to structures after a period. While the structures are visible, injuries and death of animals could potentially occur because of accidental contact. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to road kills, particularly amongst nocturnal animals that abound in the study area.

The presence of personnel within the development area during construction and maintenance periods will inevitably result in limited, contact with animals. While most of the larger animal species are likely to move away from humans, encounters with snakes, spiders, scorpions and even predators remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, poisoning, trapping, etc.

Furthermore, the creation of artificial habitat and the abundance of litter and spoils that are associated with any construction and development site will attract prey species such as rodents, exotic birds and pets (feral cats and dogs). Strongly associated with the presence of these animals are predators that include venomous snakes, larger raptors, wild cat species (Cerval, Leopard, Caracal, etc.), Jackal, Hyaena, Honey Badger, etc. These species are frequently regarded with false beliefs and killed for little reason.

While most of the significant impacts are associated with habitat clearance that precede the actual development and operational phases, this impact is also particularly relevant during the period when construction activity peaks and worker numbers are high.

- *Loss or Degradation of Natural Vegetation/ Sensitive Habitat*

The loss or degradation of natural/ pristine vegetation represents a potential loss of habitat and biodiversity on a local and regional scale. Sensitive habitat types might include mountains, ridges, koppies, wetlands, rivers, streams, pans and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

The vegetation is indicated to be highly representative of the regional vegetation type and is, for most parts, in a pristine condition, implying that the species composition, structure and other floristic attributes does not indicate variance on a local or regional scale.

The larger region is furthermore characterised by relative low transformation and fragmentation factors. Therefore, the existing ecological connectivity is significant in the functioning of the regional and local ecological processes. Indirect effects resulting from construction and operational activities on processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;

- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function.

- *Impacts on Surrounding Habitat/ Species & Ecosystem Functioning*

Surrounding areas and species present in the direct vicinity of the study area could potentially be affected by indirect impacts resulting from construction and operational activities. This indirect impact also includes adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function. Furthermore, regional ecological processes, particularly aquatic processes that is dependent on the status and proper functioning of the drainage line, is regarded important. It is well known that the status of a catchment is largely determined by the status of the upper reaches of the rivers. Small drainage lines might be insignificant on a regional scale, but the combined status of numerous such small drainage lines will determine the quality of larger rivers further downstream.

- *Impacts on SA's Conservation Obligations & Targets*

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas or threatened areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types (VEGMAP, 2006) and therefore impacts that result in irreversible transformation of natural habitat is regarded significant.

- *Increase in Local & Regional Fragmentation/ Isolation of Habitat*

  Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

  The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are usually beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular.

  The general region is characterised by moderate levels of transformation and habitat fragmentation. However, a high degree of connectivity is still present outside development areas. This connectivity is critical in the preservation of pollinator species that provide important ecological services. The isolation of parcels of natural habitat is likely to contribute to loss of genetic variability, decrease in diversity and accentuated impacts from surrounding land uses.

- *Cumulative Increase in Environmental Degradation, Pollution*

  Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

  The nature of the development is such that pollution and degradation of the immediate surrounds is reasonably expected, although mitigation efforts are expected to ameliorate the occurrence and effect to this impact to a large extent

8.3 Identification of Potential Social Impacts

8.3.1 Visual

Visibility of an object is one of the primary attributes by which visual impact can be concluded. This is determined by a line of sight where nothing obscures the view of an object. Exposure is defined by the degree of visibility, in other words "how much" or "which part" of an object is visible to the observer. This is influenced by topography and the incidence of objects such as trees and buildings that obscure the view partially or in total. Visibility can be modelled by making use of a digital terrain model (DTM), created from contour data, and performing a viewshed analysis using GIS software. It must be noted that the viewshed analysis only accounts for topographical influences, and that the screening effect of vegetation is not included. This indicates a worst-case scenario, where the possibility of visual exposure is mapped, from which possible sensitive viewer locations can be identified.

In addition to viewshed analyses as described above, a proximity analysis is required to incorporate the effect of reduced visibility over distance. By integrating the two types of analyses, an index of possible visual impact is generated, as shown on the map in **Figure 8.1**.

