INTEGRATED ENVIRONMENTAL IMPACT ASSESSMENT:

PROPOSED EXPANSION OF ASH DISPOSAL FACILITY, KRIEL POWER STATION, MPUMALANGA

ENVIRONMENTAL IMPACT REPORT

DEA:14/12/16/3/3/3/217

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Eskom

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Please note that all additions made to this report from the version made available for public comment has been underlined and omissions ~~strikethrough~~.

Contents

Annexures

Figures

Tables

NEMA REQUIREMENTS WITH REFERENCE TO RELEVANT SECTIONS OF THIS REPORT

The Environmental Impact Assessment (EIA) process undertaken to date has culminated in the production of this Draft Environmental Impact Assessment Report (DEIR) which provides detailed information relevant to the project.

Table 1 illustrates how the structure of the DEIR addressed applicable requirements for information in terms of National Environmental Management Act (Act No. 107 of 1998) (NEMA), as amended. The second Table 2, refers to specific requirements from the Department of Environmental Affairs (DEA) that was provided in the approval to proceed to the EIA Phase (dated 27 February 2017).

Table 1 | EIA Regulations (GN No. 982 of 2014) requirements for environmental impact assessment reports

Appendix 3	Content as required by NEMA	Section
2(a)	(i) Details of the Environmental Assessment Practitioner who prepared the report; and (ii) Details of the expertise of the Environmental Assessment Practitioner, including a curriculum vitae.	Section 2.5
2 (b)	The location of the activity, including: (i) The 21 digit Surveyor General code of each cadastral land parcel; (ii) Where available, the physical address and farm name; (iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 5.1
2 (c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is	Section 4.2
	(i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	N/A
	(ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken;	N/A
2 (d)	A description of the scope of the proposed activity, including:	Section 4.2
	(i) all listed and specified activities triggered; and being applied for; and	Sections 1.2.2 and 1.2.3
	(ii) a description of the associated structures and infrastructure related to the development;	Section 4.2
2 (e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 1.2
2 (f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 4.1.1
2 (g)	A motivation for the preferred development footprint within the approved site;	Section 4.2
2 (h)	A full description of the process followed to reach the proposed development footprint within the approved site, including:	Section 4.2
	(i) Details of the development footprint alternatives considered;	Section 4.2

Appendix 3	Content as required by NEMA	Section
2 (h)	(ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Chapter 3
	(iii) A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 3.2
	(iv) The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 5
	(v) the impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Chapter 6
	(vi) The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Chapter 2
	(vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 6
	(viii) The possible mitigation measures that could be applied and level of residual risk;	Chapter 6
	(x) If no alternative development locations for the activity were investigated, the motivation for not considering such; and	Section 4.2
	(xi) A concluding statement indicating the alternative development location within the approved site.	Section 7.1
2(I)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity i. Description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Chapters 2 and 6
	ii. Assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Chapter 6
2(J)	An assessment of each identified potentially significant impact and risk, including- i. Cumulative impacts; ii. The nature, significance and consequences of the impact and risk; iii. The extent and duration of the impact and risk; iv. The probability of the impact and risk occurring; v. The degree to which the impact and risk can be reversed; vi. The degree to which the impact and risk may cause irreplaceable loss of resources; and vii. The degree to which the impact and risk can be mitigated;	Chapter 6
2(K)	Summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Chapter 6 and Section 7.1

Appendix 3	Content as required by NEMA	Section
2(L)	An environmental impact statement which contains i. Summary of the key findings of the environmental impact assessment; ii. Map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and iii. Summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Chapter 7 and Annexure G
2(M)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	Chapters, 6, 7 and Annexure G
2(N)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.	Section 7.1
2(O)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Section 7.2
2(P)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Sections 2.4 and 7.3
2(Q)	Reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 7.2
2(R)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised	N/A
2 (i)	An undertaking under oath or affirmation by the Environmental Assessment Practitioner in relation to: (i) The correctness of the information provided in the report; (ii) The inclusion of comments and inputs from stakeholders and interested and affected parties; and (iii) Any information provided by the Environmental Assessment Practitioner to interested and affected parties and any responses by the Environmental Assessment Practitioner to comments or inputs made by interested or affected parties;	Annexure A
2 (j)	An undertaking under oath or affirmation by the Environmental Assessment Practitioner in relation to the level of agreement between the Environmental Assessment Practitioner and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	Annexure A
2 (k)	Where applicable, any specific information required by the competent authority; and	See Table 2
2 (l)	Any other matter required in terms of section 24(4)(a) and (b) of the Act.	N/A

Table 2 | DEA EIA report requirements (comment dated 2017/02/27)

Item	Content as required by DEA	Section
1.	Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final Environmental Impact Report (EIR).	In progress
	This includes but is not limited to comments from the Mpumalanga: Department of Economic Development Environment and Tourism as well as the National Department of Water and Sanitation.	In progress
2.	Proof of correspondence with the various stakeholders must be included in the Final EIR. Should you be unable to obtain comments, proof of the attempts made to obtain comments should be submitted to the Department.	In progress; Annexure E
3.	In addition, the following amendments and additional information are required for the EIR: a) The geology of the area;	Sections 5.2.4 and 6.2 Annexure F
	b) Hydrogeology on site: structural features like, dyke etc.;	
	c) Current groundwater quality on site;	
	d) Hydrocensus of the groundwater quality in the area;	
	e) Potential impact of the activity on surrounding groundwater users if any;	
	f) Groundwater monitoring plan in terms of quality and quantity;	
	g) Historical groundwater monitoring data if available;	
	h) Storm water Management Plan;	
	i) Design drawings which are designed by a professional Engineer;	Section 4.2.1
	j) Each liner must be specified;	Section 4.2
	k) Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained?	N/A – no additional infrastructure or services will be required.
	l) A construction and operational phase EMPr to include mitigation and monitoring measures.	Annexure G
	m) Should a Water Use License be required, proof of application for a license needs to be submitted	Annexure B2
4.	The applicant is hereby reminded to comply with the requirements of Regulation 45 with regard to the time period allowed for complying with the requirements of the 2014 EIA Regulations.	Noted.
5.	Please ensure that the Final EIR includes at least one A3 regional map of the area and the locality maps included in the final EIR illustrate the different proposed alignments and above ground storage of fuel. The maps must be of acceptable quality and as a minimum, have the following attributes: • Maps are relatable to one another; • Cardinal points; • Coordinates; • Legible legends; • Indicate alternatives; • Latest land cover; • Vegetation types of the study area; and • A3 size locality map.	To be included in Final EIR.

Item	Content as required by DEA	Section
6.	Further, it must be reiterated that, should an application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Ad, Ad 25 of 1999, then this Department will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999.	Noted.

IMPORTANT NOTICE 1

The Scoping and Environmental Impact Report process required by the National Environmental Management Act (Act. 107 of 1998) (NEMA) consists of two phases: (1) Scoping phase and (2) a detailed Environmental Impact Assessment phase (i.e. the EIA Phase).

The current 2014 NEMA EIA Regulations (Government Notice No. R 982 of 2014, specifically Appendix 2 to these regulations), requires the Scoping Report to include much more detailed information, such as the identification and assessment of impacts, the preferred site, and mitigation measures. These were previously only required in the EIA phase in terms of the 2006 and 2010 EIA regulations.

Subsequent to the scoping report and comment received from DEA on the scoping report (dated 2017/02/27) a detailed impact assessment process was undertaken by various specialists. In accordance to the approved Plan of Study for the EIA phase, this EIA report contains the detailed impact assessment of the preferred alternatives.

Interested and Affected Parties should note that **only one version of the environmental impact report was made available for public comment** in terms of the 2014 NEMA EIA Regulations. Therefore the environmental impact report made publicly available should be viewed as the **final report**. This report was updated with all comments received from Interested and Affected Parties (after the conclusion of the 30 day public comment period) before submission to DEA for their consideration. Registered I&APS will be provided access to the final report submitted to the DEA for information purposes.

IMPORTANT NOTICE 2

Please note that Kriel Power Station will continue to operate as per the original technical plan, and therefore the current expansion is applied for based on the understanding that the facility will be in operation until end 2039 with a five year contingency closure period until 2045.

Importantly, **this EIA does not assess any potential early closure or decommissioning plans of the Kriel Power Station** or aspects pertaining the decommissioning of any of the facilities or infrastructure.

Please contact Eskom's Media Office directly for any questions on the potential closure of the coal fired power stations at: MediaDesk@eskom.co.za

All comments pertaining to this EIA report and process, can be emailed to Mr Dirk Pretorius of Aurecon at Dirk.Pretorius@aurecongroup.com or Ms Franci Gresse at Franci.Gresse@aurecongroup.com. Mr Pretorius can also be contacted at Tel: 021 526 6012.

GLOSSARY OF TERMS

Boiler Bottom Ash (BBA)	BBA is the larger ash particles that cannot rise and falls down into a pan below the boiler where it is quenched in water. The ash is therefore captured wet. The ash and water forming a slurry can be thickened to an optimal density before it is transported to site by means of pumping. BBA constitutes approximately 10-20% of the coal ash.
Environment	The surroundings (biophysical, social and economic) within which humans exist and that are made up of i. the land, water and atmosphere of the earth; ii. micro-organisms, plant and animal life; iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Impact Assessment (EIA)	A study of the environmental consequences of a proposed course of action.
Environmental Impact Report Assessment (EIR)	A report assessing the potential significant impacts as identified during the Scoping phase.
Environmental impact	An environmental change caused by some human act.
Environmental Management Programme (EMP)	A document that provides procedures for mitigating and monitoring environmental impacts, during the construction, operation and decommissioning phases.
Expansion	“Expansion” means the modification, extension, alteration or upgrading of a facility, structure or infrastructure at which an activity takes place in such a manner that the capacity of the facility or the footprint of the activity is increased.
General waste	"General waste" means waste that does not pose an immediate hazard or threat to health or to the environment, and includes: (a) domestic waste; (b) building and demolition waste; (c) business waste; (d) inert waste; or (e) any waste classified as non-hazardous waste in terms of the regulations made under section 69, and includes non-hazardous substances, materials or objects within the business, domestic, inert or building and demolition wastes.
Hazardous waste	"Hazardous waste" means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within the business waste, residue deposits and residue stockpiles.
Lagoon	“Lagoon” means the containment of waste in excavations and includes evaporation dams, earth cells, sewage treatment facilities and sludge farms
Pulverised Fuel Ash (PFA)	PFA rises with the furnace gasses and is collected by electrostatic precipitators in, or, before the stacks or chimneys of the power station. The ash is therefore captured dry and is commonly referred to as fly ash. The ash can be conditioned by adding small amounts of moisture to ease handling by mechanical means and to reduce dust before it is transported to the deposition facility usually by troughed conveyors. PFA constitutes approximately 80% to 90% of the coal ash.
Public Participation Process	A process of involving the public in order to identify needs, address concerns, in order to contribute to more informed decision making relating to a proposed project, programme or development.
Scoping	A procedure for determining the extent of and approach to an EIA, used to focus the EIA to ensure that only the significant issues and reasonable alternatives are examined in detail.
Scoping Report	A report describing the issues identified.
Supernatant water	Clear water that lies above a sediment or precipitate.

Waste	(a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, by the holder of the substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or (b) any substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraph (a) and (b) ceases to be a waste - (i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered; (ii) where approval is not required, once a waste is or has been re-used, recycled or recovered; (iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or (iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

ABBREVIATIONS

CRR	Comments and Responses Report
DALA	Department of Agriculture and Land Administration
DARDLA	Department of Agriculture Rural Development and Land Administration
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DEAT	Department of Environmental Affairs and Tourism
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EAPSA	Environmental Assessment Practitioner of South Africa
EIA	Environmental Impact Assessment
EIR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
GA	General Authorisation
GN	Government Notice
HDPE	High-density polyethylene
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IWULA	Integrated Water Use License Application
Mamsl	Meters above mean sea level
MBCP	Mpumalanga Biodiversity Conservation Plan
MBGL	Meters Below Ground Level
MBSP	Mpumalanga Biodiversity Sector Plan
Mtons	Metric tons
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NEMWA	National Environmental Management: Waste Act (No. 59 of 2008)
NHRA	National Heritage Resources Act (No. 25 of 1999)
NWA	National Water Act (No. 36 of 1998)
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SR	Scoping Report
ToR	Terms of Reference

1 INTRODUCTION AND BACKGROUND

The purpose of this Chapter is to introduce the project and describe the relevant legal framework within which the project takes place. Other applicable policies and guidelines are also discussed. The Terms of Reference for the Environmental Impact Assessment (EIA) is briefly discussed

1.1 Introduction

The construction of Kriel Power Station (owned by Eskom Holdings SOC Limited (Eskom)) was completed in 1979 and it was considered to be the largest coal-fired power station in the southern hemisphere at the time (see Figure 1-1 and Figure 1-2). The 38 year old power station, with an installed capacity of 3 000 MW (Eskom, 2010), is located approximately 7 km west of the small town of Kriel (also known as Ga-nala[1]) in the Mpumalanga Province. Through the process of electricity generation coarse and fine ash is produced by burning coal. At full capacity, each of the six boilers can produce up to 740 000 tonnes/year of coarse ash/ boiler bottom ash (approximately 20% of total ash produced) ash and 2 960 000 tonnes/year of fly ash/ precipitator fly ash (approximately 80% of total ash produced).

Kriel Power Station makes use of a wet ashing process to dispose of its ash. Coarse ash is transferred with a small volume fine ash (fly ash, to limit pipeline wear) from the Power Station to sumps from where it is pumped as a slurry mixture to the ash dams. The fine ash is transported separately[2] to the existing ash dam complex *via* two conveyors[3] that are located south-east of Kriel Power Station. All the water collected from the Kriel ash dams are stored in the ash water return (AWR) dams. From the AWR dams the water gravitates to a manifold and is then pumped back to a High Level AWR dam. From there the water gravitates to the borrow pits and to Swartpan. This water is then pumped from Swartpan for re-use by the Power Station for ashing purposes (Kriel Power Station, 2016).

The three existing ash dams will reach a limiting Rate of Rise (RoR)[4] by end July 2021 (see Figure 1-3). Eskom is thus proposing to expand its existing ash disposal facility by constructing and commission an additional ash disposal facility before the existing ash dams reach their limiting RoR in 2021. The new ash disposal facility (seeFigure 4-3) would fulfil the ash disposal requirements for the Power Station's extended operational life, with decommissioning of the six generating units planned to commence in 2039. A five year contingency has been allowed for, thus it's assumed that the Power Station will be operated for an additional five years at full load from 2036 to 2040, with final decommissioning date proposed for 2045.

The extended new section of the facility will be divided into three or more portions that will be needed to accommodate the disposed ash up to 2045 (including five years contingency). This EIA covers the first two sections of the new facility, referred to as Ash dam 4.1 and 4.2. These two dams can concurrently accommodate ash from 2021 to 2025 within the safe operating limit and RoR. Beyond 2025 a third dam will be needed to supplement these two sections in order to allow the new facility to accommodate ash up to 2045 within the acceptable operating limits. This third section, referred to as Ash dam 4.3, is currently being looked at under a separate exercise. The site under investigation is a backfilled site on a previously mined area that is located adjacent to the proposed Ash dams 4.1 and 4.2. A Monitored Test Embankment (MTE) is being conducted on this site in order to confirm if the ground is stable enough to accommodate the ash facility including the liner system. Once the test is concluded an EIA process will be initiated for the suitable additional site. If the

[1] Kriel name change to Ga-nala in accordance to Government Notice No.113, 10 February 2006.
[2] The moisture content of water to fly ash is 10:1.
[3] One conveyor belt is normally in service with one on standby.
[4] The safe and sustainable RoR is defined here as the minimum of either the stability limit o the operability limit. The operability limit is defined as RoR where the dam rises too fast to allow drying and subsequent repacking of the daywalls. In simple terms it is the RoR where the dam is simply too wet to access by machine or by labourers.

Monitored Test Embankment proves not feasible to use, an alternative capacity will be sourced, and appropriate permitting processes followed.

The project requires the following components:

- An additional ash disposal facility that would have sufficient capacity to store ash volumes produced up to 2045 (new);
- An AWR dam from where decant and drained water will be pumped back to the power station for re-use (new);
- An AWR Transfer Dam (new);
- Delivery and return infrastructure, including conveyor belts and/ or pipelines, transfer houses, pump stations (existing);
- Clean and dirty water channels (new and existing);
- Powerlines (new and existing); and
- Access roads (new and existing).

In terms of the National Environmental Management Act (No. 107 of 1998) (as amended) (NEMA), the proposed development triggers a suite of activities, that require authorisation from the competent environmental authority before they can be undertaken for the prevention of pollution and ecological degradation, as well as for ecologically sustainable development. Furthermore, the National Environmental Management: Waste Act (No. 59 of 2008) (NEMWA) provides various measures to protect human health and the environment. In this regard, NEMWA identifies and lists certain activities which require environmental authorisation through the NEMA EIA and waste management licensing processes, prior to commencement of those activities. Eskom appointed Aurecon South Africa (Pty) Ltd, an independent company, to conduct the EIA process required, to evaluate the potential biophysical and socio economic impacts (positive and negative) of the proposed project and undertake the required waste licensing processes.

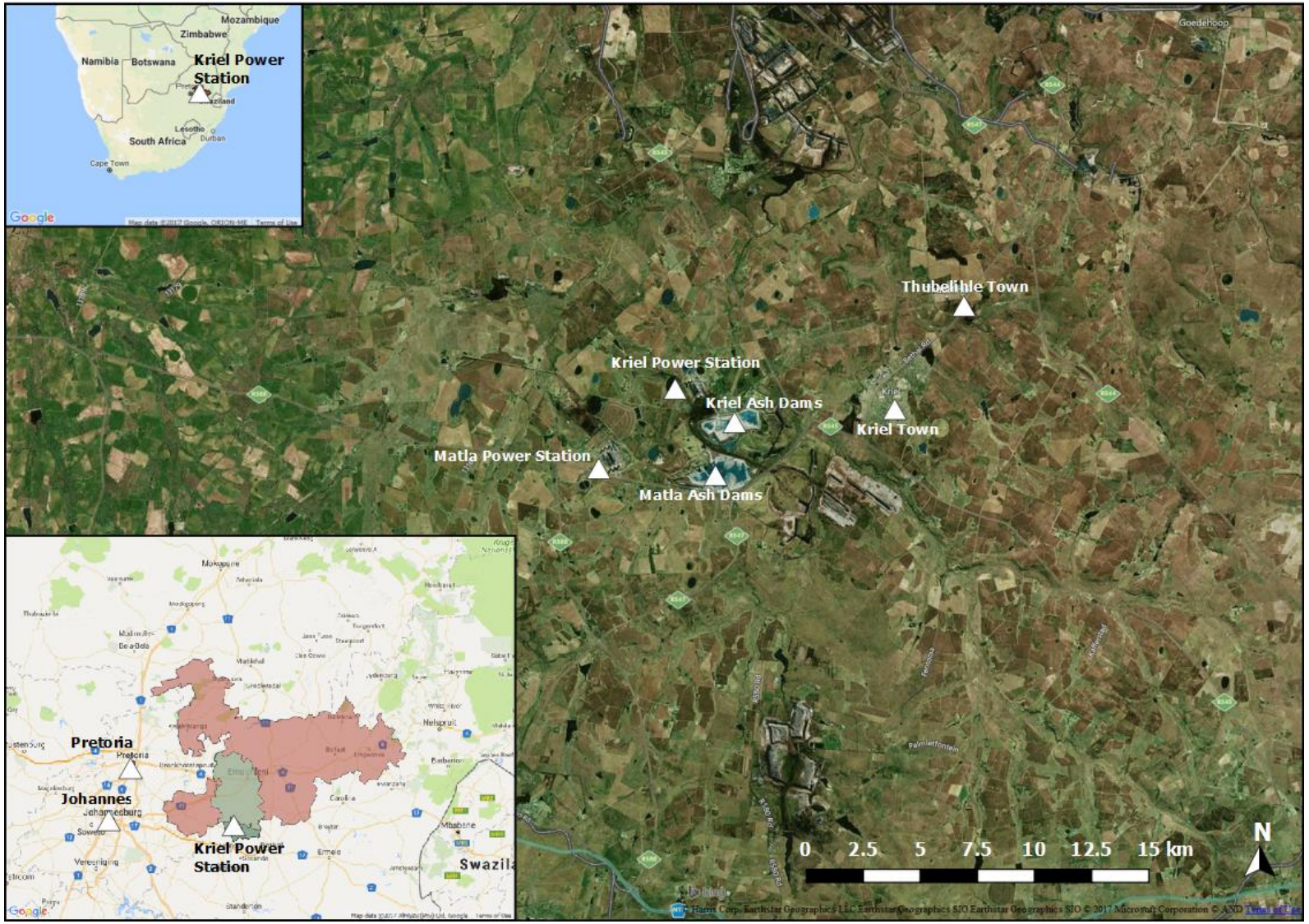


Figure 1-1 | Location of the Kriel Power Station (satelite imagery)

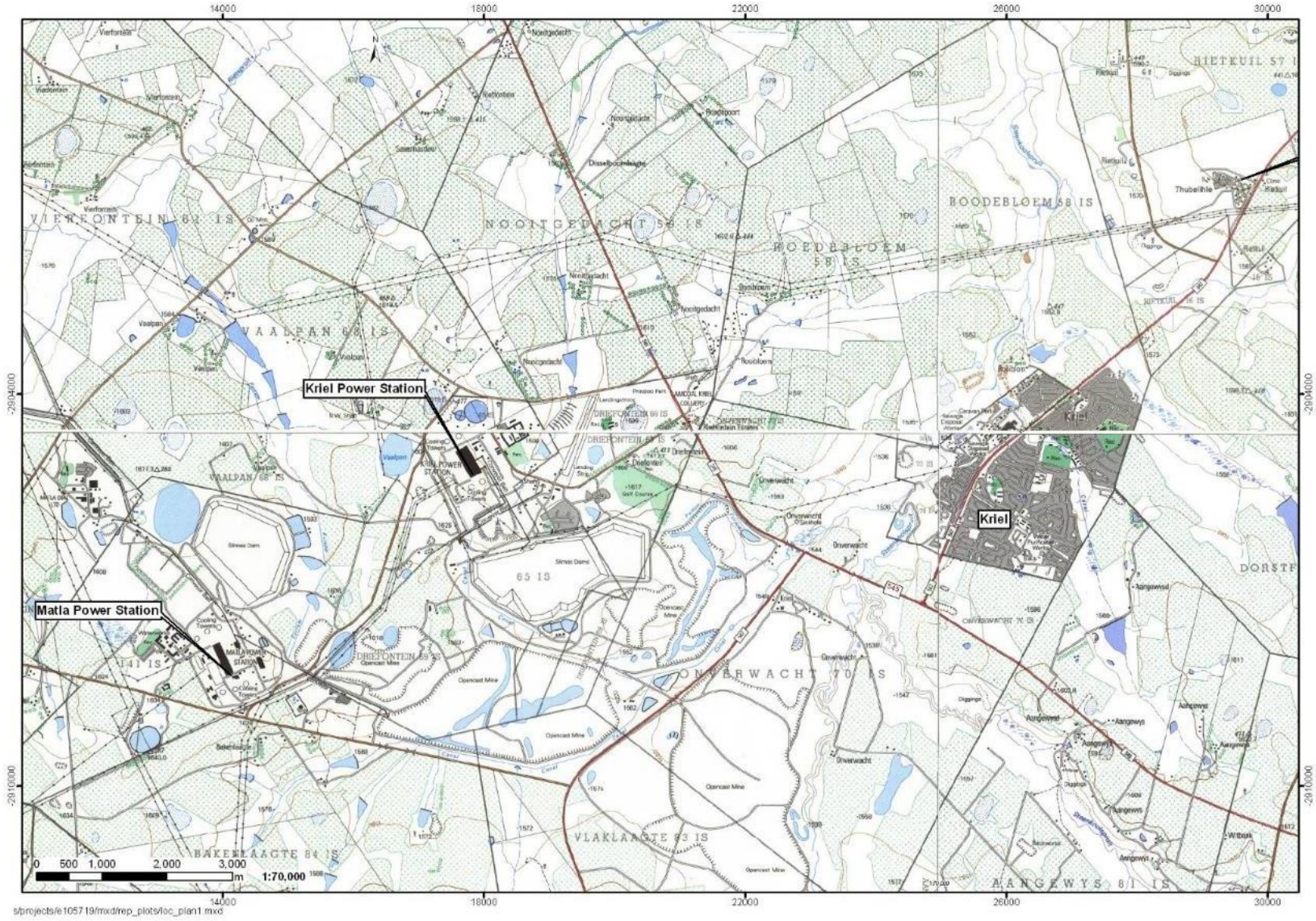


Figure 1-2 | Location of the Kriel Power Station (topocadastral map)

Figure 1-3 | Aerial photograph of the Kriel Power Station and existing ash dam complex

As this proposed project triggers a number of listed activities in terms of NEMA and NEMWA, it accordingly requires environmental authorisation and a waste management licence, thus an Integrated Environmental Authorisation process was followed. Since Eskom is a State Owned Enterprise (SOE), and Kriel Power Station is in the Eskom Generation fleet, the competent authority is the national Department of Environmental Affairs (DEA). DEA's decision will be based on the outcome of this EIA process.