The map indicates a core area of high visibility and a high degree of visual exposure within 6 km from the ash disposal site. The planned extension of the facility in an eastern direction is expected to increase the visibility thereof, and may possibly impact on a number of sensitive receptors within 3 km from the site. Permanent residents within this zone need to be identified and requirements with regard to mitigation measures investigated during the EIA phase.

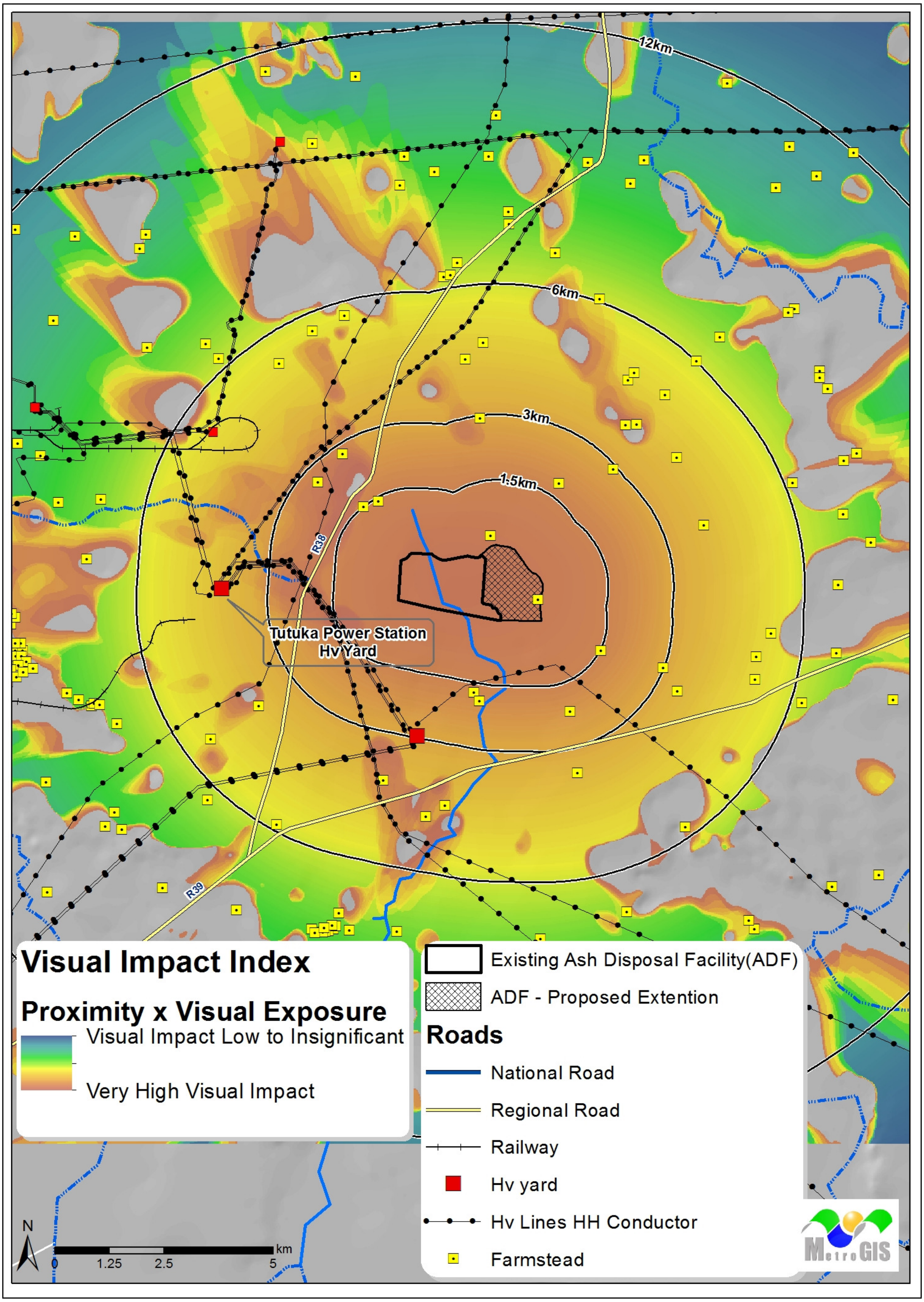

Figure 8.1: Integrated proximity and visual exposure index.

- ***Issues Relating to Visual Impact***

The ash disposal site, situated 4.5 km east of the power station forms part of the current visual landscape, together with the power station being a visually dominant structure. This provides some degree of visual absorption capacity for the extension of the ash disposal site.

A number of sensitive receptors, particularly residents on farmsteads, might be impacted upon with the continued eastern and southern movement of the ash disposal site. Issues of concern will relate to the design of the facility, particularly the footprint and vertical dimensions thereof. Whereas the above viewshed analysis was based on a conceptual design and an assumed maximum height of 65m, detailed information with regard to the design of the ash disposal site, together with detailed information gathered from a site visit will be used in an assessment of the nature and significance of visual impact.

8.3.2 Air Quality

The main pollutant of concern associated with operations is particulate matter. Particulates are divided into different particle size categories with Total Suspended Particulates (TSP) associated with nuisance impacts and the finer fractions of PM_{10} (particulates with a diameter less than 10 µm) and $PM_{2.5}$ (diameter less than 2.5 µm) linked with potential health impacts. PM_{10} is primarily associated with mechanically generated dust whereas $PM_{2.5}$ is associated with combustion sources. Gaseous pollutants (such as sulphur dioxide, oxides of nitrogen, carbon monoxide, etc.) derive from vehicle exhausts and other combustions sources. These are however insignificant in relation to the particulate emissions and are not discussed in detail.

Table 8.2 provides a list of all sources of air pollution associated with the proposed project. The subsequent sections provide a generic description of the parameters influencing dust generation from the various aspects identified.

Table 8.2: Activities and aspects identified for the construction, operational and rehabilitation phases of the proposed operations

Pollutant(s)	Aspect	Activity
Construction		
Particulates	Construction of progressing ash disposal facility	Clearing of groundcover
		Levelling of area
		Wind erosion from topsoil storage piles
		Tipping of topsoil to storage pile
	Vehicle activity on-site	Vehicle and construction equipment activity during construction operations
Gases and particles	Vehicle and construction equipment activity	Tailpipe emissions from vehicles and construction equipment such as graders, scrapers and dozers
Continuous ash disposal		
Particulates	Wind erosion form ash disposal facility	Exposed dried out portions of the ash disposal facility
	Vehicle activity on-site	Vehicle activity at the ash disposal facility

Pollutant(s)	Aspect	Activity
Gases and particles	Vehicle activity	Tailpipe emissions from vehicle activity at the ash disposal facility
Closure / Rehabilitation		
Particulates	Rehabilitation of ash disposal facility	Topsoil recovered from stockpiles
		Tipping of topsoil onto ash disposal facility
	Wind erosion	Exposed cleared areas and exposed topsoil during rehabilitation
	Vehicle activity on unpaved roads and on-site	Truck activity at site during rehabilitation
Gases and particles	Vehicle activity	Tailpipe emissions from trucks and equipment used for rehabilitation

PM_{10} concentrations are likely to exceed the NAAQS 2015 limit of 75 µg/m³ for ~1000m from the source. $PM_{2.5}$ concentrations are likely to exceed the NAAQS 2030 limit of 25 µg/m³ for ~300m from the source. The predicted elemental concentrations from the windblown ash material is predicted to exceed the most stringent effect screening levels up to a distance of 3500m from the source. With water sprays in place, and once vegetation is established, these impacts will reduce significantly. The potential for impacts at the sensitive receptors will also depend on the wind direction and speed which could not be accounted for in this assessment.

If unmitigated, the windblown dust from the ash disposal facility may result in exceedances of effect screening levels up to a distance of 3500m from the source with exceedances of PM_{10} NAAQ limits up to a distance of 1000m. This applies to the current and proposed future ash disposal operations since the "active" area should essentially remain the same irrespective of the total footprint of the ash disposal facility

8.3.3 Heritage

- ***Stone Age***

No sites, features or objects of cultural significance dating to the Stone Age were identified in the study area.

- ***Iron Age***

No sites, features or objects of cultural significance dating to the Iron Age were identified in the study area.