This report serves to document the Environmental Impact Assessment phase of the EIA process Figure 1-4. The EIA process integrates the requirements for both the environmental authorisation and waste management licensing in order to inform a streamlined decision-making process.

The purpose of this Environmental Impact Report (EIR) is to assess the preferred alternative development based on the background information as identified through the scoping proses. Accordingly, the EIR consist of the following chapters:

- **Chapter 1 Introduction (this Chapter)**

The purpose of this Chapter is to introduce the project and describe the relevant legal framework within which the project takes place. Other applicable policies and guidelines are also discussed.

- **Chapter 2 EIA Methodology**

The purpose of this chapter is to describe the approach to the EIA and the methodology to assess the significance of the project impacts. Furthermore it provides a Plan of Study (PoS), for the EIA, scope of and approach to the EIA are described and assumptions and limitations are stated.

- **Chapter 3 The public participation process**

The purpose of this Chapter is to provide an outline of the Public Participation Process, a summary of the process undertaken to date, and the way forward with respect to public participation throughout the EIA process for this

project. This Chapter also provides a summary of the key issues that have been raised to date by registered Interested and Affected Parties (I&APs).

- **Chapter 4 The Proposed Development**

This chapter considers the need for the proposed project, outlines the conceptual design which the EIA Phase has focused on and how the design has considered the facilities water balance.

- **Chapter 5Description of affected environment and potential impacts**

The purpose of this Chapter is to provide a description of the affected environment and the potential impacts that could result from the proposed project. This chapter includes a summary of the Waste Classification which discusses the geochemistry and waste classification assessment for the proposed expansion of the Kriel power station ash disposal facility.

- **Chapter 6 Impact Assessment**

This Chapter forms the focus of this EIA process and aims to assess the potential impacts on the affected environment that could result from the proposed project. Specialist studies were undertaken where areas of concern were identified. It contains a detailed assessment of the construction and operations impacts of the proposed project on the affected biophysical and socio-economic environment, using the methodology described in **Annexure F**. Mitigation measures to enhance positive impacts and reduce negative impacts are described.

- **Chapter 7 Conclusions and way forward**

The purpose of this Chapter is to summarise and conclude the EIR and describe the way forward.

- **Chapter 8 Reference**

Reference material and literature used to inform report.

1.2 Legal requirements

1.2.1 The Constitution Act (No 108 of 1996)

Section 24 of the Constitution relates to environmental rights and states that: *Everyone has the right:*

1. *to an environment that is not harmful to their health or well-being; and*
2. *to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:*
   a. *prevent pollution and ecological degradation;*
   b. *promote conservation; and*
   c. *secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.*

The current environmental laws in South Africa concentrate on protecting, promoting, and fulfilling the Nation's social, economic and environmental rights; while encouraging public participation, implementing cultural and traditional knowledge and benefiting previously disadvantaged communities.

Section 27 of the Constitution states that:

1. *Everyone has the right to have access to*
   a. *health care services, including reproductive health care;*
   b. *sufficient food and water; and*
   c. *social security, including, if they are unable to support themselves and their dependants, appropriate social assistance.*

2. *The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of each of these rights.*

Furthermore, cognisance should also be taken of chapters and sections in the Constitution Act (No 108 of 1996):

- Chapter 2 Bill of Rights;
- Section 25 Rights in property;
- Section 32 Administrative justice; and
- Section 33 Access to information.

1.2.2 National Environmental Management Act, No. 107 of 1998

NEMA, as amended, establishes the principles for decision-making on matters affecting the environment. Section 2 sets out the National Environmental Management Principles which apply to the actions of organs of state that may significantly affect the environment. Furthermore, Section 28(1) states that *"every person who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring"*. If such pollution cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution.

Eskom has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of NEMA. In developing the EIA process, Aurecon has been cognisant of this need, and accordingly the EA process has been undertaken in terms of NEMA and the EIA Regulations promulgated on 4 December 2014, as amended (see Figure 1-4 below).

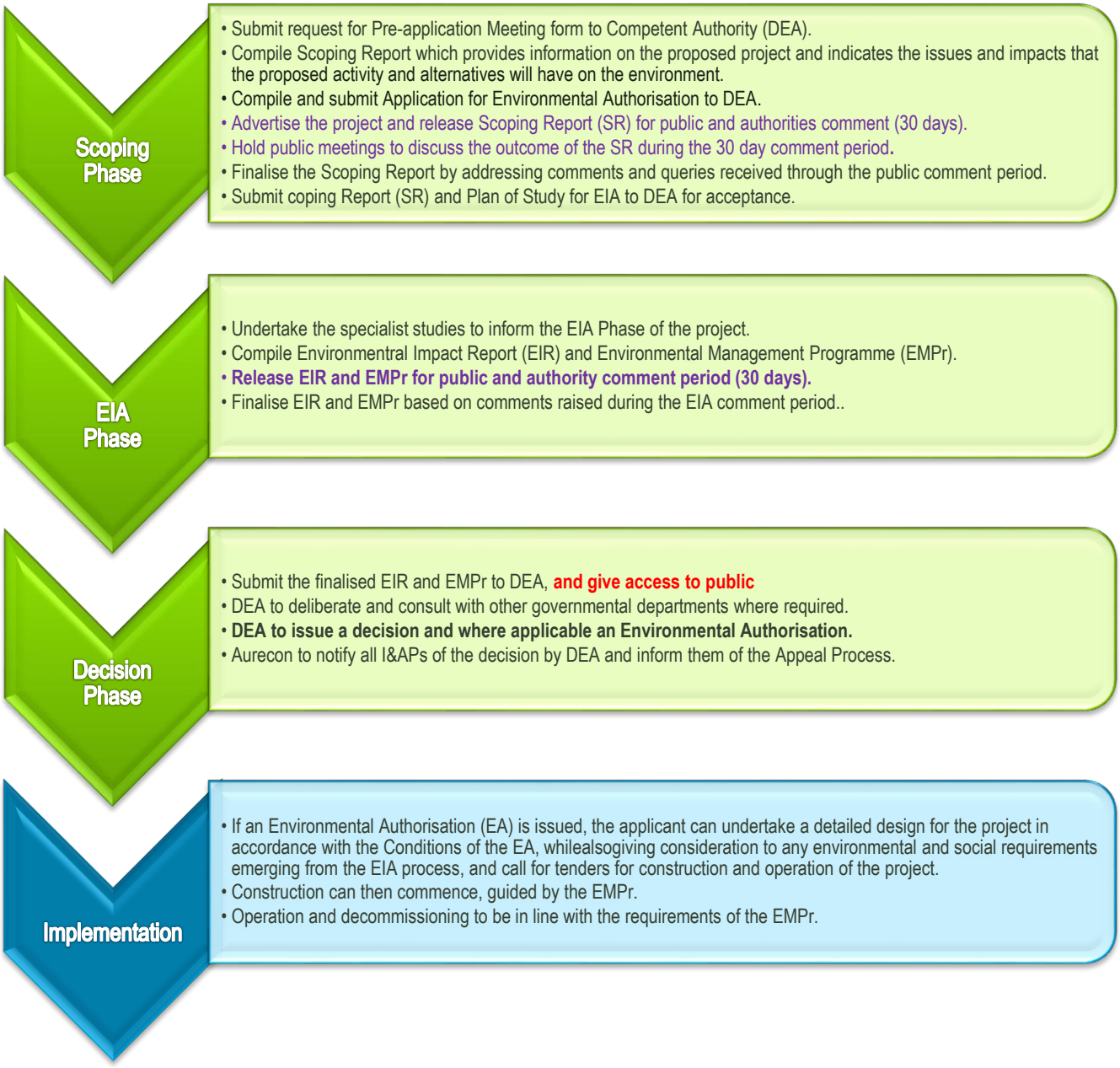


Figure 1-4 | EIA process to be followed for the proposed Kriel ash disposal facility

Table 1-1 | Listed activities in terms of NEMA GN R983, R984 and R985, 8 December 2014 (as amended), to be authorised for the proposed ash disposal facility

Listed activities in terms of NEMA GN R. 983, GN R. 984 and GN R. 985, 8 December 2014	Description of project activity that may trigger the listed activity	Listed activities in terms of NEMA GN R. 327, GN R. R325 and GN R. 324, Amended EIA Regulations published on 7 April 2017
GN R.983 Item 10 The development and related operation of infrastructure exceeding 1000 metres in length for the bulk transportation of sewage, effluent, **process water, waste**	The proposed expanded Kriel ash disposal facility would make use of various pipelines to transport process water, waste water, return water and water which contains waste from, or which has been heated in, any	***GN R.983 Item 10*** The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste

Listed activities in terms of NEMA GN R. 983, GN R. 984 and GN R. 985, 8 December 2014	**Description of project activity that may trigger the listed activity**	**Listed activities in terms of NEMA GN R. 327, GN R. R325 and GN R. 324, Amended EIA Regulations published on 7 April 2017**
water, return water, industrial discharge or slimes (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of **120 litres per second** or more;	industrial or power generation process to and from the ash facility. The transfer dam pump station and pipeline will pump 480m^3/hr (**133.3 litres per second**) process and storm water to the AWR dam through a 350mm diameter pipeline. **Slurry delivery system** • Two 400mm diameter pipes. **The decant system pipes consisting of:** • Permanent penstock steel outfall pipes, 10mm thick flanged on top of leachate collection layer of between **650mm-750mm diameter;** and • Temporary penstock **750mm diameter.** **Ash Deposition System** • Pipeline to ash dam up to **500 mm diameter**	water, return water, industrial discharge or slimes- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more;
GN R.983 Item 12 The development of - (i) canals exceeding 100 square metres in size; (ii) channels exceeding 100 square metres in size; (iv) dams, where the dam, including infrastructure and water surface area, exceeds 100 square metres in size; (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	A silt trap and transfer dam is proposed to be constructed in a depression, which could be classified as a watercourse and would thus trigger the activity being infrastructure within a watercourse. There would also be clean and dirty water containment systems, which would constitute canals, channels and retention dams.	***GN R.983 Item 12*** The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (C) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.

Listed activities in terms of NEMA GN R. 983, GN R. 984 and GN R. 985, 8 December 2014	**Description of project activity that may trigger the listed activity**	**Listed activities in terms of NEMA GN R. 327, GN R. R325 and GN R. 324, Amended EIA Regulations published on 7 April 2017**
GN R.983 Item 19 The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- (i) a watercourse	A silt trap and transfer dam would be located in a depression, which could be classified as a watercourse and would thus trigger the activity because more than 5m^3 of material would be infilled and removed within a watercourse.	***GN R.983 Item 19*** The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.
GN R.983 Item 24 The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	Internal roads of wider than 8m may be constructed to provide access to expanded ash disposal facility infrastructure and may be lengthened by more than 1 kilometre.	***GN R.983 Item 24*** The development of a road- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres. But excluding a road- (c) which is 1 kilometre or shorter.
GN R.983 Item 34 The expansion or changes to existing facilities for any process or activity where such expansion or changes will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions or pollution, excluding- (i) where the facility, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; or (ii) the expansion of or changes to existing facilities for the treatment of effluent, wastewater or sewage where the capacity will be increased by less than 15 000 cubic metres per day.	The expansion of the ash disposal facility would require the amendment of the Air Emissions Licence and Water Use Licence for the facility.	***GN R.983 Item 34*** The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding- (i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day.
GN R.983 Item 46 The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes where the existing infrastructure-	This activity adds on to the infrastructure listed under GN R.983 Item 10. Because the proposed activity relates to the construction and operation of an expanded ash dam, which would increase the footprint of the current ash dam complex, the activity triggers the	***GN R.983 Item 46*** The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes where the existing infrastructure-

Listed activities in terms of NEMA GN R. 983, GN R. 984 and GN R. 985, 8 December 2014	**Description of project activity that may trigger the listed activity**	**Listed activities in terms of NEMA GN R. 327, GN R. R325 and GN R. 324, Amended EIA Regulations published on 7 April 2017**
(i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;	development, operation and expansion of infrastructure in this case pipeline infrastructure.	(i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more
GN R.983 Item 48 The expansion of- . (i) canals where the canal is expanded by 100 square metres or more in size; (ii) channels where the channel is expanded by 100 square metres or more in size; (iv) dams, where the dam, including infrastructure and water surface area, is expanded by 100 square metres or more in size; (vi) bulk storm water outlet structures where the bulk storm water outlet structure is expanded by 100 square metres or more in size; or where such expansion or expansion and related operation occurs- (a) within a watercourse; (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	The silt trap no.2, transfer dam and permanent effluent trench (channel) is proposed to be constructed in a depression, which could be classified as a watercourse and would thus trigger the activity	***GN R.983 Item 48*** The expansion of- (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more; where such expansion occurs- (a) within a watercourse; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.
GN R.983 Item 49 The expansion of - (v) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion or expansion and related operation occurs- (a) within a watercourse; (b) in front of a development setback; or	The expansion of infrastructure including silt trap no.2, transfer dam and permanent effluent trench (channel) is proposed to be constructed in a depression, which could be classified as a watercourse and would thus trigger the activity.	**Activity *GN R.983 Item 49* has been omitted in GN R.327 and is covered under Activity 48 of GN R.327.**

Listed activities in terms of NEMA GN R. 983, GN R. 984 and GN R. 985, 8 December 2014	**Description of project activity that may trigger the listed activity**	**Listed activities in terms of NEMA GN R. 327, GN R. R325 and GN R. 324, Amended EIA Regulations published on 7 April 2017**
(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;		
GN R.983 Item 56 The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres;	Internal roads of wider than 8 meters might be lengthened by more than 1km.	***GN R.983 Item 56*** The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.
GN R.984 Item 15 The clearance of an area of 20 hectares or more of indigenous vegetation.	The footprint of the proposed expanded ash disposal facility would be approximately 172ha. Of this are it's likely that more than 150 hectares of vegetation be cleared. Of this 150ha it's very likely that more than 20ha of vegetation could cumulatively constitute as natural and thus this activity is triggered. This vegetation mainly consists of natural grasses.	***GN R.984 Item 15*** The clearance of an area of 20 hectares or more of indigenous vegetation.
GN R.984 Item 16 The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high water mark of the dam covers an area of 10 hectares or more.	The new starter dam walls are proposed to have a height of 11m (AD4.1) and 11m (AD4.2) respectively. The AWR dam will have an outer wall height of 17.2m.	***GN R.984 Item 16*** The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more.
GN R.985 **None of the geographic areas trigger.** **The proposed site is mapped as heavily to moderately modified Mpumalanga Biodiversity Sector Plan (MBSP, 2014).** **Please refer to Figure 4 to 9 under additional information.**		

TRANSITIONAL ARRANGEMENT – 2017 NEMA EIA REGULATIONS

On 7 April 2017 the Minister of Environmental Affairs, Bomo Edith Edna Molewa, signed the amended Environmental Impact Assessment (EIA) Regulations into effect. The Amended EIA Regulations are:

- GN Regulation 326 (EIA Regulations)

- GN Regulation 327 (Listing Notice 1)
- GN Regulation 325 (Listing Notice 2)
- GN Regulation 324 (Listing Notice 3)

The following Transitional Arrangements relating to pending application for Environmental Authorisation, as described in GN R.326, are applicable to this Environmental Process:

"53 (1) An application submitted in terms of the previous NEMA regulations and which is pending when these Regulations take effect, including pending applications for auxiliary activities directly related to—

(a) prospecting or exploration of a mineral or petroleum resource; or

(b) extraction and primary processing of a mineral or petroleum resource,

must despite the repeal of those Regulations be dispensed with in terms of those previous NEMA regulations as if those previous NEMA regulations were not repealed."

This Environmental Process will be dispensed with in terms of the previous EIA Regulations promulgated on 4 December 2014.

"53 (2) If a situation arises where an activity or activities, identified under the previous NEMA Notices, no longer requires environmental authorisation in terms of the current activities and competent authorities identified in terms of section 24(2) and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), and where a decision on an application submitted under the previous NEMA regulations is still pending, the competent authority will consider such application to be withdrawn."

Activity 49 of GN R.983 has been omitted from the amended Listing Notice 1 (GN R.327). According to Regulation 53(2) Environmental Authorisation for Activity 49 is no longer required.

"53 (3) Where an application submitted in terms of the previous NEMA regulations, is pending in relation to an activity of which a component of the same activity was not identified under the previous NEMA notices, but is now identified in terms of section 24(2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and may authorise the activity identified in terms of section 24(2) as if it was applied for, on condition that all impacts of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed."

All activities and their components not identified under the previous Regulations have been considered and assessed as part of this Environmental Process.

1.2.3 National Environmental Management: Waste Act, No. 59 of 2008

NEMWA seeks to reform the law on waste management by making provision for various measures for the prevention of pollution and ecological degradation, as well as ecologically sustainable development in order to protect communities and the environment through waste management. In this regard, NEMWA provides for national norms and standards for regulating waste management in all spheres of government and provides for the licensing and control of waste management activities, as well as the remediation of contaminated land.

The objectives of NEMWA include minimising the consumption of natural resources; avoiding and minimising the generation of waste; reducing, re-using, recycling and recovering waste; treating and safely disposing of waste as a last resort; promoting and ensuring the effective delivery of waste services; remediating land where contamination presents or may present a significant risk of harm to health or the environment; and achieving integrated waste management reporting and planning. Generally, the Act seeks to ensure that people are aware of the impact of waste on their health, well-being and the environment and to give effect to the constitutional right in order to secure an environment that is not harmful to one's health or well-being.

Based on the leachate tests results for waste classification of the ash the following classification of the material according to the NEM: WA guidelines can be made:

- The material has a Total Concentration (TC) classification of TCT0 < TC ≤ TCT1;
- The material has a Leachable Concentration (LC) classification of LC ≤ LCT0; and
- The waste can be classified as a Type 3 waste with the waste disposal facility to be designed in accordance to the guidelines for a Class C landfill site shown in **Figure 3**.

- The waste was classified as Type 3 (hazardous) waste may only be disposed of at a Class C landfill designed in accordance with section 3(1) and (2) of the Norms and Standards, or, subject to section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a GLB+ landfill as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).

The proposed project triggers activities listed under NEMWA and therefore a waste management licence is required. The activities in terms of NEMWA, GN No. 921 of 29 November 2013, Category B, being applied for in this EIA process is listed in Table 1-2. These triggers depend on the classification of the ash in terms of NEMWA.

Table 1-2 | Listed activities in terms of NEMWA, List of waste management activities that have, or are likely to have, a detrimental effect on the environment

NO.	LISTED ACTIVITY	
Category A		
14	The decommissioning of a facility for a waste management activity listed in Category A or B of this Schedule.	Decommissioning of the existing AWR dam.
Category B		
1	Storage of hazardous waste The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage.	Storage of ash return water in the new AWR dam.
7	The disposal of any quantity of hazardous waste to land.	Disposal of ash in ash dams.
10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	Activity 1 and 7.

1.2.4 National Heritage Resources Act, No. 25 of 1999

In terms of the National Heritage Resources Act (No. 25 of 1999) (NHRA), any person who intends to undertake *"any development … which will change the character of a site exceeding 5 000 m² in extent", "the construction of a road…powerline, or pipeline…exceeding 300 m in length"* must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency. These agencies would in turn indicate whether or not a full Heritage Impact Assessment (HIA) would need to be undertaken.

Section 38(8) of the NHRA specifically excludes the need for a separate HIA where the evaluation of the impact of a development on heritage resources is required in terms of an EIA process. Accordingly, since the impact on heritage resources would be considered as part of the EIA process outlined here, no separate HIA would be required. SAHRA or the relevant provincial heritage agency (Mpumalanga Heritage Resources Authority) would review the EIA reports and provide comments to DEA, who would include these in their final environmental authorisation decision. However, should a permit be required for the damaging or removal of specific heritage resources, a separate application would have to be submitted to SAHRA or the relevant provincial heritage agency for the approval of such an activity, if Eskom obtains authorisation and makes the decision to pursue the proposed project further.

1.2.5 Other applicable legislation and policies

A. National Water Act, No. 36 of 1998

The National Water Act (No. 36 of 1998) (NWA) protects and conserves water resources (i.e. rivers, wetlands, estuaries and groundwater), provides absolute water rights for basic human needs and aims to secure ecological sustainable development and use of South Africa's water resources. In terms of Section 21 of the NWA, the taking of water from

a water resource; storing of water; impounding or diverting the flow of water in a water course; altering the bed, bank, course or characteristics of a watercourses; disposing of waste in a manner which may impact on a water resource and the disposal of water which contains waste or which has been heated through a power generation process are all considered water uses, which in general must be licensed, unless permitted as a Schedule 1 activity, or permissible in terms of a General Authorisation (GA) under Section 39 of the Act. Schedule 1 activities relate mostly to small scale domestic usage of water and would therefore not be applicable to the proposed project.

Eskom's Environmental Department: Water has applied for the requisite license, on behalf of the Kriel Power Station, as part of an Integrated Water Use License Application (IWULA) from the Department of Water and Sanitation (DWS). Information from the IWULA has been incorporated into the EIA and public participation process where relevant.

B. Conservation of Agricultural Resources Act, No. 43 of 1983

The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) makes provision for the conservation of the natural agricultural resources of South Africa through maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of the water sources, protecting vegetation and combating weeds and invader plants. In terms of Regulation 7 of CARA no land user may drain or cultivate a vlei, marsh or water sponge, except with written permission from the Department of Agriculture. However, this regulation is only relevant if the land is zoned for agriculture.

C. National Environmental Management: Air Quality Act, No. 39 of 2004

The National Environmental Management: Air Quality Act, No. 39 of 2004 (NEMAQA), National Dust Control Regulations, 2013 (Government Notice R827 of 1 November 2013) makes provision for dust fall standards, the control of dust and prevention of nuisance by dust in addition to measures for the control of dust. During the construction and operation of the ash disposal facility, dust must be prevented by taking the requisite control measures. Furthermore, section 35 of NEMAQA relates to the control of offensive odours to ensure that offensive odours are limited by any of the activities of Eskom in constructing and operation of the ash disposal facility.

An Atmospheric Emission License (AEL) (No. 17/4/AEL/MP312/11/09) was issued to Kriel Power Station by the Mpumalanga MEC on 6 June 2013, in terms of Section 47(1) of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA) in respect of Scheduled Process No. 29 (Power Generation) and Scheduled Process No. 59 (Bulk Storage and Handling of Ore or Coal). An amended AEL was issued on 10 September 2013. The AEL is valid until 20 May 2017 and replaces the APPA Registration Certificate. The AEL specifies permissible stack emission concentrations for Particulate Matter, Sulphur dioxide (SO_2) and oxides of Nitrogen (NO_X). It also specifies a number of compliance conditions as well as conditions for emission monitoring, management of abnormal releases and management of fugitive dust resulting from coal handling and storage.[5]

D. Occupational Health and Safety Act, No. 85 of 1993

In terms of Occupational Health and Safety Act, No. 85 of 1993 (OHSA) specifically GN R1179 (GG 16536 of 25 August 1995 – Hazardous Chemical Substances Regulations) the regulations contain provisions regarding the handling of hazardous substances primarily aimed at the occupational hygiene side thereof, including the assessment of potential exposure, medical surveillance, PPE, etc. Eskom use fuels, oils, solvents, etc. and these regulations need to be taken cognisance of in terms of the transport, storage, handling and disposal thereof.

E. National Environmental Management: Protected Areas Act, No 57 of 2003

The National Environmental Management: Protected Areas Act, No 57 of 2003 (NEM: PA) came into operation on 1 November 2004. The aim of the NEM: PA, as amended, is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity, natural landscapes and seascapes. In 2004, the

[5]Atmospheric Impact Report in support of Eskom's application for postponement of the minimum emission standards compliance timeframes for the Kriel Power Station. December 2013. UMoya-NILU Consulting (Pty) Ltd.

National Environmental Management: Protected Areas Amendment Act 31 of 2004 was promulgated to amend Act 57 of 2003 with regard to the application of that Act to national parks and marine protected areas. The proposed Kriel ash disposal facility will not be situated in or near any protected areas. However, NEMPA was considered during initial site considerations for the expansion of the ash disposal facility.

F. Hazardous Substances Act, No. 15 of 1973

In terms of the Hazardous Substances Act, No. 15 of 1973 Eskom must identify the various groups of hazardous substances which will be used in terms of the expansion of the ash disposal facilities. These substances should be classed in terms of SANS10228 to ensure that they are properly stored and that the Material Safety Data Sheets are in place in the event of a spill.

G. Explosives Act, No. 26 of 1956 and R1604 of September 1972

The Explosives Act, No. 26 of 1956 and R1604 of September 1972 will be applicable to the development in the event that blasting will take place during construction. The Act relates to the use, handling, transport, storage and disposal of explosives. It's not possible to conclude if blasting will take place at this stage because the EIA is done at feasibility level and therefore this act remains relevant until ascertained otherwise.

H. Spatial Planning and Land Use Management Act, No. 16 of 2013 (SPLUMA)

The land parcels on which the current and proposed expansion of the ash disposal facility is planned are currently zoned as agricultural. Eskom Real Estate is currently in a process to get the station to be correctly rezoned to either industrial or commercial or public services infrastructure. The rezoning category will depend on the decision from the Emalahleni Local Municipality planning department. Construction of the facility cannot occur until a) a rezoning application for the change in zoning/land use of the land is submitted to and approved by the Emalahleni Local Municipality in terms of SPLUMA, or b) a Consent Use is granted by the Emalahleni Local Municipality in terms of the Emalahleni Town Planning Scheme.

I. National Road Traffic Act, No. 93 of 1996 (as amended) (NRTA)

Certain vehicles and loads cannot be moved on public roads without exceeding the limitations in terms of the dimensions and/or mass as prescribed in the Regulations of the NRTA. Although abnormal loads are not anticipated, Mpumalanga Department of Public Works, Roads and Transport will be provided with an opportunity to comment on the proposed project.

J. Guidelines

This EIA process is informed by the series of national Environmental Guidelines[6] where applicable and relevant:

- Integrated Environmental Information Management, Information Series 2: Scoping (Department of Environmental Affairs and Tourism. (DEAT), 2002).
- Integrated Environmental Information Management, Information Series 3: Stakeholder Engagement. (DEAT, 2002).
- Integrated Environmental Information Management, Information Series 4: Specialist Studies. (DEAT, 2002).
- Integrated Environmental Management, Information Series 11: Criteria for determining Alternatives in EIA. (DEAT, 2004).
- Integrated Environmental Information Management, Information Series 12: Environmental Management Plans (DEAT, 2004).
- Integrated Environmental Information Management, Information Series 3: General Guide to the EIA Regulations. (DEAT 2006).

[6] Note that these Guidelines have not yet been subjected to the requisite public consultation process as required by Section 74 of R385 of NEMA.

- Integrated Environmental Information Management, Information Series 4: Public Participation in support of the EIA regulations (DEAT 2006).
- Integrated Environmental Information Management, Information Series 5: Assessment of Alternatives and Impacts (DEAT 2006).
- Integrated Environmental Management Guideline Series, Guideline 7: Detailed Guide to Implementation of the EIA Regulations. Unpublished (DEAT, 2007).
- Guideline on Need and Desirability, Integrated Environmental Management Guideline Series 9 (DEA, 2010).
- Public Participation 2010, Integrated Environmental Management Guideline Series 7 (DEA, 2010).
- Guidelines to minimise the impact on birds of Solar Facilities and Associated Infrastructure in South Africa (Smit, 2012).
- Guideline on Need and Desirability, EIA Guideline and Information Document Series (Department of Environmental Affairs and Development Planning (DEA&DP), 2013).
- Guideline on Alternatives, EIA Guideline and Information Document Series (DEA&DP 2013).

In particular, in 1998, DWAF (now DWS) published a Waste Management Series consisting of Minimum Requirements (DWAF, 1998) that represent the lowest acceptable standards for:

- The handling, classification and disposal of hazardous waste; and
- The monitoring of water quality at waste management facilities.

However the DEA's Waste Classification and Management Regulations (August 2013) is currently the official waste classification system, thus previous ash samples classified in terms of the DWS Minimum Requirements as was the applicable system at the time of the initial Ash Classification study (2011) is no longer relevant. The ash will be reclassified as part of the EIA in terms of NEMWA.

K. Relevant Policies

The following policies, although not directly applicable to the proposed project, were also considered:

- Policies regarding greenhouse gas and carbon emissions;
- White Paper on the Energy Policy of the Republic of South Africa (1998);
- National Integrated Resource Plan (IRP) (2010) and Update Report (2013); and
- The National Development Plan 2030 (2012).

2 EIA METHODOLOGY

The purpose of this Chapter is to provide the reader with an overview of the EIA methodology followed. It also describes the public participation process undertaken, as engagement with the public and stakeholders forms an integral component of the EIA process. Details of the commenting authorities are provided and applicable guidelines which have been consulted are listed. Reference is made to current assumptions and limitations with regards to the proposed expansion of the ash disposal facility.

2.1 Terms of reference and Scope of the EIA

In November 2009, Eskom appointed Aurecon to undertake an EIA process for the proposed construction of an ash disposal facility at the Kriel Power Station in Mpumalanga (DEA EIA Ref. No: 12/12/20/1837 and DEA WML Ref No. 12/9/11/L514/6).

In 2011 the EIA process was stopped after the Final Scoping phase to allow detailed geotechnical investigation to be undertaken at Site 10 to ensure that the proposed ash disposal infrastructure would be supported by the underlying backfilled excavations located at this site.

In 2016 the geotechnical investigations, which were undertaken by Jones & Wagener, were concluded and Eskom could proceed with the EIA process. Due to the time lapsed and numerous legislative changes since 2011, a decision was made to start the EIA process from anew, in terms of the 2014 EIA regulations. An Integrated Environmental Authorisation and a Waste Management Licence are being sought for the proposed project in terms of NEMA and NEMWA. Eskom is also in the process of applying for a Water Use Licence for the proposed project in terms of NWA (see proof of submission in Annexure B2).

2.2 Approach to the project

There are three distinct phases in the EIA process namely the Scoping, EIA and decision making phases. The EIA process is diagrammatically represented Figure 2-1. This report covers the EIA Phase of the EIA process, which has culminated in this document, the EIR.

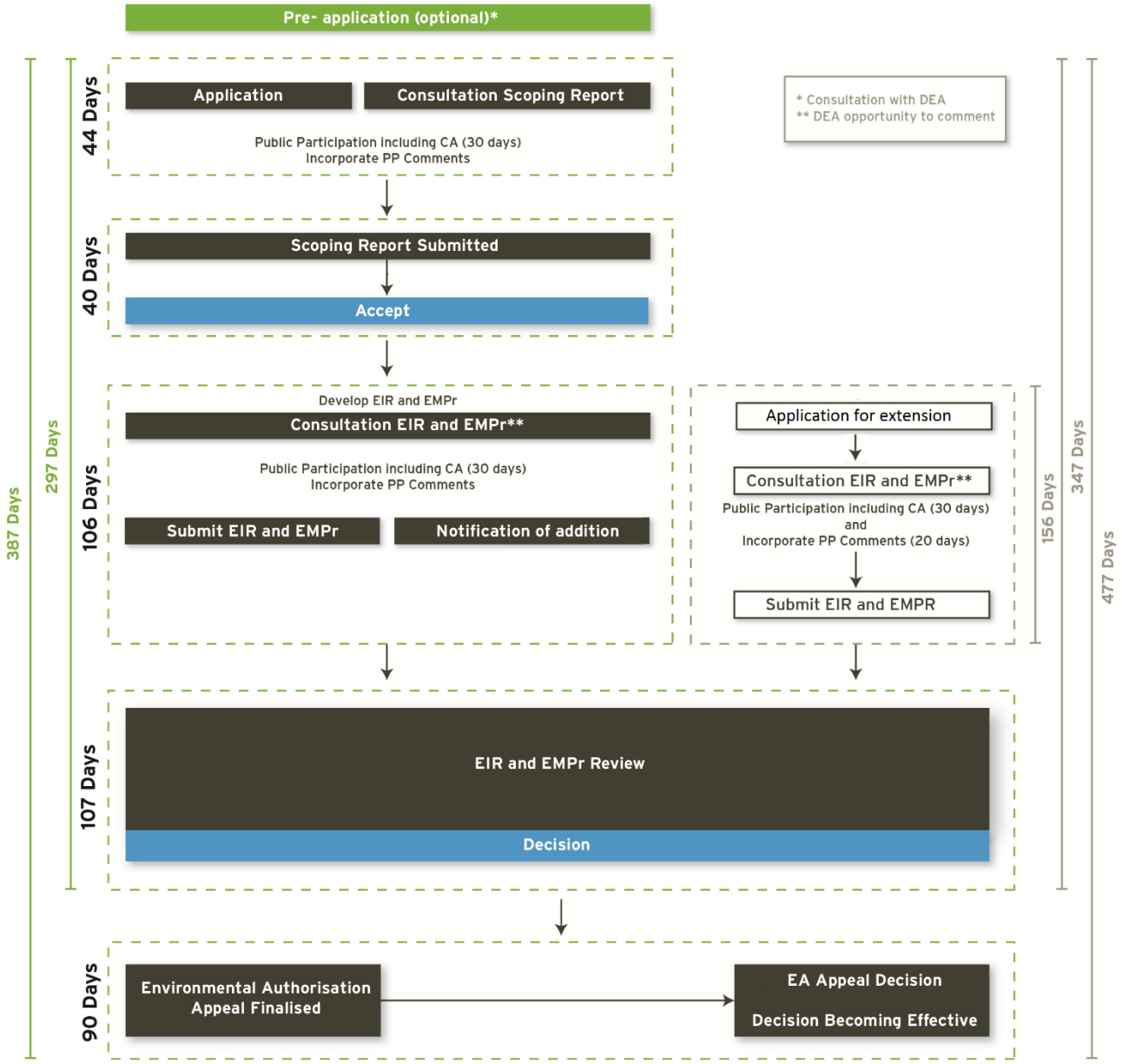


Figure 2-1| The EIA process in terms of the NEMA 2014 EIA Regulations

2.2.1 The Scoping Phase

Scoping in the EIA process is the procedure used for determining the feasible alternatives, extent of, and approach to, the EIA Phase and involves the following key tasks:

- Further identification and involvement of relevant authorities and I&APs in order to elicit their interest in the project;
- Identification and selection of feasible alternatives to be taken through to the EIA phase;
- Identification of significant issues/ impacts associated with each alternative to be examined in the EIR, and mitigation measures that can be applied; and

- Determination of specific Terms of Reference (ToR) for any additional specialist studies required in the EIR Phase (i.e. the Plan of Study for the EIR).

Various methods and sources were utilised to identify the potential social and environmental aspects associated with the proposed project and to develop the ToR for the specialist studies. The sources of information for the preparation of this report include, amongst others, the following:

- Collection of information regarding the project, as provided by Eskom:
  - Project description;
  - Methodology for construction of the various project components;
  - Methodology during operations;
  - Expected time table for project development;
  - Maps and figures, outlining the proposed facilities; and
  - Technical information relating to design.
- Other relevant EIRs;
- Environmental baseline surveys for this site and surrounding areas;
- Consultation with the project team; and
- Consultation with I&APs, including authorities.

The applicant had 44 days to submit Scoping Report (SR) after receipt of application. During the Scoping Phase, the SR was subjected to a 30-day PPP from 26 October 2016 to 28 November 2016 (the PPP process was, however, kept open because certain key stakeholders? did not comment within the allocated timeframe). On completion of the public comment period, the SR was updated and finalised, taking cognisance of the comments received and issues raised by I&APs.

The DEA commented on the consultation SR on 19 December 2016.

A request for extension of the legislated EIA phase timeframes was approved by DEA on 9 January 2017 (Aurecon requested extension to public participation timeframes in terms of Regulation 3(7) of GN R 982 to incorporate comments from the Department's Integrated Environmental Authorisation Directorate into the final version of the Scoping Report for submission, on 9 January 2017).

The SR was completed and submitted to the Department for consideration, on 9 January 2017, and was accepted on 27 February 2017.

2.2.2 The EIR Phase

The Scoping Phase is followed by the EIR Phase, which has been informed by the specialist investigations. In terms of the EIA regulations, the applicant has 106 days to submit the EIR after acceptance of this SR (this is inclusive of a public participation period of at least 30 days). This phase will culminate in a comprehensive EIR that documents the outcome of the impact assessments.

The purpose of the EIR would be to present an assessment of the relative significance of the potential environmental impacts for the proposed ash facility alternatives. The EIR, thus, includes the following:

- A description of potential environmental impacts and reasonable alternatives identified during the scoping investigation;
- Key findings of the various specialist studies as they pertain to the affected environment;
- An overview of the public participation process conducted during the compilation of the EIR;
- A detailed assessment of the significance of the potential environmental impacts for the various project alternatives; and
  - This assessment, which uses the methodology outlined in **Section 2.3**, would be informed by the findings of the specialist studies.

- The full range of mitigation measures including an indication of how these influence the significance of any potential environmental impacts, together with a Construction and Operational EMPr.
  - The mitigation measures were informed by the specialist studies, professional experience and comment received from I&APs.

2.2.3 The Public Participation Process (PPP)

The PPP is undertaken to ensure participatory consultation with members of the public in a manner that provides them with adequate opportunity to comment on the proposed project. Consultation with the public and all stakeholders formed an integral component of this investigation and enabled I&APs (e.g. directly affected landowners, authorities, environmental groups, civic associations and communities), to identify their issues and concerns, relating to the proposed activities, which they felt should be addressed in the EIA process. Comments on the scoping report, EIR and decision by DEA will be solicited from the public. The objectives of public participation are to provide information to the public, identify key issues and concerns at an early stage, respond to the issues and concerns raised, provide a review opportunity, and to document the process properly.

The public participation process, during the EIA Phase, includes the following:

A. **Public comment on the EIR**

~~Following the completion of~~ The EIR document was lodged at the Kriel Public Library, the Thubelihle Community Health Centre and the security centre at Kriel Power Station, as well as on the Eskom and Aurecon websites, as was done for the Scoping Report:

- **Eskom:**http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx
- **Aurecon:** http://www.aurecongroup.com/en/public-participation.aspx

Registered I&APs were notified of the lodging by means of letters (mailed and/or emailed), and given 30 days in which to comment on the report. Advertisements were placed in Die Beeld (Afrikaans) and The Ridge (English) to notify potential I&APs of the opportunity to comment on the EIR. If the need arose or if requested[7], a public meeting were to be held during the comment period in Kriel and Thubelihle during which the Environmental Consultant would present the findings of the EIR and provide I&APs with the opportunity to engage with the EIA team directly. ~~If the public meeting is required, registered I&APs have been requested to RSVP for such a public meeting on 26 July 2017 by 14 July 2017to Aurecon. This request was included in the notification letters used to inform I&APs of the lodging of the EIR for public comment.~~ No request for a public meeting was received.

All written correspondence will be in English. ~~Should public meetings be requested, it will be presented in English, but translations to other dominant local language will also be available.~~

All written comments received were consolidated into Annexure E3 of the EIR. This took the form of a Comments and Response Report (CRR), in which raised issues and concerns were included and responded to by the Project Team. The report was also be revised in light of feedback from the public, where necessary. This revised EIR/ document has been submitted to DEA for their decision making process.

B. **Opportunity for appeal**

All registered I&APs will be notified in writing of the receipt of the authorities' decision and will be provided with an opportunity to appeal the DEA's decision in terms of the NEMA National Appeal Regulations GN R.993 of 8 December 2014 (as amended). Any person affected by a decision who wishes to appeal (including the applicant) must lodge a Notice of Intention to Appeal with the Minister by the date as specified by the relevant notice. The relevant appeal process forms can be obtained from www.environment.gov.za/documents/forms. Lodging may occur by any of the following methods:

[7] Public meetings were held at Kriel and Thubelihle during the scoping phase. Based on the lack of attendance it is not deemed pivotal that public meetings be held during the EIA phase unless the need arises or if requested by I&APs.

- By post: Private Bag X447, Pretoria, 0001;
- By Hand: Environment House, 473 Steve Biko Road, Pretoria, 0083;

Please note that all appeals must be submitted in writing to Mr. Z. Hassam, Director: Appeals and Legal Review of the Department of Environmental Affairs at the above mentioned addresses. Mr. Hassam can also be contacted at:

- Tel: 012 399 9356 / 9355; or
- Email: AppealsDirectorate@environment.gov.za.

On submission of an appeal, an Appellant must serve on the applicant (Eskom SOC Ltd) a copy of the Notice of Intention to Appeal, and indicate where and for what period the appeal submission will be made available for inspection by the applicant. If the applicant wishes to lodge an appeal, it must also serve a copy of the intention to appeal on all registered I&APs as well as a notice indicating where, and for what period, the appeal submission will be available for inspection.

In the instance where and appeal is lodged, the activity may not be commenced with until such time that the appeal is finalised.

C. **Stages at which the competent authority were consulted**

The NEMA 2014 EIA diagram, Figure 1-4 (on page 19) indicates the stages at which the DEA were consulted or provided opportunity to comment on the EIA reports. To date, the following consultation engagements with the Department have taken place:

- Pre-application meeting (21 September 2016, in Pretoria at DEAs Arcadia offices);
- 30-day scoping phase public participation period (comment received from DEA on 19 December 2016); and
- 30-day EIA phase public participation period (current process).

Furthermore, the DEA will be consulted if *ad hoc* scenarios arise which require their input.

2.3 Method of assessing the significance of potential environmental impacts

This section outlines the proposed method for assessing the significance of the potential environmental impacts outlined above. As indicated, these include both operational and construction phase impacts.

For each impact, the **EXTENT** (spatial scale), **MAGNITUDE** and **DURATION** (time scale) is described. These criteria were used to ascertain the **SIGNIFICANCE** of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the EIR represents the full range of plausible and pragmatic measures but does not necessarily imply that they will be implemented.

The tables on the following pages show the scale used to assess these variables, and defines each of the rating categories.

Table 2-1 | Assessment criteria for the evaluation of impacts

Criteria	Category	Description
Spatial influence of impact	**Regional**	Beyond a 10 km radius of the candidate site.
	Local	Between 100m and 10 km radius of the candidate site.
	Site specific	On site or within 100 m of the candidate site.
Magnitude of impact (at the indicated spatial scale)	**High**	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact (temporal)	**Construction period**	From commencement up to 2 years after construction
	Short Term	From 2 to 5 years after construction
	Medium Term	From 5 to 15 years after construction
	Long Term	More than 15 years after construction

The **SIGNIFICANCE** of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in Table 2-2.

Table 2-2 | Definition of significance ratings

Significance ratings	Level of criteria required
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and construction or short term duration
Neutral	• Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the **PROBABILITY** of this impact occurring as well as the **CONFIDENCE** in the assessment of the impact, was determined using the rating systems outlined in Table 2-3 and Table 2-4, respectively. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring. Lastly, the **REVERSIBILITY** of the impact is estimated using the rating system outlined in Table 2-5.

Table 2-3 | Definition of probability ratings

Probability ratings	Criteria
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 2-4 | Definition of confidence ratings

Confidence ratings	Criteria
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 2-5 | Definition of reversibility ratings

Reversibility ratings	Criteria
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

2.4 Assumptions and limitations

2.4.1 Assumptions

In undertaking this investigation and compiling the EIR Report, the following has been assumed:

- The strategic level investigations undertaken by Eskom prior to the commencement of the EIA process are technologically acceptable and robust.
- The information provided by the applicant and specialists is accurate.
- The scope of this investigation is limited to assessing the environmental impacts associated with the proposed expansion of the ash disposal facility, and associated infrastructure, at the Kriel Power Station.
  - The EIA does not assess disposal of any other waste streams (except that of the ash created by the burning of coal and water used to transport the ash) or materials generated at the Kriel Power Station.
  - The EIA does not assess the merit of coal fired electricity or associated impacts.
  - The EIA does not assess the possibility of decommissioning the Kriel Power Station.
- The IWULA is not part of this EIA process, as Eskom's Environmental Department: Water is currently applying for the license in a separate process.
- No ash dams will be constructed over backfilled areas, but associated infrastructure that does not pose potential subsidence risk may be constructed over these areas.

2.4.2 Gaps in knowledge

The planning for the proposed Ash disposal facility and its associated infrastructure is at a feasibility level and therefore some of the specific details are not available at this stage of the EIA process. This EIA process forms a part of the suite

of feasibility studies, and as these studies progressed, more information has become available to inform the EIA process. This required the various authorities, and especially DEA, to issue their comments and ultimately their environmental decision to allow for the type of refinements that typically occur during these feasibility studies and detailed design phase of projects. Undertaking the EIA process in parallel with the feasibility study does however have a number of benefits, such as integrating environmental aspects into the layout and design and therefore ultimately encouraging a more environmentally sensitive and sustainable project.

2.5 Independence and Personnel

As with the Scoping phase, Aurecon's Andries van der Merwe provides strategic guidance to the EIA process and Franci Gresse undertakes the management of the EIA process and, together with Dirk Pretorius, the requisite reporting. A short summary of these consultants is given below. CVs are available upon request.

The requirement for independence of the environmental consultant is aimed at reducing the potential for bias in the environmental process. Neither Aurecon nor any of its sub-consultants are subsidiaries of Eskom. Furthermore, all these parties do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed project.

Mr **Andries van der Merwe**, the Project Director, is appropriately qualified and registered with the relevant professional bodies. Mr van der Merwe is a professionally registered Environmental Engineer registered with the Engineering Council of South Africa (Pr. Eng.) and holds a B. Eng. (Civil) degree. Mr van der Merwe has over 14 years' experience in the field of impact assessment.

Miss **Franci Gresse**, the Project Leader, is a Senior Environmental Practitioner at Aurecon's Cape Town office with more than eight years' experience in the field. Miss Gresse has a Bachelor of Science (Honours) degree in Conservation Ecology and has been involved in a number of energy related projects in the Western and Northern Cape provinces, as well as Namibia.

Mr **Dirk Pretorius**, one of the project staff, is a Senior Environmental Practitioner at Aurecon's Cape Town office with more than six years' experience in the field. Mr Pretorius is registered as a Professional Natural Scientist at the Natural Scientific Professions Act, 2003 (Act 27 of 2003) and has a Bachelor of Science (Honours) degree in Conservation Ecology. He has been involved in a number of energy related projects in the Western, Eastern and Northern Cape provinces of South Africa as well as East Africa.

3 THE PUBLIC PARTICIPATION PROCESS (PPP)

The purpose of this Chapter is to provide an outline of the Public Participation Process, a summary of the process undertaken to date, and the way forward with respect to public participation throughout the EIA process for this project. This Chapter also provides a summary of the key issues that have been raised to date.

3.1 Introduction

In terms of Section 41 of the EIA Regulations (2014) a call for open consultation with all I&APs at defined stages of the EIA process are required. This entails participatory consultation with members of the public and authorities (including DEA, DWS and the Department of Economic Development, Environment and Tourism) by providing an opportunity to comment on the proposed project. Consultation with the public forms an integral component of this investigation and enables I&APs (e.g. directly affected landowners, national-, provincial- and local authorities, environmental groups, civic associations, and communities), to identify their issues and raise their concerns, relating to the proposed project and its activities, which they feel should be addressed in the EIA process. The PPP, as shown in Table 3-1, has thus been structured to provide I&APs with an opportunity to gain more knowledge about the proposed project, to provide input through the review of documents/reports, and to voice any issues of concern at various stages throughout the EIA process.

The EIA for the proposed development which was initiated in 2009 and stopped in 2011 undertook a rigorous public participation process and therefore many of the potential issues have been identified and subsequently addressed where still applicable[8]. However, due to the initiation of a new EIA process a new public participation process has also been initiated.

The objectives of public participation are to:

- Provide project information to the public;
- identify key issues and concerns at an early stage, and continuously;
- respond to the issues and concerns raised;
- to document the EIA process properly; and
- provide a review opportunity for the process and EIA documentation developed.

The PPP is being managed to meet these objectives throughout the EIA process. Advertising (undertaken at the start of the EIA process) focused on the local and regional area to invite members of the public to register as I&APs. Advertising is also being undertaken during the EIA phase to make sure the broader community i.e. at local and regional scale, is aware of the proposed expansion of the facility. The remainder of the communications will focus on registered I&APs. The PPP undertaken for this EIA process is summarised in Table 3-1.