- ***Historic period***

The following sites, features and objects dating to the historic period were identified in the study area:

8.3.4 Socio-Economic

The key social issues that would need to be assessed during the SIA can be divided into:

- Perceptions and fears associated with the proposed project; and
- Local, site-specific issues (during construction and operation phases).

The local site-specific issues can in turn be divided into construction and operational related issues.

- **Perceptions and Fears**

Social impacts are unique in that the mere introduction of information into the public domain can result in social impacts that manifest themselves in the form of perceptions, fears and expectations. In the case of the proposed continuous ashing project, the introduction of information into the public domain is likely to have resulted in social impacts, specifically for landowners and other stakeholders who may potentially be affected.

The extent and nature of these fears are likely to be linked to concerns related to the visual and sense of place impacts associated with the continuous ashing activities as well as fuelling any existing issues and concerns that stakeholders have regarding the existing ash disposal facility in the study area.

These impacts could in turn have negative implications for property values, investments in tourism initiatives and the public's perception of Eskom in general etc. The SIA will seek to identify and assess the potential extent and severity of these fears and perceptions as part of the assessment process.

- **Local, Site-specific Issues**

The potential impacts could include:

- The potential risks to personal safety, specifically for farmers, increase in stock theft, trespassing, poaching and fires;
- The impact of dust pollution on surrounding areas;
- Damage to productive farm lands and crops due to construction related activities;
- Damage to natural vegetation and grazing due to construction related activities;
- Impact on tourism related activities due to construction related activities;
- The impact of the bigger ash disposal facility on the visual character of the area and sense of place. These impacts will be felt at both a local, individual landowner level, and also at a larger, landscape level that affects visitors to the area;
- The impact of the proposed continuous ashing activities on farming activities and land use potential.

- The impact on current and future tourism and conservation related activities and potential. This will be closely linked to the visual and sense of place impacts associated with the proposed alignments;
- Impact on property values.
- The broader social benefits for South Africa associated with the ongoing supply of electricity;

8.4 Summary of the potential impacts identified during the scoping phase

The following is a summary of the potential impacts that will be investigated in detail during the EIA phase:

- **Biophysical Impacts**
    - *Geology*
        - Impacts related to the construction-related earthworks
        - Impacts related to the pollution in case of spillage/leakage of hydrocarbon and other hazardous material from storage facilities
    - *Groundwater*
        - Contamination of ground water due to hydrocarbon spillage and seepage into groundwater reserves, affecting groundwater quality.
        - Further construction of infrastructure and compaction of the area will further contribute to reduced water infiltration rates to replenish groundwater aquifers.
    - *Soil and agricultural potential*
        - Pollution of soil due to handling, use and storage of hazardous substances during construction and operation.
        - The loss of available top soil.
        - 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 disposal facility.
        - The loss of viable agricultural land.
    - *Avifauna*
        - Ash disposal facility
            - Destruction of habitat and disturbance of birds
        - Associated Infrastructure such as powerlines
            - Electrocutions
            - Collisions
            - Habitat destruction
            - Disturbance
    - *Surface Water*
        - Impacts on surface water quality;
        - Impacts on hydrology;
        - Impacts related to erosion and sedimentation;
        - Impacts on aquatic biota; and
        - Impacts on aquatic ecosystem services.

- *Biodiversity*
  - Direct impacts on threatened flora species;
  - Direct impacts on protected flora species;
  - Direct impacts on threatened faunal taxa;
  - Direct impacts on common fauna species/ faunal assemblages (including migration patterns, corridors, etc.);
  - Human - Animal conflicts;
  - Loss or degradation of natural vegetation/ pristine habitat (including ecosystem functioning);
  - Loss/ degradation of surrounding habitat;
  - Impacts on SA's conservation obligations & targets;
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation, pollution (air, soils, surface water)..

- **Social Impacts**
  - *Air Quality*
    - Increase in dust generating activities during construction and operation including exceedances of PM_{10} concentrations and exceedances of dustfall rates.
  - *Visual*
    - Impact on the current visual landscape.
    - Impact on sensitive receptors,
  - *Heritage*
    - identify the potential heritage sites within the study area
    - identify any impacts (if any) that may occur on these sites as a result of the continuous ashing project
  - *Socio-Economic*
    - Perceptions and fears associated with the proposed project; and
    - Local, site-specific issues.

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