[8] Note that many of the previous issues such as building ash dams over backfilled areas and consequent issues are no longer applicable due to design changes as explained in Section 4.2 of this report.

Table 3-1 | Summary of the proposed EIA PPP [9]

Task	Details	Date
Initial I&AP notification (relevant authorities and I&APs)		
I&AP identification	An I&AP database was initially developed during 2009-2011 with consideration of the contemporary EIA regulations (NEMA, 2006). During the inception of the EIA process in 2016 the previous I&AP database was updated for the project by establishing the jurisdiction of organisations, individuals and businesses in proximity to the project site or within an interest of the proposed development. The database of I&APs includes the landowner, the adjacent landowners, relevant district and local municipal officials, relevant national and provincial government officials, and organisations. This database was augmented *via* chain referral during the EIA process and continually updated as new I&APs were identified throughout the EIA process. The current list of I&APs is attached in **Annexure E1**.	2009 to 2011 and August 2016
Site notices	Site notices with a size of 600 mm x 420 mm were placed to inform the general public of the proposed projects and the public participation process. Site notices were erected at the access roads to Kriel Power Station and Kriel town (i.e. the R545 to Bethal), as well as the: • Canteen, reception, workshop and employee entrance at Kriel Power Station; • Reception and employee entrance at Matla Power Station; • Local municipal offices; • Mica (local hardware store); and • Kriel Colliery and the Exxaro offices at Matla.	26 October 2016
Notification of and comment on Scoping Report		
Notify I&APs and authorities of availability of Scoping Report	All registered I&APs were informed of the availability of the SR by means of post and/or email. Relevant government departments as listed in **Annexure E1** were notified of the report and requested to submit comments. I&APs had 30 days within which to submit comments or raise any issues or concerns they may have had with regard to the proposed project or EIA process. The public commenting period was from 26 October 2016 to 28 November 2016. Copies of the SR were made available for review at the following locations: • Kriel Public Library • Kriel Power Station Furthermore, a digital version of the SR was uploaded onto the Aurecon and Eskom websites for perusal and download: • Aurecon: http://www.aurecongroup.com/en/public-participation.aspx • Eskom: http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx	26 October to 28 November 2016
Addressing comments received	All comments received on the SR were collated into the Comments and Responses (CRR). The responses to these comments from the applicant and the EAP were provided in the CRR and were included as **Annexure 3** to the Scoping Report that was submitted to for DEA decision making. The Scoping Report was also updated to respond to submissions in the CRR.	29 November 2016

[9] Proof of public participation is saved as attached as Annexure E2

<table>
<tr><th>Task</th><th>Details</th><th>Date</th></tr>
<tr><td>Advertisements</td><td>An advertisement was placed in the Die Beeld (Regional) and The Echo (Local) during the comment period to notify I&APs of the availability of the SR, as well as scheduled public meetings.</td><td></td></tr>
<tr><td>Public Meeting</td><td>All registered I&APs were invited to attend the scheduled public open house meetings at the following venues:
<table>
<tr><th><u>Venue</u></th><th><u>Date</u></th><th><u>Time</u></th><th><u>Address</u></th></tr>
<tr><td>Methodist Church Hall, Kriel</td><td>9 November 2016</td><td>18:00 – 20:00</td><td>Springbok Crescent, Kriel, 2271 and Methodist Church Hall, Kriel</td></tr>
<tr><td>Thubelihle Hall</td><td>9 November 2016</td><td>14:00 – 17:00</td><td>Thubelihle Hall</td></tr>
</table></td><td>9 November 2016</td></tr>
<tr><td colspan="3">Notification of and comment on EIA Report</td></tr>
<tr><td>Notify I&APs and authorities of availability of EIR</td><td>All I&APs <u>were</u> informed of the availability of the EIR by means of post and/or email. Relevant government departments as listed in Annexure E <u>were</u> notified of the report and requested to submit comments. I&APs <u>were</u> provided 30 days within which to submit comments or raise any issues or concerns they may have had with regard to the proposed project or EIA process. ~~The public commenting period will be from 4 July to 2 August 2017.~~

<u>Copies of the EIR were made available for review at the following locations:</u>
• Kriel Public Library
• Kriel Power Station
• Thubelihle Community Health Centre

Furthermore, a digital version of the EIR <u>was</u> uploaded onto the Aurecon and Eskom websites for perusal and download at the following location:
• Aurecon: <u>http://www.aurecongroup.com/en/public-participation.aspx</u>
• Eskom: <u>http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx</u></td><td>July 2017</td></tr>
<tr><td>Public Meeting</td><td>~~Due to non-attendance of the public meetings during the Scoping Phase and lack of submissions against the project to date, registered I&APs are requested to indicate by 14 July 2017 if they require a public meeting.~~ Based on the responses, <u>no</u> open house meetings <u>were held</u>. ~~scheduled for xxx July 2017 at the following locations:~~
<table>
<tr><th>~~Venue~~</th><th>~~Date~~</th><th>~~Time~~</th><th>~~Address~~</th></tr>
<tr><td>~~Methodist Church Hall, Kriel~~</td><td>~~26 July 2017~~</td><td>~~18:00 – 20:00~~</td><td>~~Springbok Crescent, Kriel, 2271 and Methodist Church Hall, Kriel~~</td></tr>
<tr><td>~~Thubelihle Hall~~</td><td>~~26 July 2017~~</td><td>~~14:00 – 17:00~~</td><td>~~Thubelihle Hall~~</td></tr>
</table></td><td>July 2017</td></tr>
</table>

Task	Details	Date
Addressing comments received	All comments received on the EIR were collated into the CRR. The responses to these comments from the applicant and the EAP were provided in the CRR and included as an Annexure to the EIR Report with copies of the original comments received. The Environmental Impact Report was updated to respond to submissions in the CRR, where applicable.	August 2017
Notification of and opportunity to appeal decision on EIA by DEA		
Notify I&APs and authorities of outcome of the EIA	All I&APs will be informed of the outcome of the EIA process and their right to appeal the outcome or aspects of the outcome by means of post and/or email. Furthermore, a digital version of the decision will be uploaded onto the Aurecon and Eskom websites at the following location: • Aurecon: http://www.aurecongroup.com/en/public-participation.aspx • Eskom: http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx	November 2017

3.2 Comments received to date

The public comment period for the scoping report was open from 26 October 2016 to 28 November 2016. A total of five (5) comments were received which related to:

- Confirmation of attending the public meetings;
- Potential job opportunities;
- Land use;
- Rehabilitation;
- Alternatives;
- Extent of potential impacts;
- Mapping of sensitive areas;
- Request for an ecological and wetland impact assessment report; and
- The EIA process requirements.

The public comment period for the EIR was open from 4 July 2017 to 2 August 2017. A total of two (2) comments were received which related to:

- Use of truck in emergency situations to transport ash;
- Impact of dust on stock;
- Air pollution in general area from different activities; and
- Closure of Kriel Power Station.

A CRR is attached as **Annexure E.3** of this report for ease of reference.

3.3 Ensuing review and decision period

I&APs were afforded a 30-day public comment period on the EIR from 4 July to 2 August 2017. I&APs were notified of the availability of the report and requested to indicate their need for public meetings. The EIR was lodged at the Kriel Public Library, Kriel Power Station, Thubelihle Community Health Centre and on the:

- Aurecon website:
  http://www.aurecongroup.com/en/public-participation.aspx; and
- Eskom website:
  http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx) and potential.

Cognisance was taken of all comments in compiling the EIR for decision making, and the comments, together with the EAP and Applicant's responses thereto, were included in the EIR. Where appropriate, the report was updated accordingly. Once the EIR has been submitted to DEA they will have a 107 days to make a decision on the information and comments provided to them. The outcome of the DEAs decision will be sent to all registered I&APs.

3.4 Proposed PPP programme

A summary of the proposed programme is given in the table below.

Table 3-2 | Proposed EIA programme

Activity	Proposed date	Deliverable
1st round of public engagement:		
• Letter to I&APs & adverts	26/10/2016	Informed I&APs
• Lodge SR in public venues and with Authorities	26/10/2016	SR in libraries, websites etc.
• Open day and public meeting	09/11/2016	Public engagement
• Public comment period ends	28/11/2016	Updated CRR
Submit SR (incl. Plan of Study for EIA) to environmental authority	09/01/2017	Approved SR & Plan of Study EIA
Specialist studies	15/06/2017	Specialist reports
2nd round of public engagement:		
• Letter to I&APs & adverts	29/06/2017 03/07/2017	Informed I&APs
• Lodge EIR in public venues	3/072017	EIR in libraries, Thubelilhle Community Health Centre, website etc.
• Public comment period ends	2/08/2017	Updated CRR
Submit EIR to DEA	7/08/2017	Decision from DEA
3rdround of public engagement:		
• Letter to I&APs to notify them on DEA decision	11/2017	Authorities' decision.

4 THE NEED FOR THE PROPOSED DEVELOPMENT

This chapter considers the need for the proposed project, outlines the conceptual design which the EIA Phase focuses on and how the design has considered the facilities water balance.

4.1 Status of the existing ash disposal facility

The current operational Kriel Power Station ash disposal facility consists of three ash dams of different sizes (**Table 4-1**). All three ash dams are located adjacent to each other with Ash Dam 1 on the western border, Ash Dam 2 in the middle and Ash Dam 3 located at the eastern end of the ash dam complex (Figure 4-1).

Table 4-1 | Capacity details of the three existing ash dams

Dam	Footprint (ha)	Upper Surface Area (ha)	Maximum Height (m) (J&W, 2016)	Maximum Elevation (above MAMSL) (J&W, 2016)
1	44.4	16.38	90	1675
2	129.77	70.73	90	1675
3	73.7	50.78	72	1651

Figure 4-1| Location of the Kriel Power Station and current ash dam complex

The ash dams are constructed through the "day wall" method. This method makes use of fly ash to construct a wall during the day that is used to impound coarse ash and a mixture of coarse ash and fly ash during the night. Each dam is equipped with gravity penstocks to remove supernatant[10] water. Decant and drain water is diverted to three return water dams from where it is pumped to the power station for re-use. Seepage and surface water runoff is also collected *via* stormwater canals at the perimeter of the ash dams which feeds into the return water dams. This water is then re-used by the power station to transport ash to the ash dams, thereby limiting their need for "raw" water uptake.

Based on the design ash load the three existing ash dams will reach a limiting Rate of Rise (RoR) by end July 2021 (see Figure 2 1). Eskom is thus proposing to expand its existing ash disposal facility by constructing and commission an additional ash disposal facility before the existing ash dams reach their limiting RoR in 2021 . The expanded new ash dams disposal facility (see Figure 4 10) would fulfil the ash disposal requirements for the Power Station's extended operational life, with decommissioning of the six generating units planned to commence in 2039. A five year contingency has been allowed for, thus it's assumed that the Power Station will be operated for an additional five years at full load from 2039 to 2045 , with final decommissioning date proposed for 2045During this period approximately 71.5Mtons of ash will be produced (see Table 4-2).

Table 4-2 | Ash production volumes of the Kriel Power Station

Description	Amount	Unit
Maximum Power Station Ash Production	3 700 000	tonnes/year
No. of Units	6	Unit
Maximum Unit Ash Production	616 667	tonnes/year/unit
Fly Ash (80%)	2 960 000	tonnes/year
Boiler Bottom Ash (BBA) (20%)	740 000	tonnes/year
Fly Ash Sold	329 000	tonnes/year
BBA Sold (uncertain)	0	tonnes/year

4.1.1 Need and desirability

The consideration of "need and desirability" in EIA decision-making requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest. The government decision-makers, together with the environmental assessment practitioners and planners, are therefore accountable to the public and must serve their social, economic and ecological needs equitably. This requires a long-term approach to decision-making in order to ensure that limits are not exceeded and that the proposed actions of individuals are measured against the long-term public interest. Sustainable development therefore calls for the simultaneous achievement of the Triple Bottom-Line.

A. **Need (timing) for proposed expansion**

One of the strategic objectives highlighted by the Emalahleni Draft Integrated Development Plan (2015/16) (IDP) is to ensure efficient infrastructure and energy supply that will contribute to the improvement of quality of life for all citizens within Emalahleni. More specifically the Emalahleni IDP (2015) indicates the history of the Kriel, which was established by Eskom in 1973 as a residential area for the workers at the Kriel Power Station, which was constructed between 1975 and 1979. The town experienced rapid growth during 1982 to 1989 and was declared as a municipality

[10] Definition: Clear water that lies above a sediment or precipitate.

in 1990. Accordingly most of the residents in Kriel and Thubelihle are employed at the power stations and the mines in the area underpinning the importance to sustain economic viability of these towns.

Furthermore, the Emalahleni Spatial Development Framework (SDF) of 2015 recognises that the southern parts of the Emalahleni Municipality form part of the region referred to as the Energy Mecca of South Africa, due to its rich deposits of coal reserves and power stations. It also identifies the rich coal deposits, coal mines and power stations throughout the southern extents of the municipal area as the most dominant structuring elements having a major influence on settlement development and expansion trends.

Based on the above, the importance of the Kriel Power Station in the socio-economic environment of the area is evident, which in turn highlights the strategic importance of the proposed expansion of the ash disposal facility to keep the power station operational for at least another 28 years to contribute to the national energy supply and job security in the region.

For more information on the need for the proposed expansion, please refer to **Annexure C1** which contains a table with responses to the specific questions raised by DEA's need and desirability guideline (GN 891 of 2014).

B. **Desirability (location) of the proposed expansion**

Given the need to develop additional disposal facilities for Kriel Power Station, Eskom initiated an EIA process for the development of a new ash disposal facility that would have sufficient capacity for the remaining operational life of the power station, until 2045. During the site selection process, potential candidate areas within the study area were identified by considering a range of technical, financial and environmental criteria. These included inter alia locality of coal resources and undermined areas, existing infrastructure, groundwater/ hydrological features, geotechnical considerations and sensitive biodiversity features. It was determined that the proposed expansion at Site 10, located directly adjacent to the existing ash dam facility would be preferred since it is:

- located relatively close to the Kriel Power Station and therefore requires lower capital costs than an alternative further away;
- a brownfields site with limited future land use (due to the nature of the adjacent activities);
- reduction of environmental footprint due to the proposed development;
- located on Eskom-owned land;
- not located on a Critical Biodiversity Area (CBA), Ecological Support Area (ESA), National Protected Areas Expansion Strategy (NPAES) or any other priority environmental area;
- unlikely to have a notable change on the sense of place of the area; and
- not opposing any planning in the Emalahleni SDF and IDP.

Due to the proposed site being situated adjacent the existing ash disposal facility and the transformed nature of the proposed development area alternatives that could have a greater negative effect on the environment, land development practices and processes do not have to be developed. Furthermore, potential health and safety impacts are known and managed for the existing ash disposal facility and could easily incorporate the proposed expanded ash disposal facility. Also, additional potential health and safety mitigation measures identified by the EIA specialists have been included in the construction and operational EMP, which is available as **Annexure G1** to this EIA report. The EMPr describes all reasonable and feasible mitigation measures and addresses long-term environmental impacts. For more detail on the preferred site and layout, please refer to Section 4.3 of this EIA report, as well as Chapter 7 which describes potential impacts and mitigation measures.

4.2 Description of the proposed project

The Kriel Power Station proposes to expand the existing ash disposal facility to include a fourth ash disposal facility, consisting of two ash dams (namely AD4.1 and AD4.2). The ash disposal facility is a final disposal mechanism at the end of the energy generation process as illustrated in **Figure 4-2**.

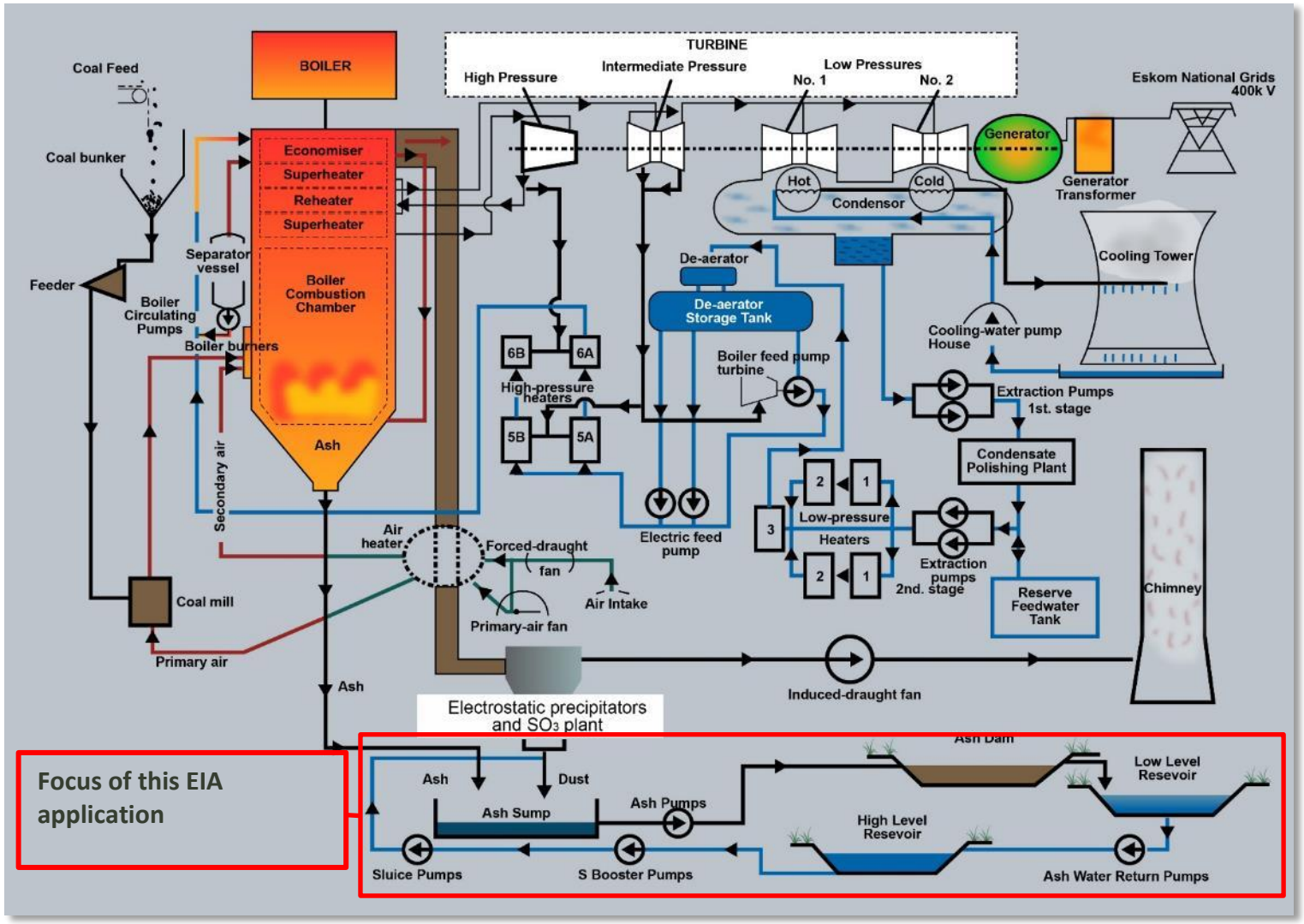


Figure 4-2| Flow chart of the operation showing inputs and outputs of the process at Kriel Power Station (including the ash disposal facility indicated in the red box)

As mentioned earlier, a range of project alternatives associated with the proposed activities were assessed during the Scoping Phase in terms of location, layout and activities. **Table 4-3** below indicates the preferred alternatives that are being investigated in detail in this EIA report:

Table 4-3 | Preferred alternatives and main reasons for their preference

Preferred alternative	Reason for preferred alternative
▪ **Location alternative** – Site 10 for the proposed ash disposal facility and associated conveyor system alignments.	Various site locations were considered within a 12km radius of the Kriel Power Station for the proposed extended ash disposal facility as described in Chapter 2 of this report. One site, i.e. Site 10, was identified as being the most suitable for the proposed extended Ash disposal facility for the following reasons: ▪ located **close** to the Kriel Power Station and therefore requires less capital **costs**; ▪ located on a brown field site **within the disturbance footprint** of the existing ash disposal facility; ▪ **limited environmental and visual footprint** due to its proximity to the existing Ash disposal facility; and ▪ located on **Eskom-owned land**.
▪ **Site layout alternative** – Ash dam 4 layout, consisting of only AD 4.1 and 4.2 (Figure 4-3).	Three potential layout alternatives have been considered for the preferred site: ▪ 2014 ash dam layout, consisting of one large and one small ash dam; ▪ 2016 ash dam layout, consisting of three ash dams; and ▪ 2016 ash dam layout, consisting of only AD 4.1 and 4.2 (Figure 4-3). The main aspect that influenced the design layouts relate to potential geotechnical issues due to subsidence. It was, however, determined that the proposed extended AD 4.1 and 4.2 do **not** hold any **potential geotechnical issues** since the backfilled mined area (located beneath AD 4.3) is avoided, resulting in the remaining two layout alternatives to be screened out as feasible options.
▪ **Activity alternative** – Wet ashing.	Two methods for ash disposal were considered: ▪ Wet ashing; and ▪ Dry ash stacking. Wet ashing is considered to be **financially the best** practical option in comparison to dry ash stacking which would require a change in the station's current **design**, and would entail considerable **costs** to change the existing wet ashing infrastructure and systems at Kriel Power Station. Secondly, even though dry ash stacking would require less water than the wet ashing option, the water that is used for the current (and proposed) wet ashing operations is recycled wastewater from the power station's cooling system (see Figure 4-2). Lastly, the footprint requirements for a dry ash dump is larger than for a wet ash dam and would thus increase the disturbance footprint of the Kriel Power Station.
▪ **No-go alternative**	NEMA requirement against which all alternatives should be measured.

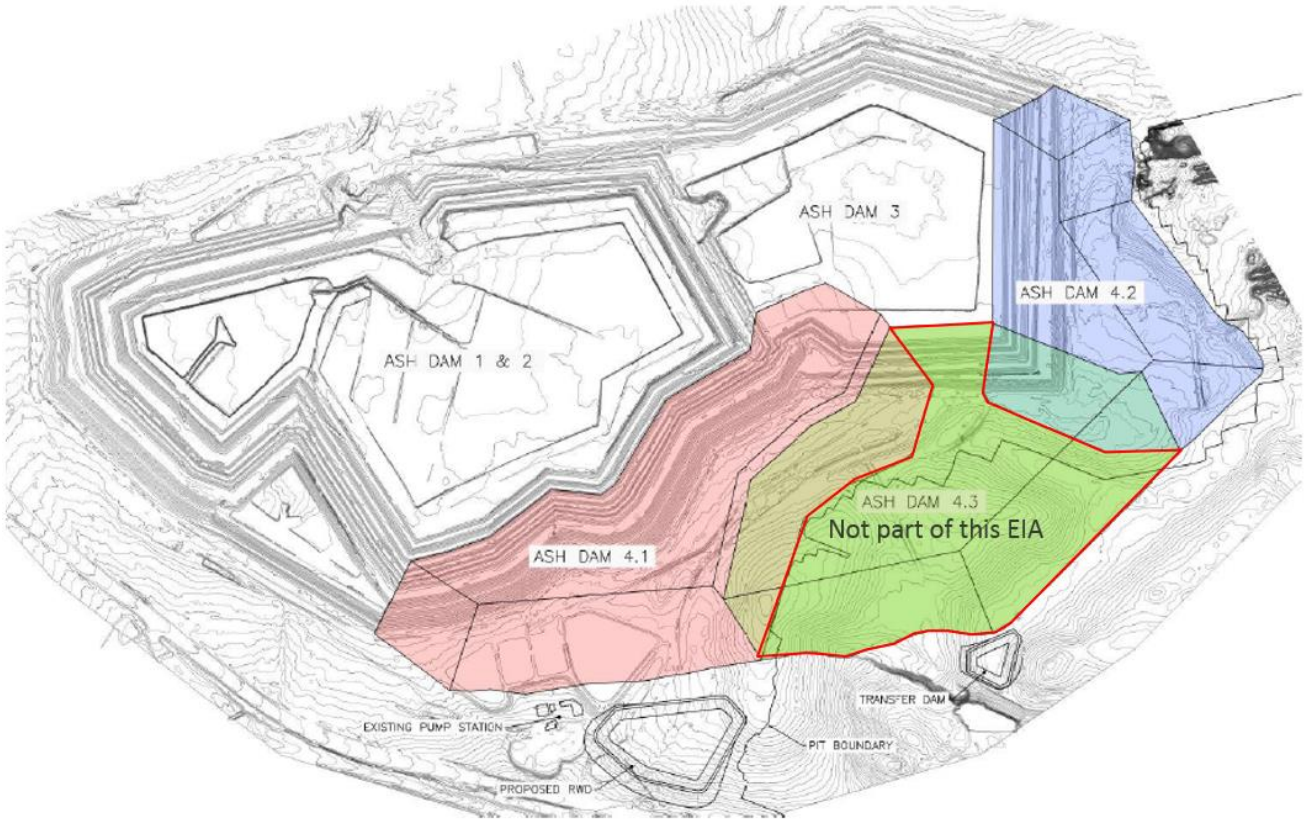


Figure 4-3| Ash Dam 4 Concept (Source: JW044/16/E821)

4.2.1 Conceptual Design

This section has been adopted from the conceptual design report from Jones and Wagener (April, 2016) report No. JW044/16/E821. The conceptual design has been developed to allow for a five year contingency plan for the Kriel Power Station. Note that it has been assumed that the Kriel Power Station will be operated for an additional five years at full load from 2036 to 2040, thereby pushing the decommissioning dates out from 2041 to 2045. The planned ash production reduces from the year 2036 due to the decommissioning of generating units as mentioned above. However, the design also takes into consideration ash production with all units operational to allow for an additional five years from the year 2036 to account for a five year contingency. An average ash dry density of 1 t/m^3 was assumed[11].

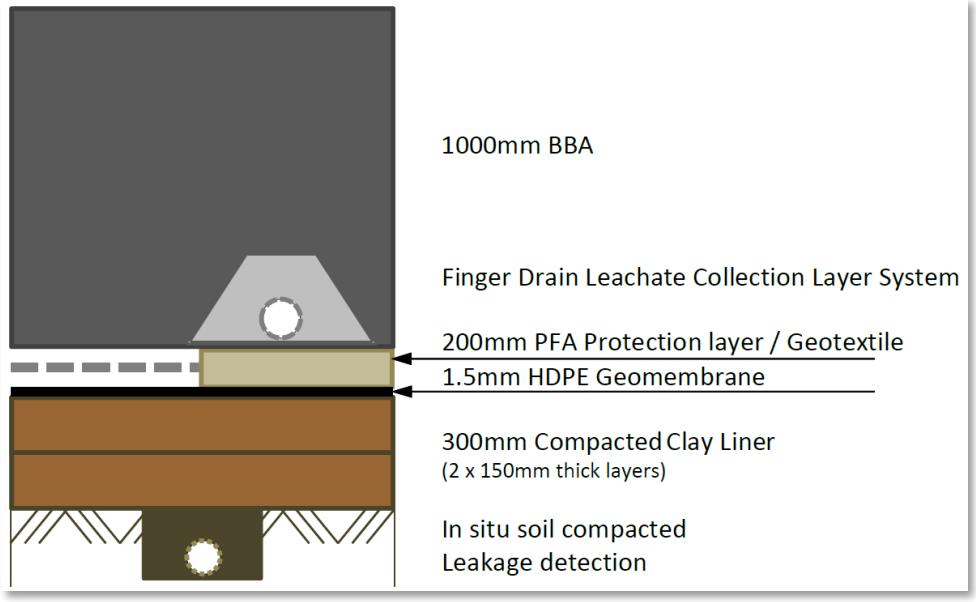
4.2.2 Project components and layout

The conception design report (JW044/16/E821) contains very detailed descriptions of all project components and the applicable design requirements that were taken into consideration. The table below, **Table 4.4**, provides a summarized description of the various components that have been taken into consideration by the specialist for this EIA process. The full report is available in **Annexure D1**.

[11] It should be noted that if the ash dry density was assumed to be 0.9 t/m3, the remaining life of the existing dams will only be until the year 2019 and not 2021.

Table 4-4| Description of layout and components required for the proposed AD4.1 and 4.2

Aspect	Description
General	
Development phases	It is proposed to develop two of the three ash dams that have been identified as options for Kriel Power Station: ■ AD4.1: Overlying natural ground south of Ash Dams 1-3. ■ AD4.2: Overlying natural ground east of Ash Dam 3. This is to avoid development over the backfilled open pit areas while investigations are being undertaken to determine the feasibility for such an option. In addition to the above, AD4.1 and 4.2 serve as stability buttresses for the east and south sides of the existing ash dams (see **Figure 4-3**) that have stability concerns. Of particular importance is to note that AD4.1 is extended over the existing AWR dams to maximise the buttress of AD1.
Development sequence	Deposition was split between the existing and new dams in order to reduce the height of the preliminary starter walls, as well as the final height of the new dams. It is anticipated that deposition on the existing dams will continue for four years after the commissioning of AD4.2 in 2021 after which the existing dams would either be maintained as part of the overall ash dam complex or be decommissioned, and rehabilitated. It is anticipated that AD4.1 will be commissioned in July 2023.
Components	The project requires the following components: ■ An expanded ash disposal facility that would have sufficient capacity to store ash volumes produced up to 2045; ■ An AWR dam from where decant and drained water will be pumped back to the power station for re-use; ■ An AWR transfer dam; ■ Delivery and return infrastructure, including conveyor belts and/ or pipelines, transfer houses, pump stations; ■ Clean and dirty water channels; ■ Powerlines; and ■ Access roads.
Development footprint	The proposed ash disposal facility would have a total development footprint of approximately 171.76 ha, consisting of the following components: ■ AD4.1 ■ AD4.2 ■ AWR dam ■ AWR transfer dam ■ AD4.1 stockpile ■ AD 4.2 stockpile ■ Access roads ■ Powerlines ■ Clean and dirty water channels
Design criteria	
Source of ash	The ash that requires disposal at the proposed ash disposal facilities originates from the Kriel Power Station and consists of fly ash and coarse ash from the coal burning operations.
Volume of ash	The total volume of ash produced by the Kriel Power Station is 3 700 000 tonnes per year. Also see **Table 4-2** for a breakdown of the ash produced at the power station.
Ash classification	The ash from Kriel Power Stations has been classified as a Type 3 waste (see Section 4.2.3 for more information on the waste classification process), which requires a Class C liner in accordance with GN 636 (2013) of NEMWA.
Liner system	The regulatory liner and liner component specification are shown below:

Aspect	Description
	 Note that a Class C liner would be provided on the wide horizontal bench approximately mid-height of the existing ash dam outer walls, to collect leachate from the upper slope areas. This is deemed a sufficient barrier as the side slopes are steep providing drainage towards the drain pipes at the toe and bench. This approach has also been approved by DWS. For more information on the liner requirements, please refer to section 3.5.6 of the conceptual design report included in **Annexure D1**.
Deposition method	The most common upstream method in South Africa for constructing a conceptual wet ash dam, which is also current operations on site, is referred to as the daywall method.
Maximum height	The maximum heights for the proposed AD4.1 and 4.2 are as follow: ■ AD4.1: 64m ■ AD4.2: 61m
Height and rate of rise limits	The maximum rate of rise specified as part of this project is at 3m/year for stability and 3.5m/year for operability. The operability limit was applied to determine the height of starter walls and the stability limit for final heights. These limits are empirical and are based on ash dams that are effectively managed within South Africa.
Pre-deposition works	
Pre-deposition works	The works required before operations can start on AD4.1 and 4.2 include the reshaping of the basin to allow proper drainage, construction of starter walls, lining the site and providing the necessary drainage boundaries between clean and dirty water systems[12]. For more information on the pre-deposition works, please refer to section 3.5 of the conceptual design report included in **Annexure D1**.
Clean and dirty water systems	
Slurry delivery system	The ash dams would be developed as a ring dyke with the outer walls raised continuously using machine packed day walls. Deposition would take place in a planned cycle so that: ■ The rate of rise of the outer wall exceeds or is at least equal to that of the basin;

[12] Note that differential settlement and the mitigation thereof is not discussed as this relates only to AD4.3 which does not form part of this EIA application.

Aspect	Description
	■ The crest of the dam remains as level as practical within freeboard requirements; ■ Sufficient deposition area is available at any time; and ■ The pool is always located at the penstock inlet. The delivery lines (deposition lines) would be similar to the current system and consist of the following ■ Permanent main line for BBA – 1 x duty 300mm nominal diameter steel pipes. ■ Deposition stations – Every 300m – Open-ended deliveries. ■ Permanent main line for PFA – 2 x duty 450mm nominal diameter HDPE pipes. ■ Deposition stations – Every 300m ■ Open-ended deliveries For more information on the slurry delivery system, please refer to section 3.6 of the conceptual design report included in **Annexure D1**.
Decant system	Storm and supernatant water are to be decanted off the basin of the dam by means of a gravity penstock. The penstock would consist of vertical stacked concrete ring towers that is raised as the dam rises and a sub-horizontal thin walled steel outlet pipe that is encased in concrete to drain decant water to the toe of the dam. At the toe of the dam, the pipe would discharge into a solution trench that drains towards the AWR dam. Access to the inlet would be provided by means of a conceptual pool wall, timber catwalk and timber platform. A decant system would be required for each phase of development to be able to decant the water. Wing walls would also need to be constructed to assist in maintaining the pool at the inlet. For more information on the decant system, please refer to section 3.7 of the conceptual design report included in **Annexure D1**.
Return water system	Based on the preliminary findings of the water balance a new AWR would be required to accommodate the new ash dam(s) to ensure the site does not discharge to the environment more than once in 50 years (NWA, 1998 GN.704[13]). The location next to the East Wing Dam of the existing AWR is a suitable location for the construction of a new AWR or extension of the existing dam due to the fact that the dam is: ■ Situated on natural ground as opposed to backfill thereby reducing the risk of large settlements and possible cracking and failure of the water retaining embankments. ■ At one of the low points on site thereby maximising gravity flow of drain, decant and dirty storm water. Note that the whole site cannot drain to this point as discussed in the next section. ■ Near the existing AWR pump station allowing re-use of the facility. The following additional infrastructure would also be required as it would not be possible for the entire site to drain under gravity to the AWR dam: ■ A Transfer Dam to collect and channel all water from AD4.2, decant water from Ash Dam 3 (existing) and a portion of seepage water from AD4.1. The Transfer Dam would be excavated into the Cut 1 ash fill adjacent to the original starter wall and will not permanently hold water but rather only serve as temporary transfer area for water from the above mentioned sources. ■ The solution trench at the toe of AD4.1 west of the AWR is elevated to allow part of the storm water from AD4.1 and the decant water from Ash Dams 4.1 and 4.22 to flow under gravity into the AWR.

[13] The NWA regulations on the use of Water for Mining and Related Activities Aimed at the Protection of Water Resources Section 4d (d), use any area or locate any sanitary convenience, fuel depots, reservoir or depots for any substance which causes or is likely to cause pollution of a water resource within the **1:50 year flood-line** of any watercourse or estuary.

Aspect	Description
	▪ The AD4.1 underdrains east of the AWR would connect to a concrete manhole that would be equipped with a pump to transfer the water to the solution trench mentioned above. For more information on the return water system, please refer to Chapter 5 of the conventional design report included in **Annexure D1**.

4.2.3 Waste classification

Digby Wells Environmental (Digby Wells) undertook a geochemistry and waste classification assessment for the proposed expansion of the Kriel Power Station Ash disposal facility (see **Annexure H** for the complete report). The objectives of the study were to:

- Geochemically assess the existing ash dam material, as well as fresh ash material to assist with waste classification of the material; and
- Undertake a waste classification; and
- Establish liner requirements.

The following table summarises the findings of the study as well as provide general information with regards to the ash disposal facility requirements (as explained in the above table):

Table 4-5| Proposed ash disposal facility requirements and waste classification

Aspect	Description
General	
Source of ash	The ash that requires disposal at the proposed ash disposal facilities originates from the Kriel Power Station and consists of fly ash (80%) and coarse ash (20%) from the coal burning operations.
Volume of ash	The total volume of ash produced by the Kriel Power Station is 3 700 000 tonnes per year. Also see Table 4-2 for a breakdown of the ash produced at the power station.
Ash classification	The ash from Kriel Power Stations has been classified as a Type 3 waste and requires a Class C liner in accordance with GN 636 (2013) of NEMWA. ▪ TC classification: TCT0 < TC ≤ TCT1 ▪ LC classification: LC ≤ LCT0
Geochemistry (as taken from the Digby Wells Ash Classification Report)	
Characterisation tests undertaken	▪ Synthetic Precipitation Leachate Procedure (SPLP) and Distilled water leachate tests (DWLT) ▪ Acid Base Accounting (ABA) procedure (including Net Acid Generation (NAG) tests) ▪ X-Ray Fluorescence (XRF) tests ▪ X-Ray Diffraction (XRD) tests
SPLP result conclusions	▪ The ash slurry sample produced the cleanest leachate with only an alkaline pH again being above recommended values; ▪ The ash dump and fly ash samples had leachable concentrations of B, Ba, Cr, Mo and TDS, above the recommended guideline values; and ▪ The cleaner results in both test types on the ash slurry indicate that the potential impact from the new ash dump will be much less than previous dumps.
DWLT result conclusions	▪ The two fresh samples submitted for testing according to NEM:WA guidelines showed the best leachate quality results with all parameters of concern below the SANS drinking water guideline values, with the exception of pH; ▪ Both samples showed leachable pH levels above 10 indicating, as mentioned in the mineralogical and ABA interpretations, a high buffering capacity; ▪ The fly ash and existing ash dump samples however showed leachable concentrations of B, Ba, Cr, Mo and TDS above the recommended limits for drinking water;

Aspect	Description
	■ The higher leachability in these samples can be due to the fresh ash slurry samples (that has been mixed with water) allowing for a lower leachability of elements in the aqueous state; and ■ The fly ash samples showed the highest concentration of metal leachate due to no water being mixed with the sample, allowing for a higher available total element concentration.
ABA & NAG results	■ All samples have a paste pH of above 11 which is well above the acid producing margin of pH 5. This shows that the material is highly alkaline with a buffering potential. The high pH can however lead to dissolution and higher aqueous activity of metals like Al and B; ■ The total sulphur concentrations in all samples are below the recommended 0.3%; ■ The Neutralising Potential Ratio (AP:NP) is well above 4:1 indicating that the nett neutralising capacity of the material is much higher than any potential for acid production; ■ Along with the high NPR, all samples show no NAG potential (all values are less than 0.01) and thus all the ash samples can be classified as non-acid generating; and ■ Although no acid generation is predicted there is still a potential for certain elements to leach at high pH levels.
XRF results	■ The dissolution and removal of some elements from the from the reactions with the slurry water and natural leaching of elements on the existing dumps are not a major factor and does not affect the mineralogical nature of the ash material; ■ The major oxides present in the ash material are SiO_2, Al_2O_3, Fe_2O_3, CaO and MgO; ■ The sulphur content is low with a high lime content (CaO) indicating a low potential for acid generation with a high buffering capacity. On ignition of the test there was a low loss of material as the ash already went through a high temperature procedure with a low moisture content; ■ The trace element distribution was compared to average crustal values and in most cases is higher than normal. This is however no indication of any potential impacts or leachability; and ■ All heavy metals expected in the amorphous ash in small quantities are present with As, B, Ba, Al and Mn mostly prone to dissolve and be removed from the solid system.
XRD results	■ The process in which the ash is produced at high temperatures lead to high aluminium silicate content with iron and calcium based minerals left; and ■ The pyrite content can potentially lead to acid formation. However, a high calcite and lime content with high buffering capacity and the low reactivity of silica will counter any acid production with neutralising reactions.

4.3 Development Phases

4.3.1 Construction

A construction period of two years for AD 4.1 and 4.2 is expected for each. AD4.2 would be constructed first and commissioned in 2021 whilst AD4.1 would be commissioned in 2023. Construction (pre-deposition works) would consist of site clearance, earthworks and reshaping of the site to allow proper drainage, lining of the site, establishment of dirty water systems, including ARWD and Transfer Dam, and ash return water channels, establishment of ash transfer conveyor/pipeline systems, construction of the starter walls and providing the necessary drainage boundaries between clean and dirty water systems. Once the site has been shaped the required Class C liner and gravity penstock (to serve as the decant system) would be constructed. Ancillary infrastructure to be constructed include the AWR dam and Transfer Dam; the Transfer Dam would also have a Class C liner with a concrete protection layer to collect leachate. Other smaller scale ancillary infrastructure include clean and dirty water channels, outlet works and pump system, return water pipes, low voltage power lines (11kV), internal roads and access points. Once the pre-deposition works have been completed, the starter walls would be deposited and the process moves into the operational phase.

4.3.2 Operation

Operation of the expanded ash disposal facility would commence in 2021 (AD4.2) and 2023 (AD4.1). The planned operation of the entire facility is until 2039 with a 5 year contingency plan during which the entire facility would be

decommissioned. The operation of the ash disposal facility would see the deposition of ash in an upstream direction using the daywall paddocking method and slurry deposited using a ring main delivery system. PFA would be deposited at a single point (via conveyor) where it is slurried or sluiced and allowed to gravitate along the daywall, whereas the BBA is pumped and deposited by open-ended deliveries at selected positions directly into the basin of the dam. Storm and supernatant water would be decanted off the basin of the dam by means of a gravity penstock. Decant and process water from AD4.2 would be fed to the AWR dam. The ash water is pumped to the high level ash water return reservoirs where it is reused at the Kriel Power Station.

4.3.3 Decommissioning

Decommissioning of the Kriel Power Station, ash disposal facility, coal stock yards and return water system would need to be assessed in terms of the relevant environmental legislation in place at the end of the power station and ash disposal facility's lifespan, which currently stands at 2045.

The only present-day decommissioning activity that would take place, is the concurrent rehabilitation of the outer slopes of the ash dam, during the operational phase, to aid with dust suppression. The capping of the ash consists of a 300mm topsoil layer (from topsoil stock piles) which would be vegetated as per the existing rehabilitation plan for AD1-3.

5 DESCRIPTION OF AFFECTED ENVIRONMENT

The purpose of this Chapter is to provide a description of the affected environment and the potential impacts that could result from the proposed project.

5.1 Introduction

The description of the affected environment provided below draws on existing knowledge from published data, previous and new specialist studies, site visits to the area and discussions with various role-players. This chapter provides context for the assessments presented in Chapter 7.

5.1.1 Description of the site

The preferred site, Site 10, is located south to southwest directly adjacent to the existing ash disposal facility at the Kriel Power Station (see Table 5-1) on properties as indicated in Table 5-2. The site is approximately 359 ha in extent of which about 172 ha will be affected by the proposed expansion of the ash disposal facility.

Table 5-1| Location information for development

Physical Address where the development will take place	Kriel Power Station, between the towns of Kriel and Ogies in Mpumalanga Postal code 2271
Site centre point	26°16'31.86"S 29°12'1.88"E
Local Municipality	Emalahleni Local Municipality
District Municipality	Nkangala District Municipality

The land, which is entirely owned by Eskom, is zoned agricultural and mostly consists of grassed slopes with some areas of thicker vegetation and trees, often alien invasive species such as Blue gum and Black Wattle. The properties indicated in Table 5-3 are directly adjacent to those affected by the proposed development of AD4.1 and 4.2.

Table 5-2| Properties on which infrastructure for Site 10 is proposed to be constructed

ID	Major region	Parcel No.	Portion	Parent farm name
T0IS000000000 065 00000	IS	65	0	Kriel Power Station
T0IS00000000006900015	IS	69	15	Driefontein
T0IS00000000006900030	IS	69	30	Driefontein
T0IS00000000006900003	IS	69	03	Driefontein
T0IS00000000006900019	IS	69	19	Driefontein
T0IS000000000070 00009	IS	70	9	Onverwacht
T0IS000000000070 00011	IS	70	11/RE	Onverwacht
T0IS000000000070 00023	IS	70	23	Onverwacht

Table 5-3| Properties directly adjacent to properties on which Site 10 is proposed to be constructed

ID	Major region	Parcel No.	Portion	Parent farm name
T0IS000000000 059 00008	IS	59	8	Nooitgedacht
T0IS000000000 068 00003	IS	68	3	Vaalpan
T0IS000000000 068 00009	IS	68	9	Vaalpan
T0IS000000000 069 00000	IS	68	0	Driefontein
T0IS000000000 069 00001	IS	69	1	Driefontein
T0IS000000000 069 00008	IS	69	8	Driefontein
T0IS000000000 069 00013	IS	69	13	Driefontein
T0IS000000000 069 00017	IS	69	17	Driefontein
T0IS000000000 069 00020	IS	69	20	Driefontein
T0IS000000000 069 00021	IS	69	21	Driefontein
T0IS000000000 069 00022	IS	69	22	Driefontein
T0IS000000000 069 00025	IS	69	25	Driefontein
T0IS000000000 069 00026	IS	69	26	Driefontein
T0IS000000000 069 00031	IS	69	31	Driefontein
T0IS000000000 069 00032	IS	69	32	Driefontein
T0IS000000000 070 00005	IS	70	05	Onverwacht
T0IS000000000 070 00007	IS	70	7	Onverwacht
T0IS000000000 070 00012	IS	70	12	Onverwacht
T0IS000000000 070 00015	IS	70	15	Onverwacht
T0IS000000000 070 00016	IS	70	16	Onverwacht
T0IS000000000 070 00019	IS	70	19	Onverwacht
T0IS000000000 070 00020	IS	70	20	Onverwacht
T0IS000000000 070 00021	IS	70	21	Onverwacht
T0IS000000000 070 00026	IS	70	26	Onverwacht
T0IS000000000 083 00002	IS	83	2	Vlaklaagte
T0IS000000000 141 00000	IS	141	0	Matla Power Station

5.1.2 Land uses in the surrounding area

The surrounding landuse is mainly agriculture, including maize and cattle farming, and mining (see **Figure 5-2**). The power station is located adjacent to the Kriel Colliery, which is dedicated to the Kriel and Matla power stations. The town of Kriel is approximately 5 km to the east of the power station, as well as a small informal settlement approximately 5 km to the southeast. The Thubelihle Township is approximately 11 km to the northeast. The power station also has a small housing development for employees approximately 1 km to the southeast. The Matla Power Station (also coal fired) is situated 4.5 km to the south west of the Kriel Power Station, with the prior's ash dams expanding towards the south. The Exxaro Matla mines (three underground mines) are situated to the east of Kriel with the main facilities about 5.7 km to the east of the Kriel Power Station. A small airfield is located approximately 1 km to the east of the power station and the Kriel Golf Club is approximately 2 km to the southeast. The residential developments Rietstroom Park and Lehlaka Park are approximately 9 km to the north.

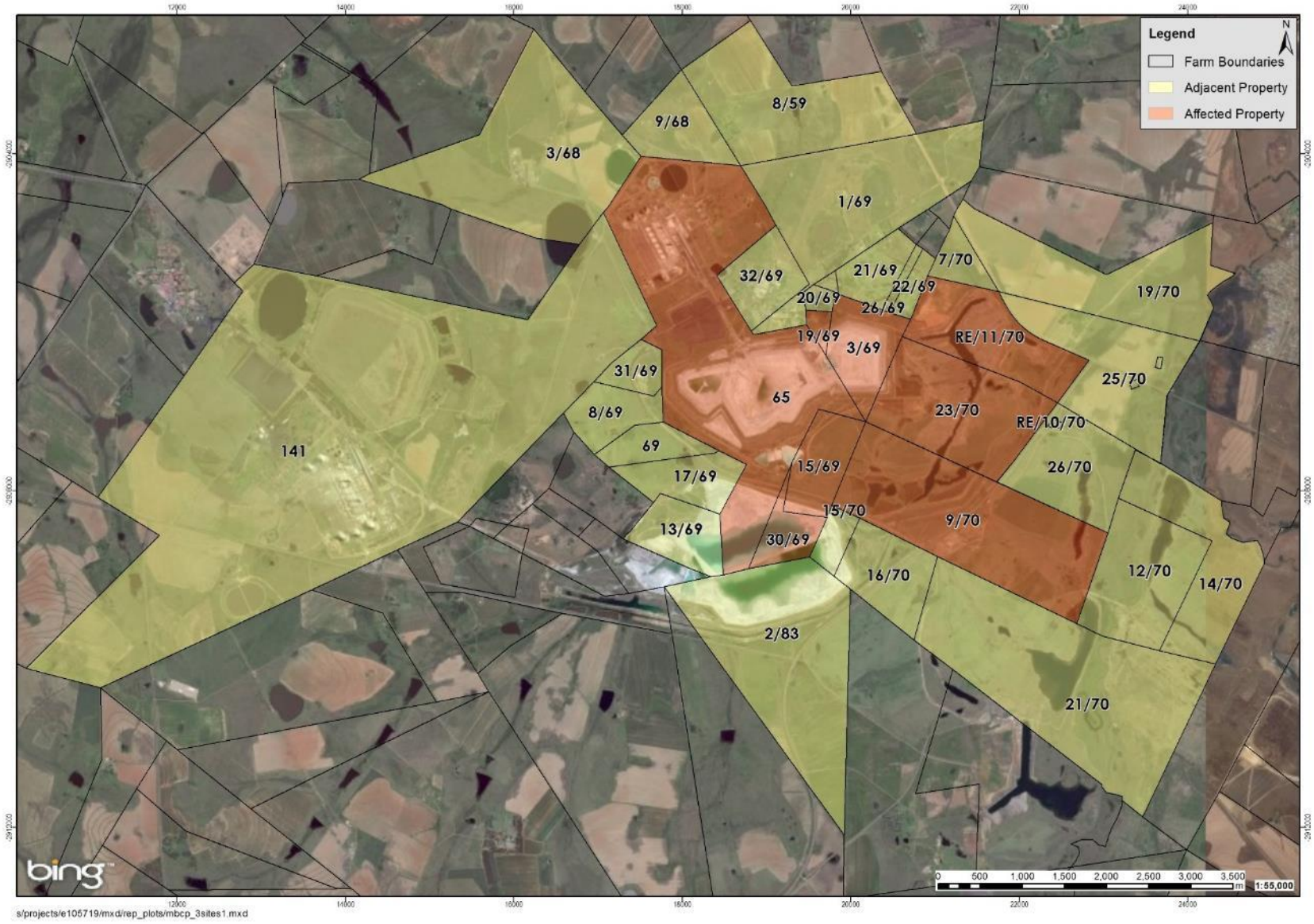


Figure 5-1 | The cadastral units around Kriel ash dam site

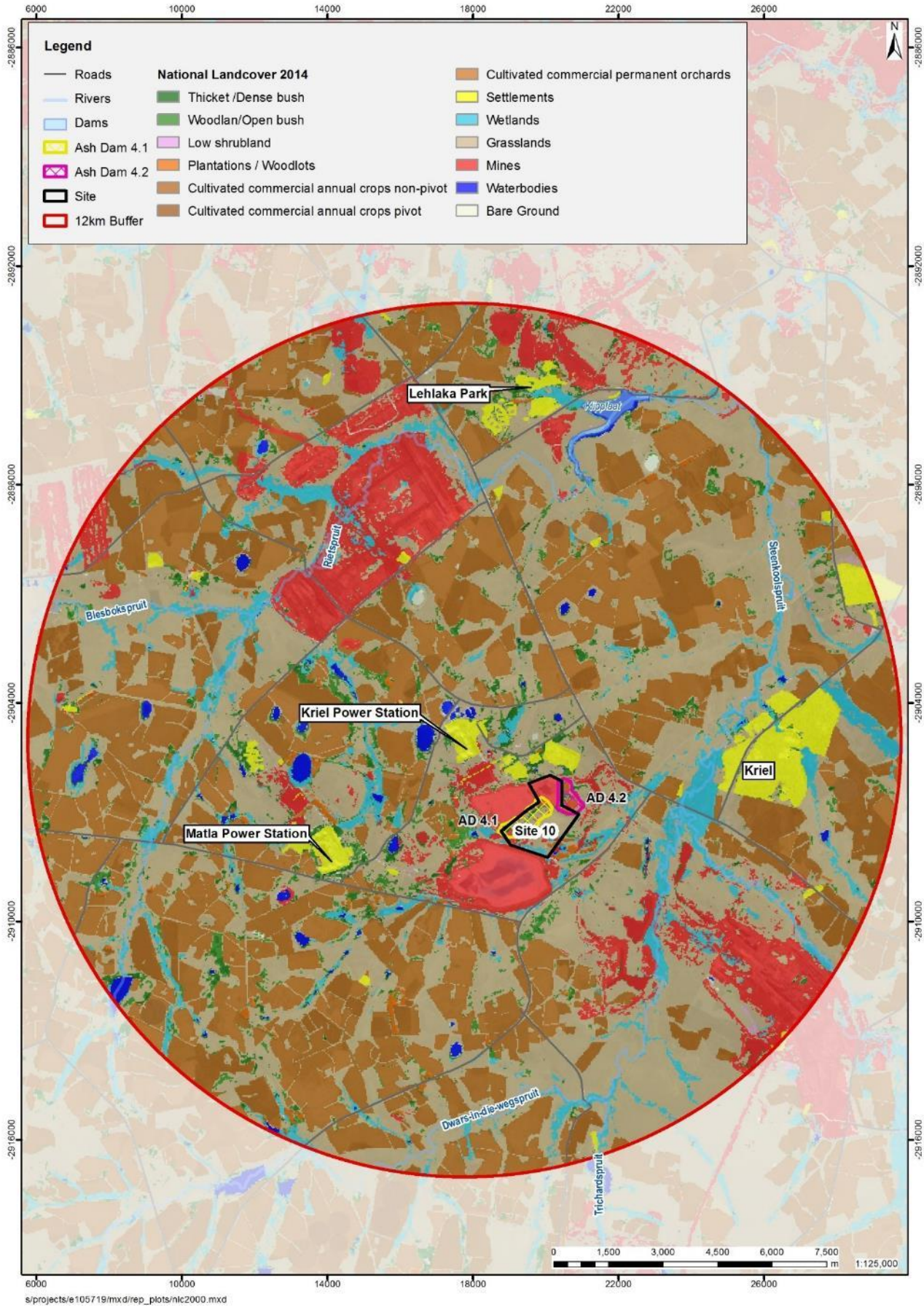


Figure 5-2 | Land uses within the 12 km radius area from the Kriel power station

5.2 Description of the affected Biophysical and Socio-economic environment

5.2.1 Climate

The broad municipal area is situated in a Highveld climate zone and receives rain during the summer months from October to March, mainly through thunderstorms. On average ranges between 601 - 700 mm per annum. The average temperature for the broad municipal area is moderate (average 24.5°C) with frost occurring on average 30 days per annum during winter. Northerly and easterly winds are dominant during the summer months, while easterly winds occur mostly in the autumn months and westerly winds in the winter months (Emalahleni LM, 2009; Airshed, 2010).

Further discussion of climatic and atmospheric conditions at a local level are presented in the subsections below. Meteorological data was obtained from Kriel village ambient air quality monitoring station for the period 8th January 2013 to 30th November 2015.

5.2.2 Wind

The wind field was dominated by winds from the north-west; north-east; and, less frequently the south-west. Calm conditions, occurred less than 1% of the time. During the day, winds at higher wind speeds occurred more frequently from the easterly sector, with 0.2% calm conditions. Night-time airflow had winds also most frequently from the easterly sector but at lower wind speeds. The frequency of night-time calm conditions increased to 0.9%, relative to day-time. Summer and spring show similar wind direction profiles to the period average, while autumn and winter show the more frequent winds from the south-west (refer to **Figure 5-3** below). There is an increased frequency of wind speeds of 3 m/s or more during spring.

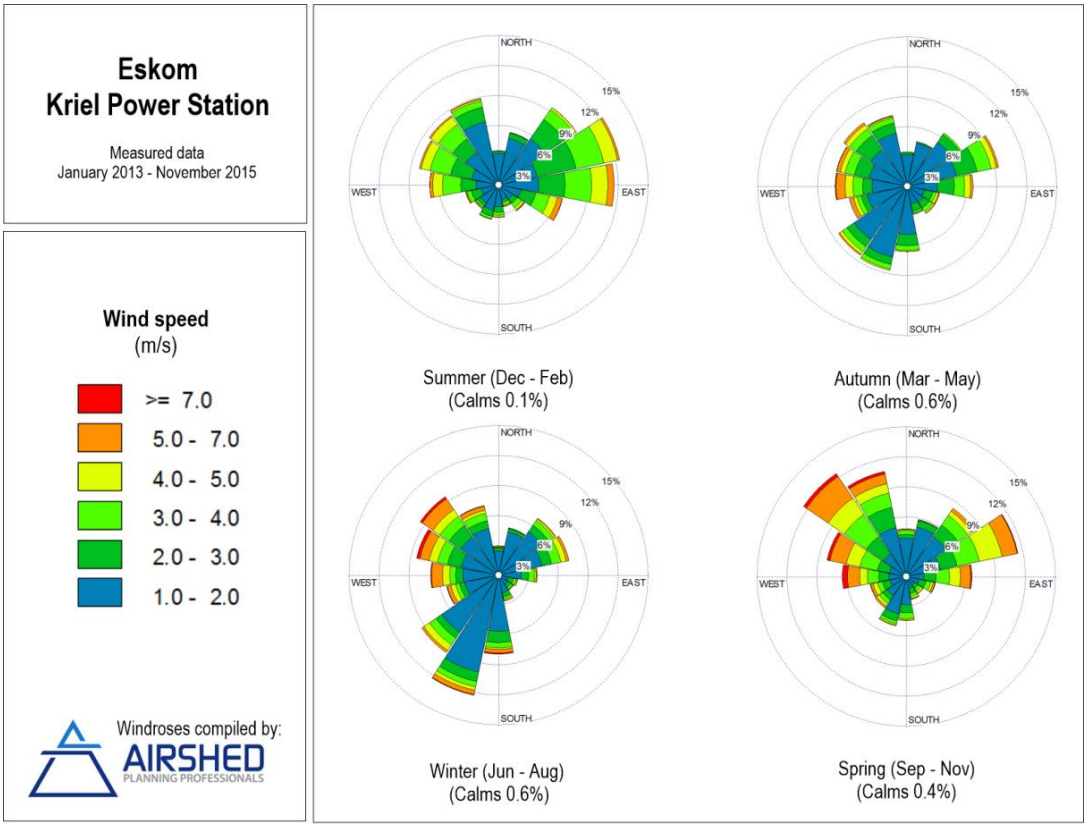


Figure 5-3| Seasonal wind roses (measured data; 2013 to 2015)

5.2.3 Temperature

The monthly temperature pattern is shown in **Figure 5-4**. The area experienced warm temperatures above 24°C during summer. Winter temperatures were relatively low especially in the months of June and July. Average daily maximum temperatures range from 27.9°C in February to 18.9°C in July, with daily minima is between -1.0°C in July and 11.0°C in October.

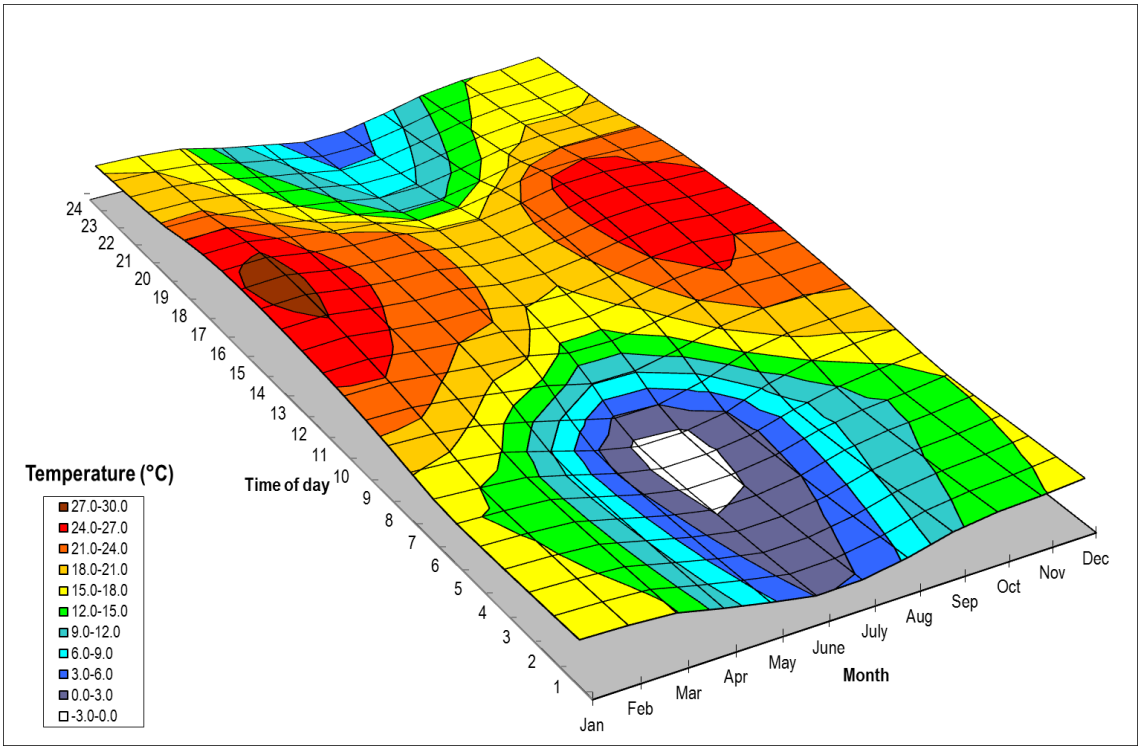


Figure 5-4| Monthly temperature profile (measured data; 2013 to 2015)

5.2.4 Air quality

Meteorological data made available by Eskom for this assessment and ambient concentrations of PM_{10} measured at the Kriel ambient monitoring station were used to determine the current status of air quality. **Table 5-4** provides the ambient concentrations of PM_{10} measured at the Kriel ambient monitoring station. No dustfall measurement could be found in the vicinity of the existing or proposed ash dams.

Table 5-4 | Availability of valid ambient pollutant concentrations from the Kriel air quality monitoring station

Year	PM_{10}
2013	83.9%
2014	57.4%
2015	70.0%

During the period of assessment (2013 to 2015) the ambient PM_{10} concentrations recorded at the Kriel Village station were in non-compliance with the NAAQS[14] (**Table 5-5**).

Table 5-5 | Availability of meteorological data from the Kriel Village air quality monitoring station

[14] The maximum allowable number of days exceeding the limit concentration (the 75 µg/m³) is four (4) days per year.

Year	Number of days in dataset	Days exceeding NAAQ limit concentration	Annual average concentration (µg/m³)
2013	358	96	60.4
2014	365	71	60.9
2015	334	37	42.9

Elevated PM_{10} concentrations (80 µg/m³ or above) originate to the north-westerly sector at wind speeds greater than 4 m/s (likely due the mining activities 10 km north-west of the monitoring station). Similarly, low wind speeds (<1 m/s) result in an almost equal contribution to PM_{10} concentrations from all wind sectors, with daily average concentrations of approximately 60 µg/m³ .

PM_{10} concentrations show a diurnal fluctuation with peaks in the evening, most likely associated with domestic fuel combustion for cooking requirements (**Figure 5-5**). The increase in PM_{10} concentrations during winter (May to August) is likely to be associated with the use of coal, wood and gas for heating requirements, especially in informal settlements or areas where electrification is less common. Other potential sources in the vicinity contributing to elevated PM_{10} concentrations include: the Kriel Power Station and ash disposal facility; the Matla Power Station and ash disposal facility; agricultural activities; and mining activities.

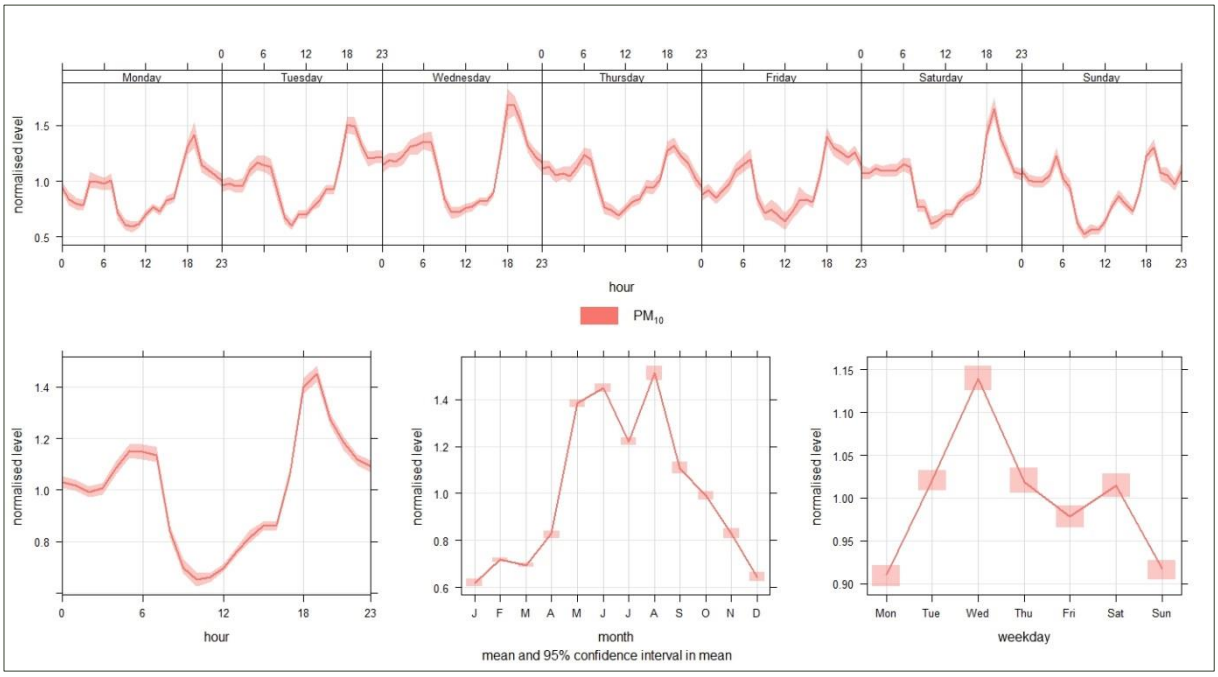


Figure 5-5 | Time variation of normalised PM_{10} concentrations at the Kriel Village monitoring station

5.2.5 Topography and hydrology

A. Topography

The municipal area is approximately 1 600 m above sea level on the Highveld plateau and is characterised by an undulating landscape with slopes less than 1:30 (Emalahleni LM, 2009). The general surface area surrounding the Kriel Power Station is characterised by mine dumps and open cast mines.

Figure 5-6 | An old open cast mine (cut 2) on the property which forms part of the Kriel Coalfield

The topography of the area in which Site 10 is located, is somewhat variable due to the nature of the mining activity and the subsequent rehabilitation that has taken place. The entire area to the east and south of the existing ash disposal facility has been disturbed, either by the mining and rehabilitation activities, or by the construction of the existing dams. Where the pit has been rehabilitated, the topography is gently undulating, however, there are areas where the dragline tips still form steep cones of spoil. The eastern final cut void is still open and is partially filled with water. The ground generally slopes towards the south-west.

The current Kriel ash disposal facility span more than 2.7 km from east to west and more than 1km from north to south. Furthermore the Matla ash disposal facility, located only about 500 m to the south of the Kriel ash disposal facility, also occupy a vast area approximately 2.7 km from east to west and 1.7 km from north to south. These ash dams may reach heights of 70-90m above ground which in practical terms equates to a small hill. The visual impacts are further discussed in Chapter 6.4.

Figure 5-7 | Change in the topograhy due to the extent of the current ash dams at Kiel Power Station

B. Hydrology

The Emalahleni Local Municipality falls within the Olifants River primary catchment with the Klein-Olifants, Olifants, Wilge, Rietspruit, Steenkoolspruit and Brugspruit being the main rivers in the municipal area. Major dams include the Rietspruit, Doringpoort and Emalahleni Dams (Emalahleni LM, 2009).

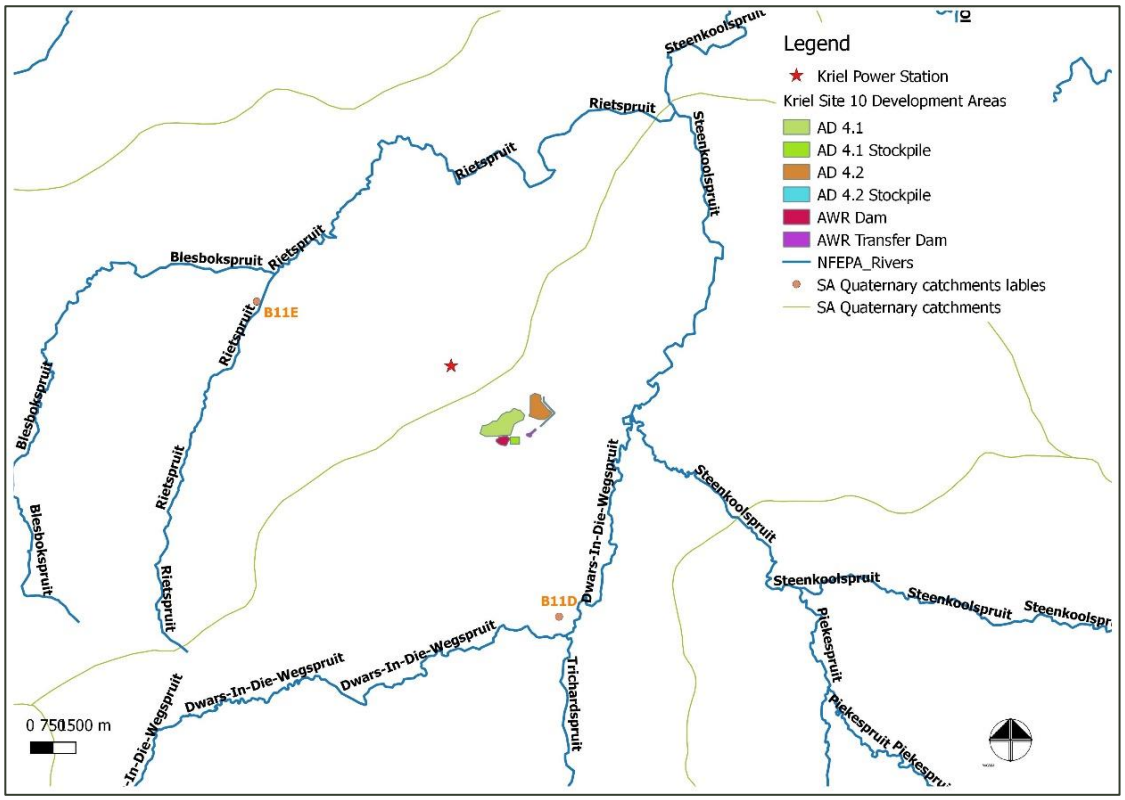


Figure 5-8 | The main-stem rivers found within the respective quaternary catchments in the study region

Springs in the vicinity of Kriel Power Station feed the seasonal Onverwacht, Pampoen, and Vaal Pan Spruits (which drain to the east, north, and west, respectively). Ultimately, all surface water from this area drains into the Olifants River via the Riet (water draining north and west of the ridge), and Steenkool (water draining east) Spruits. The Rietspruit flows to the north of the Kriel Power Station into the Rietspruit Dam from where water enters the Steenkoolspruit, which is located to the southeast of the power station. Both rivers are perennial and fall within the B11E and B11D quaternary catchments, respectively. The Rietspruit and Steenkoolspruit both have a Present Ecological Status (PES) of Class D: Largely Modified and are considered to be Critically Endangered due to the ecosystem processes they maintain downstream.

5.2.6 Geology and geohydrology

A. Geology

Kriel Power Station is located within the Great Karoo Basin that contains sediments deposited in fluvial floodplains and shallow shelves over a period extending from the late Carboniferous Period (290 million years ago) to the early Jurassic Period (190 million years ago) before the separation of southern Africa from Gondwanaland. These sediments were deposited in a fluvio-deltaic environment where swamps and marshes existed and peat accumulated. Interlayered shales, mudstones, siltstones and sandstones constitute the bulk of the formation. Dolerites, a prominent feature of the Karoo Basin, intruded after sedimentation in the basin had nearly ceased due to the intrusion of Drakensberg basalt. These dolerite dykes and sills intruded the Karoo older sediments along planes of weakness. In the vicinity of Kriel, few dolerite intrusions occur apart from a few narrow sub-vertical dykes (J&W, 2010). Furthermore, coal seams are interrupted by numerous minor faults of which many are water bearing. Small fracture zones which are generally associated with the upper and lower contacts of sills (usually water bearing) also occur throughout the power station area[15] (Aurecon, 2010).

[15]Prior investigations have identified a near surface, slightly weathered to fresh dolerite sill of which the extent is unknown.

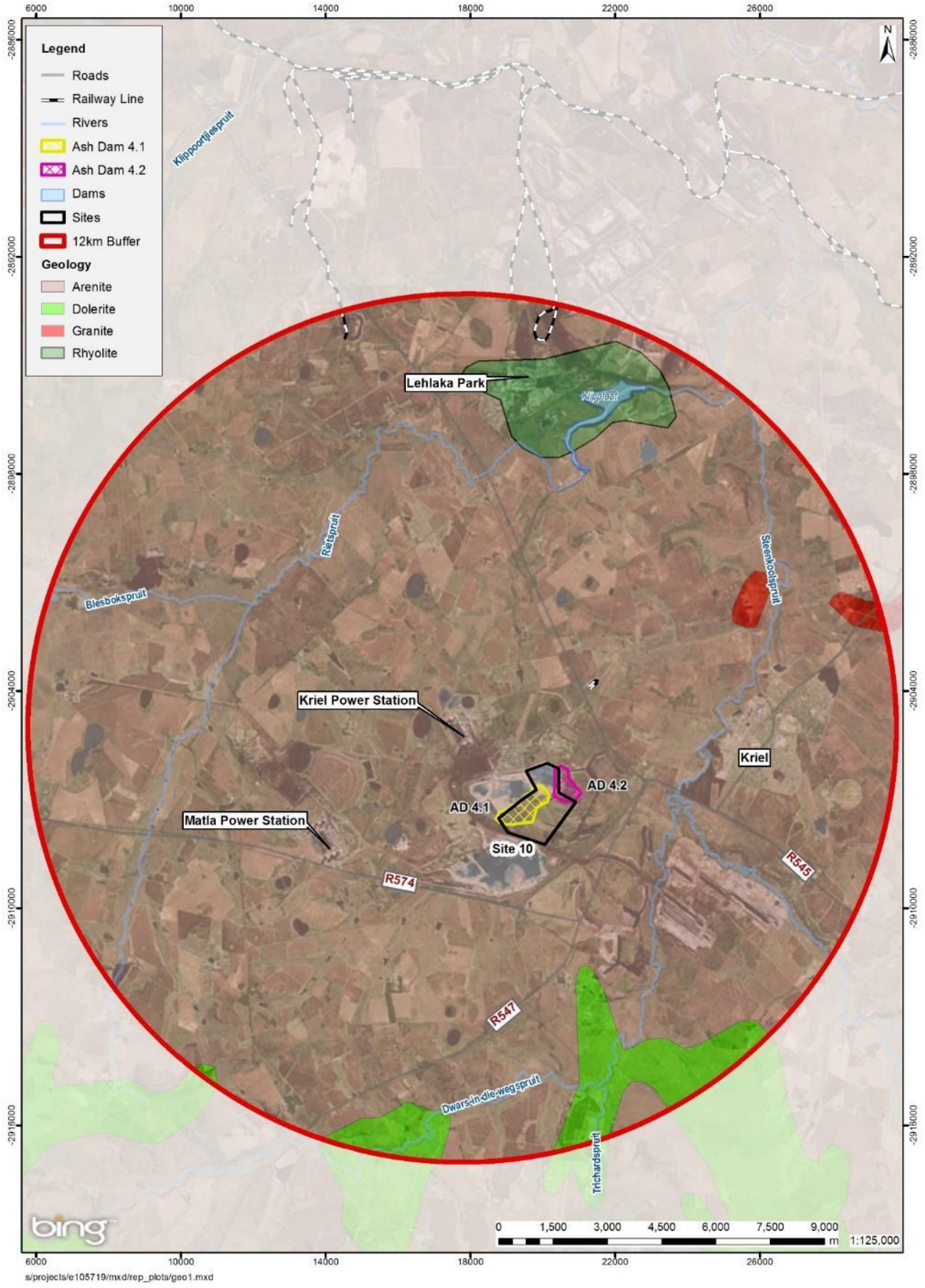


Figure 5-9| Geology of the sites and surrounding areas

The Karoo basin has been subjected to several cycles of erosion, which resulted in weathering to great depths. Rocky outcrops are rare in the Kriel area and are often covered by transported soils. Weathering in the area is largely dependent on climatic conditions with disintegration occurring in the dryer regions and decomposition in the wetter regions (J&W, 2010).

The Kriel Coalfield, which forms part of the Highveld Coalfield covers an area of more than 25 000 ha. This coalfield is underlain by Dwyka and Middle Ecca strata that are located on an undulating floor containing felsites, granites and diabase that is generally associated with the Bushveld Complex. Coal occurring in fault-margins is often burned and is therefore not mined (Buchan, et al., 1980). In the Kriel area two sedimentary units are of interest namely the Dwyka Formation and the Vryheid Formation. The younger Vryheid formation is comprised of a succession of sandstones and minor interbeds of siltstone and mudstone to a thickness of 180m at the site. Typically, five seams, numbered 1 (youngest) to 5 (oldest) are represented across the Highveld Coalfield, although Seam 1 is often absent. Seam 4, a flat lying to gently undulating unit with a thickness of about 4.8 m and regional dip of less than 1^{o} to the southwest, is the only seam currently mined by the Kriel Colliery, and typically occurs at a depth of about 30m in open cut areas. While the entire thickness of the seam is extracted during surface mining, underground operations only exploit the lower two thirds of the unit. The layout of mine operations and subsequent extraction of the coal is influenced by the presence of dolerite sills that tend to displace the coal measures, thereby compartmentalizing the reserves.

B. Geohydrology

Water levels in boreholes at the Kriel and Matla Power Station are measured on a regular basis as part of a routine groundwater monitoring programme for approximately 20 years. In addition to this data, Kriel Colliery also provided Aurecon with water level data from boreholes monitored by themselves. Measured water levels in the study area varied between 0.12 m and 81.79 m below ground level.

Under undisturbed conditions, a linear relationship can be expected to exist between groundwater levels and surface topography. This is however not the case in the project area as historical and current opencast and underground mining, mine dewatering and rehabilitation activities has altered the static water level and natural groundwater flow directions significantly.

Water levels in each of the measured boreholes must be interpreted in context of the area they are located. The deep water levels in excess of approximately 70 mbgl (metres below ground level) most probably depict the water level in the underground workings it was drilled into. The measured water level in the majority of boreholes is less than 5 mbgl which confirms the presence of a perched water table within the Weathered Ecca Aquifer. Water levels between 10 and 20 mbgl most probably represents the water level in the Fractured Ecca Aquifer.

A large number of boreholes exist within the area identified for AD4.1 and 4.2 (see **Figure 5-10**). The latest addition to the existing monitoring network was the drilling of eleven new monitoring boreholes by GHT during July 2010 (GHT 2010). During 2009 GHT conducted an extensive hydrocensus to identify the water users and usage within the possible impact zone of the Kriel and Matla Power Station. A total number of 100 boreholes/springs were identified (GHT 2009). The majority of the boreholes were drilled for monitoring purposes. Four boreholes are being used for domestic purposes only. A total of 10 boreholes are being used for both agricultural (livestock) and domestic purposes.

The combined database of Kriel Colliery, Kriel and Matla Power Stations contained a total number of 124 boreholes at the time of compiling this report.

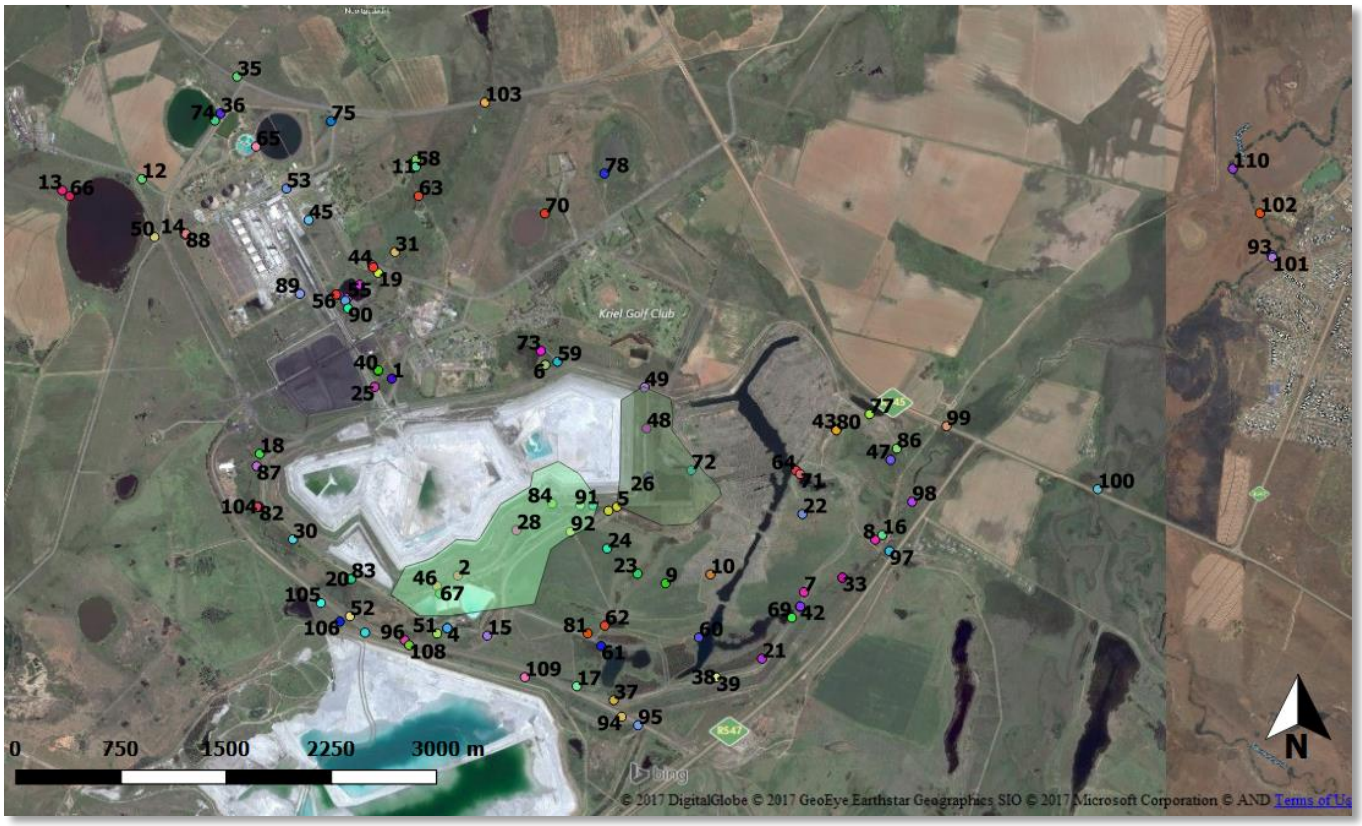


Figure 5-10| Exisiting monitoring boreholes around the Kriel Ash disposal facility

It was determined that the water is generally of good quality with only one borehole (KB35) exceeding the Class 2 drinking water standards due to elevated sulphate concentrations. Three boreholes (KB 61, 63 and 65), indicated high pH values, which can be attributed to the high pH in ash water which is usually above 12. High levels of calcium and sodium were also identified at a couple of boreholes (Hodgson *et al* 1998).

Even though seepage from the existing ash dams into the underlying strata occurs, very few of the ash water's components are carried into the underlying aquifer. This is due to the unstable chemistry of the ash water. Hodgson *et al.* (1998) did a comparison between ash water and groundwater chemistries within boreholes in close proximity to ash dams and concluded that unstable components are filtered out to a significant degree from ash water, before it reaches the aquifer.

Groundwater in the Pit 1 area has been impacted upon by mining/in-pit ashing areas. In-pit ash disposal has taken place into some of the ramps and voids of Pit 1 (Hodgson et al.,1998). The majority of boreholes drilled in this area exceed the Class 2 drinking water standards, with only a small number of boreholes falling within Class 1. Hodgson *et al.* (1998) performed in-depth investigations and geochemical modelling of in-pit ash disposal at Kriel Power Station and concluded that it is safe to dispose of power station fly ash into Pit 1, on condition that the necessary precautions are taken that ash water does not decant from the pit into public streams.

A subsequent investigation by Hodgson concluded that, while water quality varied significantly from point to point, four groundwater environments could be identified within Pit 3N on the basis of the chemistry of water samples; stagnant in-pit water; dynamic in-pit water; water accumulation in ramps and void; and; groundwater in areas adjacent to mining. Of these, water quality was worse within the stagnant and accumulated water systems. Hodgson also concluded that groundwater in the area adjacent to the pits was generally very good.

5.2.7 Terrestrial and aquatic ecology

A. Vegetation

Kriel Power Station is located within the Mesic Highveld Grassland Bioregion as defined by Mucina and Rutherford (2006). The dominant vegetation type found in the vicinity of the power station and surrounding areas is Eastern Highveld Grassland. This vegetation type occurs on plains at a general altitude of 1 520 – 1 780 m, but also as low as 1 300 m, within the Mpumalanga and Gauteng Provinces. The landscape is characterised by slight to moderate undulating plains as well as low hills with intermittent pan depressions which supports short, dense grassland dominated by general Highveld grass species such as *Aristida, Digitaria, Eragrostis, Themeda* and *Tristachya*. These pan depressions are considered to be important as they provide critical important foraging habitat to two "Near-threatened" Flamingo species (Scherman Colloty & Associates, 2010). Nearly 44% of this grassland type is already transformed by cultivation, coal mining and the creation of artificial impoundments. Although the latter has contributed to the regional waterfowl diversity, severe transformation by opencast mining activities has led to the demise of the local biodiversity that historically occupied the area. Eastern Highveld Grassland is thus considered a vulnerable vegetation type with only a handful of patches conserved (SANBI, 2013). The conservation target is 24% (Mucina, 2006).

The proposed site consists of two broad land cover classes which include mined land and post-mined rehabilitated grasslands (**Figure 5-11**). The rehabilitated grasslands on site were expected to be poor in floristic richness, and were dominated by secondary taxa such as *Eragrostis curvula, E. plana* and *Hyparrhenia hirta*. These species were confirmed the dominant species during the 2016 assessment, and were being heavily grazed (most of the fences have been removed to allow access for the cattle). Small scattered rocky outcrops that are characterised by wiry, sour grasses and some woody species also occur within this area.

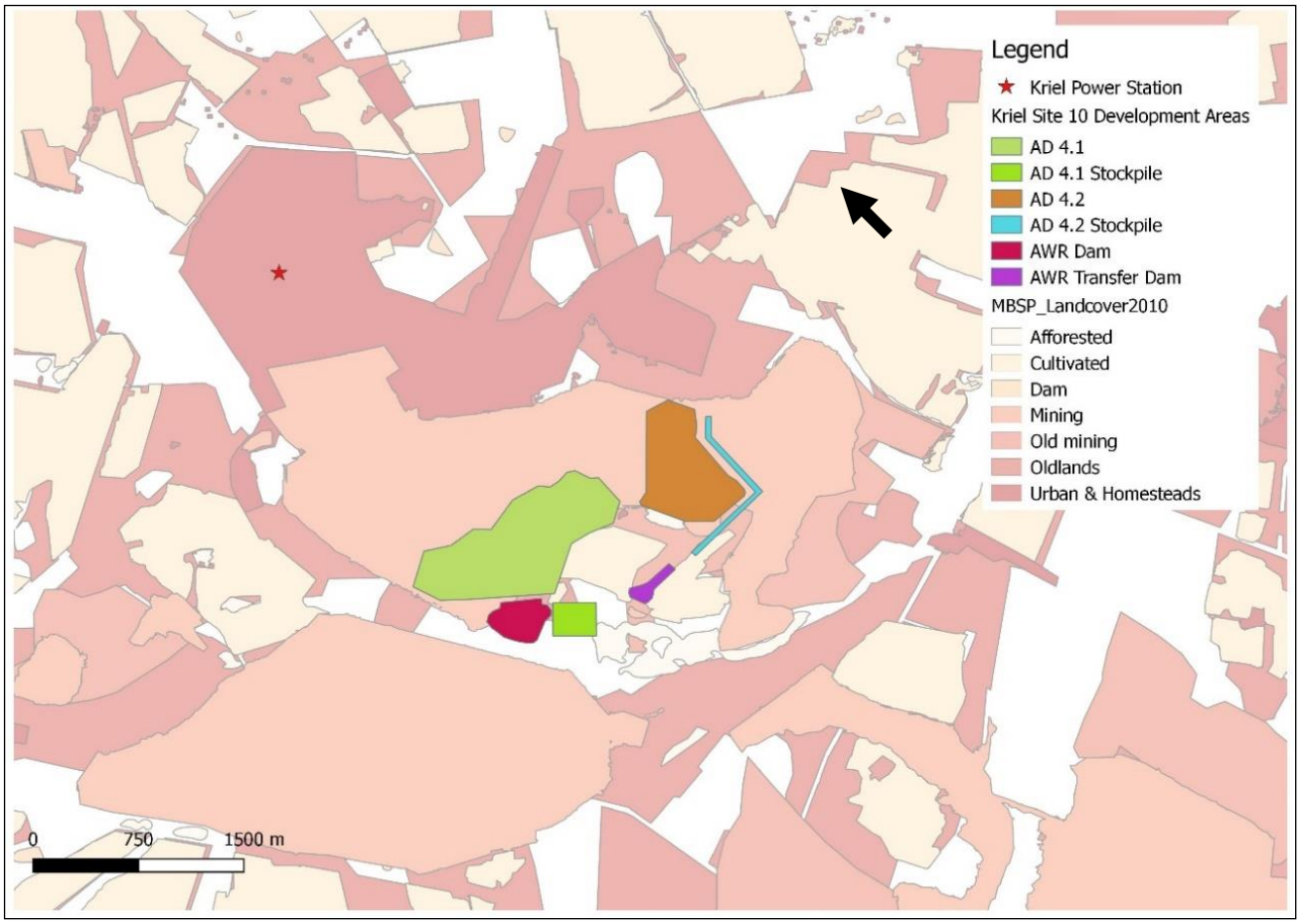


Figure 5-11 | A map illustrating the land cover classes corresponding to Site 10, as well as the spatial position of a nearby small roosting/breeding colony of Southern Bald Ibis (*G. calvus*) (see arrow)

The majority of the area surrounding the power station was considered to be areas of 'No Natural Habitat Remaining' in terms of the Mpumalanga Biodiversity Conservation Plan[16] (MBCP, 2007). This was further refined in the Mpumalanga Biodiversity Sector Plan (MBSP, 2014), which mapped the surrounding area as heavily modified, moderately modified (old lands) and other natural areas (see **Annexure F1** for the assessment report).

B. Fauna

Of the approximate 164 **mammal** species recorded for Mpumalanga (according to Emery *et al*., 2002), a total of 31 species could occur at the site. Among those confirmed include two antelope species, three rodents, one canine (jackal), two herpestids (mongoose) and one leporid (hare). Experience (personal observations by Brian Colloty) from similar environmental conditions also dictates an abundant occurrence of meso-predators that will invariably utilise the cultivated lands as "temporary" movement corridors during foraging bouts. Recent observations from nearby areas have shown that the cultivated lands provide an alternative food resource for carnivore species (i.e. Black-backed Jackal *Canis mesomelas* and Cape Fox *Vulpes chama*) as evidenced by the frequent occurrence of undigested corn in their droppings.

Figure 5-12 Images of confirmed mammal species occuring at the site (Source: www.Arkive.org)

Of the 51 species of **amphibians** occurring in Mpumalanga (Minter et al., 2004), 13 species could occur at the site. (mostly in temporary waterbodies and inundated grassland). However, two of these have distribution patterns peripheral to Site 10 and are believed to be sporadic on the site. None of the frog species under consideration are listed as species of conservation concern.

14 taxa of **reptiles** (comprising of nine (9) snakes and five (5) lizard species) have been recorded by the South African Reptile Conservation Assessment (SARCA)). The expected richness represents an underestimation of the reptile diversity likely to occur. Therefore, it is possible that many more species could exist at the site although current distributional data is lacking in this regard.

According to the South African Bird Atlas Project (SABAP1) (Harrison *et al*., 1997), an average of 185 **bird** species have been recorded from the quarter degree grid cells (QDGC) that overlaps Site 10. However, recent data suggests that the diversity of habitat types prevalent at Site 10 is more likely to sustain approximately 50 species (www.sabap2.adu.org.za).

C. Aquatic ecology

The Present Ecological State (PES) scores for both the Steenkoolspruit and Olifants rivers systems have been rated as Class D, "largely modified" by the Department of Water Affairs (DWA – RQS website), and due to the ecosystems processes that these rivers maintain downstream, they have been rated as Critically Endangered (SANBI – BGIS). The PES scores for all the main-stem systems in the Olifants catchment have been re-evaluated using an updated PES model, but as such the scores due to present land use have remain unchanged (Louw pers comm., 2011, DWS, 2014).

Wetland areas that are considered to be "Important and Necessary" in terms of the MBCP occur within the area of investigation. These wetlands provide important dispersal and ephemeral foraging habitats to faunal species. Furthermore, an important endorheic pan is also located to the northeast of the Kriel power station which provides foraging and roosting habitat for "Near-threatened" taxa such as Servals (*Leptailurus serval*) and Flamingos

[16] The MBCP is intended to guide conservation and land-use decisions in support of sustainable development in Mpumalanga. The MBCP areas indicated as 'Irreplaceable', 'Highly Significant' and 'Important and Necessary' should remain unaltered and should be managed for biodiversity by various means.

(*Phoenicopterus* spp). Amphibians that are of conservation concern are not expected to occur, however 14 red listed avifauna species are likely to utilise the area.

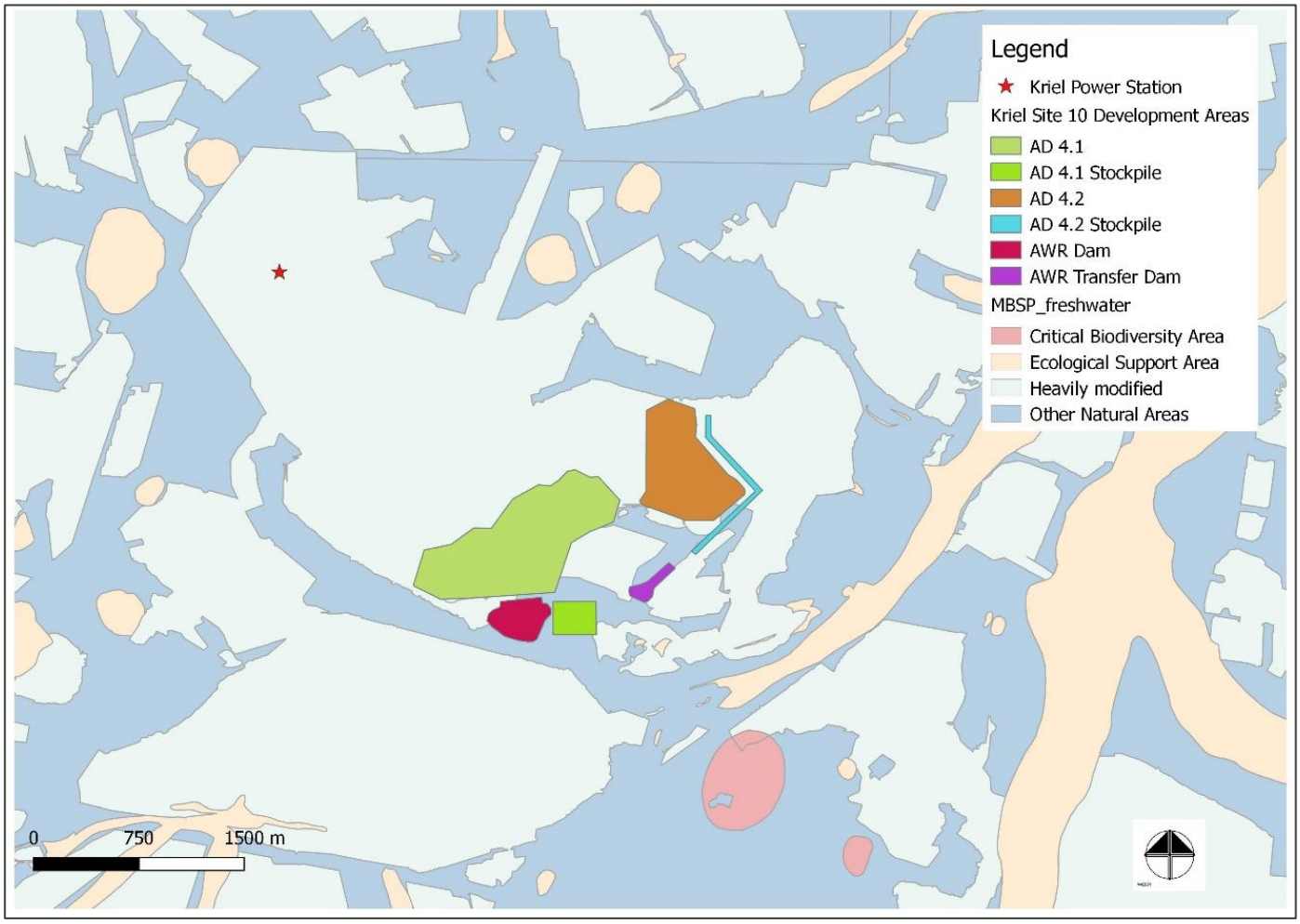


Figure 5-13 | Map showing important and necessary wetlands identified by the MBCP in relation to the Kriel Power Station

5.2.8 Heritage

A. Historical Overview of the Study Area and Surroundings

A basic historical and archaeological background study was undertaken using available resources accessed at the National Archives in Pretoria as well as published literature and historical map series. A historical overview of the greater study area and surrounds is provided in **Table 5-6** below. An assessment was also undertaken of the South African Heritage Resources Information System (SAHRIS) of the South African Heritage Resources Agency (SAHRA) and revealed several previous heritage and archaeological studies from within the study area and its immediate surroundings.

Table 5-6| Historical overview

DATE	DESCRIPTION
2.5 million to 250,000 years ago	The Earlier Stone Age comprises two technological phases. The earliest of these technological phases is known as Oldowan, which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. The second technological phase in the Earlier Stone Age of Southern Africa is known as the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulian phase dates back to approximately 1.5 million years ago. No information with regard to Early Stone Age sites from the surrounding area could be found. However, it seems likely for such sites to exist here.

DATE	DESCRIPTION
250,000 to 40,000 years ago	The Middle Stone Age is associated with flakes, points and blades manufactured by means of the so-called prepared core technique. A large number of Middle Stone Age materials are found around the general vicinity of the study area. Unfortunately, these are mostly in the form of surface material which has been eroded out of dongas and riverbeds. As a result the primary context of these sites and associated material is often in doubt (Van Schalkwyk, 2001).
40,000 years ago to the historic past	The Later Stone Age is associated with an abundance of very small stone artefacts or microliths. A large number of Later Stone Age materials are found around the general vicinity of the study area. Unfortunately, these are mostly in the form of surface material which has been eroded out of dongas and riverbeds. As a result the primary context of these sites and associated material is often in doubt (Van Schalkwyk, 2001). One rock painting site (which is also associated with the Later Stone Age) is mentioned by Bergh (1999) to be located on the eastern bank of the confluence of the Steenkoolspruit and the Olifants River.
1450 – 1650	This period is associated with a Late Iron Age group referred to as the Ntsuanatsatsi facies of the Urewe Tradition and was associated with the Fokeng. Its name is derived from the Ntsuanatsatsi Hill located between Vrede and Frankfort in the Free State where the earliest examples of this facies were located. The Fokeng also associate this hill with their place of origin. The Ntsuanatsatsi later moved north across the Vaal River into the Balfour, Suikerboschrand, Klipriviersberg and Vredefort areas. This movement was likely as a result of severe climatic conditions in the Free State at the time. The pottery is characterised by the predominance of comb stamping and finger pinching as decoration techniques. The necks of these pottery vessels bear broad bands of stamping and stamped arcades are also characteristic. The settlement layout has been classified as Type N or Group I and comprises a few central cattle enclosures with an enclosing wall in which a number of smaller enclosures may be located. The settlement layout may also comprise an enclosing wall with a small enclosure in the centre giving it the appearance of a 'fried egg' (Huffman, 2007).
1700 – 1820	During the early Historic Period the Ntsuanatsatsi south of the Vaal River developed into the Makgwareng facies. Though still associated with the Fokeng, this pottery is characterised by the predominance of comb-stamped triangles, finger pinching and rim notching. The settlement pattern of this group is known as Type V which is named after Vegkop near Heilbron. Type V settlements comprise cattle enclosures surrounded by beehive houses and grain bins without the presence of an enclosing wall. This type is also associated with the first appearance of corbelled huts (Huffman, 2007). An example of a Type V site from the wider landscape is the site Wildebeestfontein (5 km east of Kinross and 17km south-west of Kriel). The site was located on a domed hill surrounded by flat plateaus. The work undertaken here has revealed a stone-walled site associated with the post-*difaqane* Iron Age. It comprised circular shallow depressions around which a line of small stones interposed by big stones were packed. The site contained archaeological deposits and ceramics (Taylor, 1979).
1821-1823	After leaving present-day KwaZulu-Natal the Khumalo Ndebele (more commonly known as the Matabele) of Mzilikazi migrated through the general vicinity of the study area under discussion before reaching the central reaches of the Vaal River in the vicinity of Heidelberg in 1823 (http://www.sahistory.org.za/people/king-mzilikazi). Two different settlement types have been associated with the Khumalo Ndebele. The first of these is known as Type B walling, and is associated with the early Khumalo Ndebele settlements and conforms more to the typical Zulu form of settlement. These walls stood in the open without any military or defensive considerations and comprised an inner circle of linked cattle enclosures (Huffman, 2007). The second settlement type is known as Doornspruit associated with the later settlements of the Khumalo Ndebele in areas such as the Magaliesberg Mountains and Marico and represents a settlement under the influence of the Sotho with whom the Khumalo Ndebele intermarried. It comprises a layout which from the air has the appearance of a 'beaded necklace'. This layout comprises long scalloped walls (which mark the back of the residential area) which closely surround a complex core which in turn comprises a number of stone circles. The structures from the centre of the settlement can be interpreted as kitchen areas and enclosures for keeping small stock. As the Khumalo Ndebele passed through the general vicinity of the study areas shortly after leaving Kwazulu-Natal, one can assume that their settlements here would have conformed more to the Type B settlement. It must be stressed however that no published information could be found which indicates the presence of Type B sites in the general vicinity of the study area.
Early 1860s	While the exact date for the permanent settlement of the first white farmers in the areas surrounding the study area are not known, adjacent districts such as Standerton and Ermelo were both permanently settled by white farmers during the early 1860s. The permanent settlement of white farmers in the general vicinity of the study area would have resulted in the proclamation of individual farms and the establishment of permanent farmsteads. Features that can typically be

DATE	DESCRIPTION
	associated with early farming history of the area include farm dwellings, sheds, rectangular stone kraals, canals, farm labourer accommodation and cemeteries. While very few heritage sites associated with the very first establishment of white farmers in the study area would likely still be found, a number of farmsteads dating from the 1890s are still in existence in the general vicinity of the study area. One such an example is the original farmstead on the farm Nooitgedacht 94 IS which was used as a headquarters by the No. 3 Flying Column during the South African War. This farmstead is located approximately 8.2 km south-west of Site 10. These early farmsteads were often constructed of stone and usually had a corrugated iron roof, although the earliest farmsteads would certainly have had thatch roofs. The other sites often associated with these early farms are graves and cemeteries for both white farmers and black farm labourers. A large number of such cemeteries are located in the general vicinity of the study area.
1899 – 1902	Although no evidence for battles or skirmishes within the study area during the South African War could be found, it is known that a significant battle took place in the general vicinity. Known as the Battle of Bakenlaagte, it was one of the last significant battles of the war. While the events of the battle stretched over the farms Nooitgedacht 94 IS, Bakenlaagte 84 IS, Kruisementfontein 95 IS and Onverwacht 97 IS, the final action took place on the farm Nooitgedacht. This point is located approximately 8.2 km south-west of the study area (www.angloboerwar.com).
Early 1970s	The town of Kriel was established on the farms Roodebloem and Onverwacht and was named after the first resident magistrate of Bethal, D.J. Kriel (www.mpumalanga.com).
March 1975	The first coal was mined at the Kriel mine during this time. At the time it operated as an underground mine aimed at supplying the Kriel Power Station with coal. To maximise production the mine was subsequently turned into an opencast colliery (Lang, 1995).
1979	The Kriel Power Station was completed in this year. At the time of its completion it was the largest coal-fired power station in the southern hemisphere (www.eskom.co.za).
2.5 million to 250,000 years ago	The Earlier Stone Age is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these technological phases is known as Oldowan, which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. The second technological phase in the Earlier Stone Age of Southern Africa is known as the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulian phase dates back to approximately 1.5 million years ago. No information with regard to Early Stone Age sites from the surrounding area could be found. However, it seems likely for such sites to exist here.
250,000 to 40,000 years ago	The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called prepared core technique. A large number of Middle Stone Age materials are found around the general vicinity of the study area. Unfortunately, these are mostly in the form of surface material which has been eroded out of dongas and riverbeds. As a result the primary context of these sites and associated material is often in doubt (Van Schalkwyk, 2001).
40,000 years ago to the historic past	The Later Stone Age is the third phase identified in South Africa's Stone Age history. This phase in human history is associated with an abundance of very small stone artefacts or microliths. A large number of Later Stone Age materials are found around the general vicinity of the study area. Unfortunately, these are mostly in the form of surface material which has been eroded out of dongas and riverbeds. As a result the primary context of these sites and associated material is often in doubt (Van Schalkwyk, 2001). One rock painting site (which is also associated with the Later Stone Age) is mentioned by Bergh (1999) to be located on the eastern bank of the confluence of the Steenkoolspruit and the Olifants River.
1450 – 1650	This period is associated with a Late Iron group referred to as the Ntsuanatsatsi facies of the Urewe Tradition and was associated with the Fokeng. Its name is derived from the Ntsuanatsatsi Hill located between Vrede and Frankfort in the Free State where the earliest examples of this facies were located. The Fokeng also associate this hill with their place of origin. The Ntsuanatsatsi later moved north across the Vaal River into the Balfour, Suikerboschrand, Klipriviersberg and Vredefort areas. This movement was likely as a result of severe climatic conditions in the Free State at the time. The pottery is characterised by the predominance of comb stamping and finger pinching as decoration techniques. The necks of these pottery vessels bear broad bands of stamping and stamped arcades are also characteristic. The settlement layout has been classified as Type N or Group I and comprises a few central cattle enclosures with an enclosing wall in which a number of smaller enclosures may be located. The settlement layout may also comprise an enclosing wall with a small enclosure in the centre giving it the appearance of a 'fried egg' (Huffman, 2007).

DATE	DESCRIPTION
1700 – 1820	During the early Historic Period the Ntsuanatsatsi south of the Vaal River developed into the Makgwareng facies. Though still associated with the Fokeng, this pottery is characterised by the predominance of comb-stamped triangles, finger pinching and rim notching. The settlement pattern of this group is known as Type V which is named after Vegkop near Heilbron. Type V settlements comprise cattle enclosures surrounded by beehive houses and grain bins without the presence of an enclosing wall. This type is also associated with the first appearance of corbelled huts (Huffman, 2007). An example of a Type V site from the wider landscape is the site Wildebeestfontein (5 km east of Kinross and 17km south-west of Kriel) that was excavated by M.O.V. Taylor. The site was located on a domed hill surrounded by flat plateaus. The work undertaken here has revealed a stone-walled site associated with the post-*difaqane* Iron Age. It comprised circular shallow depressions around which a line of small stones interposed by big stones were packed. The site contained archaeological deposits and ceramics (Taylor, 1979).
1821-1823	After leaving present-day KwaZulu-Natal the Khumalo Ndebele (more commonly known as the Matabele) of Mzilikazi migrated through the general vicinity of the study areas under discussion before reaching the central reaches of the Vaal River in the vicinity of Heidelberg in 1823 (http://www.sahistory.org.za/people/king-mzilikazi). Two different settlement types have been associated with the Khumalo Ndebele. The first of these is known as Type B walling and was found at Nqabeni in the Babanango area of KwaZulu-Natal. These walls stood in the open without any military or defensive considerations and comprised an inner circle of linked cattle enclosures (Huffman, 2007). The second settlement type associated with the Khumalo Ndebele is known as Doornspruit, and comprises a layout which from the air has the appearance of a 'beaded necklace'. This layout comprises long scalloped walls (which mark the back of the residential area) which closely surround a complex core which in turn comprises a number of stone circles. The structures from the centre of the settlement can be interpreted as kitchen areas and enclosures for keeping small stock. It is important to note that the Doornspruit settlement type is associated with the later settlements of the Khumalo Ndebele in areas such as the Magaliesberg Mountains and Marico and represents a settlement under the influence of the Sotho with whom the Khumalo Ndebele intermarried. The Type B settlement is associated with the early Khumalo Ndebele settlements and conforms more to the typical Zulu form of settlement. As the Khumalo Ndebele passed through the general vicinity of the study areas shortly after leaving Kwazulu-Natal, one can assume that their settlements here would have conformed more to the Type B than the Doornspruit type of settlement. It must be stressed however that no published information could be found which indicates the presence of Type B sites in the general vicinity of the study area.
Early 1860s	While the exact date for the permanent settlement of the first white farmers in the areas surrounding the study areas are not known, adjacent districts such as Standerton and Ermelo were both permanently settled by white farmers during the early 1860s. The permanent settlement of white farmers in the general vicinity of the study area would have resulted in the proclamation of individual farms and the establishment of permanent farmsteads. Features that can typically be associated with early farming history of the area include farm dwellings, sheds, rectangular stone kraals, canals, farm labourer accommodation and cemeteries. While very few heritage sites associated with the very first establishment of white farmers in the study area would likely still be found, a number of farmsteads dating from the 1890s are still in existence in the general vicinity of the study area. One such an example is the original farmstead on the farm Nooitgedacht 94 IS which was used as a headquarters by the No. 3 Flying Column during the South African War. This farmstead is located approximately 8.2 km south-west of Site 10. These early farmsteads were often constructed of stone and usually had a corrugated iron roof, although the earliest farmsteads would certainly have had thatch roofs. The other sites often associated with these early farms are graves and cemeteries for both white farmers and black farm labourers. A large number of such cemeteries are located in the general vicinity of the study area.
1899 – 1902	Although no evidence for battles or skirmishes within the study areas during the South African War could be found, it is known that a significant battle took place in the general vicinity. Known as the Battle of Bakenlaagte, it was one of the last significant battles of the war. On 30 October 1901 the combined forces of Generals Grobler, Brits, Viljoen and Louis Botha attacked the rear guard of Colonel G.E. Benson's No. 3 Flying Column. Although the British soldiers were outnumbered almost four to one, they established themselves on a hill known as Gun Hill and fought heroically until they were almost annihilated. Of the original 210 troops, 73 were killed and 134 wounded. Colonel Benson, who was also wounded during the battle, succumbed to his wounds a few days later. The Boer losses amounted to approximately 14 killed (including General Opperman) and 48 wounded.

DATE	DESCRIPTION
	The brave rear guard action of Colonel Benson's troops ensured that the main column under Lieutenant-Colonel Wools-Sampson had enough time to establish a defensive perimeter which deterred any further Boer attacks (http://alh-research.tripod.com/Light_Horse/index.blog/1889262/bakenlaagte-south-africa-october-30-1901/). While the events of the battle stretched over the farms Nooitgedacht 94 IS, Bakenlaagte 84 IS, Kruisementfontein 95 IS and Onverwacht 97 IS, the final action took place on the farm Nooitgedacht. This point is located approximately 8.2 km south-west of the study area (www.angloboerwar.com).
Early 1970s	The town of Kriel was established on the farms Roodebloem and Onverwacht and was named after the first resident magistrate of Bethal, D.J. Kriel (www.mpumalanga.com).
March 1975	The first coal was mined at the Kriel mine during this time. At the time it operated as an underground mine aimed at supplying the Kriel Power Station with coal. To maximise production the mine was subsequently turned into an opencast colliery (Lang, 1995).
1979	The Kriel Power Station was completed in this year. At the time of its completion it was the largest coal-fired power station in the southern hemisphere (www.eskom.co.za).

B. **Palaeontological Desktop Study**

The study area is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Vryheid Formation (Ecca Group, Karoo Supergroup). The formation is considered to be of high palaeontological sensitivity, with a moderate to high likelihood that plant and ichno fossil assemblages may be present where outcrops occur. The study area is underlain by palaeontologically significant sedimentary rocks of the Vryheid Formation. The likelihood of finding fossils in disturbed and old backfilled areas, or before actual excavations into intact sedimentary rocks take place is considered fairly low.

5.2.9 Socio-economic

Although the proposed expansion to the ash dams would likely have little bearing on the receiving socio-economic environment it is still deemed necessary to look at the potential impacts in context of what is being proposed by Eskom. The variables and characteristics which underpin the socio-economic environment are briefly discussed below.

A. **Demographics**

Kriel is located within the Emalahleni Local Municipality (LM) within the Nkangala District Municipality (DM) in the North-Western part of the Mpumalanga Province. The LM covers an area of approximately 2 678 m^2, with the DM covering 16 892 m^2 in extent. The LM is home to 395 466 people and the DM has a population of 1 226 500. The district has the second largest population concentration (35%) in the province. Emalahleni LM is characterised by a strong economically active population segment, representing more than half of the total population of the DM. The LM has a growth rate of 3.6 between 2001 and 2011 which is higher than the national growth rate 1.86(Census, 2011).

The Local Municipality is dominated by the black African population (81.3%), with a smaller representation of white people (15.7%) with very few coloured (1.7%), Indian and Asian people (0.9%). The demographic composition by age is important in defining the population change and growth dynamics. The age distribution reflects a higher percentage of youth and economically active people (15 – 64) at 71% of the population, with children (0-14) slightly lower at 25% of the total population, and the elderly (64 – above) at 4%. The portion of the youth (43%) is higher than the average of the country as a whole (Emalahleni LM SDF, 2015).

B. **Service provision**

Of the total population of the district 8.3% are located in rural areas and 91.7% are in urban areas. The average household size in the LM is 3.2 (Census, 2011). Efficient service delivery is outlined in the Emalahleni LM vision and mission statement. In terms of water provision in the LM, 65.3% of the households have access to piped tap water inside their dwellings, with 21.4% having piped tap water inside their yard, approximately 13.3% of households do not have access to piped water

closer than 200m from their dwelling. This is less than the national average of 91% in terms of piped water inside dwellings. The lack of basic facilities such as water has been highlighted as a challenge that needs to be addressed in the Nkangala DM IDP (2015). With respect to sanitation 76% of households have access to a flush toilet connected to a sewerage system, 16.4% have a pit latrine, 0.5% have bucket toilets, and 1.7 have no access to sanitation while the remainder have chemical toilets or other. These conditions are more favourable than the national average of 52% in terms of flushed toilets (Emalahleni LM SDF, 2015).

In terms of energy sources for lighting, the majority (79.4%) of the households in the Emalahleni LM have access to electricity, with 18.2% only having candles, 0.2% make use of solar energy, and the remainder having either paraffin, gas , other or no energy for lighting. This is slightly below the national average of 85%. The access to refuse removal is more favourable than the national average (64%) as a whole with 73.9% of households having refuse removal services.

One of the threats identified in the IDP is dilapidated roads. In connection with this, the IDP earmarks a number of national and regional roads in the Municipality for maintenance as they are freight routes for the transport of coal from mines to power stations, one of these is the R547 which provides access to the Kriel Power Station (Emalahleni LM, 2016).

Overall, there is generally a favourable level of service provision within the LM, although there is still potential for improvement. The IDP notes that the main challenge facing the Municipality is the damage to infrastructure due to the heavy mining and industrial vehicles and general neglect of maintenance (Emalahleni LM SDF, 2015). The priority for Ward 27 has been identified as supply of water, sanitation, land for human settlement and upgrading of roads (Emalahleni LM, 2016).

C. Education

The level of education is a strong indicator of the economic status and quality of life within an area. According to Census 2011, 5.8% aged 20 and above have no formal schooling, 38.4% have some form of primary education, and 5.9% have completed primary school with 32.7% having some form of secondary education. 31.4% have completed matric with 2.5% having completed higher education. This is higher than the national average at 28% with matric but lower than the national average with higher education (12%).

The Emalahleni LM SDF (2015) outlines that there are currently four higher education facilities within the area. In relation to the low employment levels and literacy levels within the municipal area, education facilities need to be improved.

D. Employment and welfare

The Emalahleni LM has a relatively high unemployment rate (27.3%) which surpasses the national unemployment rate of 25.2% (as recorded for the fourth quarter of 2014) as set out in the IDP. The youth unemployment rate of the municipal area is 36%. According to the Emalahleni LM SDF (2015) the high unemployment rate is the highest since the initial labour force survey in 2008. The annual average household income of the municipal area is below the Minimum Living Levels of R54 000 p/a and below the national average of household income of R100 000 p/a. People in Emalahleni are relatively poor with almost 57% of the economically active population earning no income at all (Emalahleni LM, 2013) (Census, 2011) (Emalahleni LM IDP, 2016).

The Emalahleni LM IDP (2016), documents a Human Development Index (HDI) of 0.63 for the LM as per the 2011 statistics, which is the most favourable in the province but deteriorating. The HDI is measured using indicators like literacy levels, infant mortality rate, annual household income and life expectancy. The per capita personal income of R48 436, is higher than the district and is second highest in the province.

In terms of poverty and inequality, a Gini-coefficient of 0.62 was recorded for the LM in 2011 which shows slight improvement between 2001 and 2011 and is slightly lower (better) than the district (0.63) but equal to the provincial level. The poverty rate is 26.2% which is lower than the district (33.5%) and significantly lower than the province (41.6%). This could be attributed to the surrounding mines which contribute to employment and the general economy of Emalahleni (Emalahleni LM, 2016).

The Nkangala IDP indicates that in terms of welfare, the prevalence of street children in Emalahleni LM has been identified as a growing phenomenon. This phenomenon is indicative of the breakdown in the family system that manifests itself in

the public. Some social ills include HIV infection, rape, alcohol and drug abuse, crime, domestic violence and exploitation. The Nkangala DM IDP (2015) reports that the most prevalent crimes reported to the Police include robbery, murder of farm workers, house breaking, rape, drug and substance abuse by the youth.

Community services in Emalahleni LM include 5 hospitals, 6 clinics, 3 mobile clinics, a police station, 2 post offices and 2 libraries. However some of the clinics need to be revitalised. Other facilities in the area include 10 pre-schools, 6 primary schools, 4 secondary schools and 3 higher education institutions. The area also has 1 community hall and recreation facility. One of the priorities for Ward 27 has been identified as recreation and sports facilities (Emalahleni LM, 2016).

E. **Economy**

According to the Emalahleni LM SDF (2015), the economy is dominated by four sectors in terms of employment, namely coal mining (35%), followed by electricity (14.4%) and finance (14.4%) and then community, social and personal services (10.4%). The industry composition of employment shows that the majority of employed people are involved in trade (representing 21.1% of job opportunities), followed by mining (20.6%) and then manufacturing (14.2%) for the 2012 period.

As mentioned above, coal mining is the dominant mining activity in the area. Five coal seams are located within southern sections of the municipal area. Other minerals found in the area include Flint, Iron, Gold, Cobalt, Molybdenite and Iron-oxide. The District has considerable mining potential. As a result of the abundance of coal reserves within the municipal area and surrounds, Eskom has developed power stations to provide electricity for the needs of South Africa, electricity is closely linked to economic growth. The power stations include the Kriel, Ga-Nala, Matla, Wilge and Duvha power stations and form a large contribution to the local economy (Emalahleni LM IDP, 2016).

The agricultural sector is an important economic activity for the district, as the land around the area has high production value and potential (Emalahleni LM SDF, 2015). In terms of agriculture, stock farming (sheep and cattle) and maize farming with some irrigated farming, occur throughout the entire municipal area. Intensive crop farming is mainly concentrated in the areas to the south of the N4 freeway while cattle and (limited) game farming are mostly located to the north of the N4.

Manufacturing is also among the main economic drivers in the municipal area with huge potential for economic growth and job creation. Main contributors to the manufacturing sector is steel manufacturing. According to the Emalahleni LM SDF (2015), the manufacturing industry has a proxy relationship with other sectors such as mining and agriculture which increases the potential for the sector to be explored and diversified.

According to the Nkangala District IDP (2015), the district offers considerable tourism potential. The natural beauty, rural appeal and popularity of fly-fishing are the main attractions with regards to tourism in the region. The northern and eastern regions of the Nkangala District already offer a variety of tourism opportunities associated with the scenic landscape, wetlands and conservation areas such as the Ezemvelo Nature Reserve. The IDP highlights Emalahleni as an accommodation centre for tourism as a result of its tactical location between Gauteng, Nelspruit and Maputo.

In terms of the economy, the Gross Value Added (GVA) in 2011 was R40.5 billion at current prices and R19.9 billion at constant 2005 prices, which is third largest economy in the province. Key challenges include lack of diversification of the district economy, the local economy has a relatively undiversified economy with emphasis on the mining and agricultural sector; lack of education and skills; and a lack of economic opportunities (Nkangala DM, 2015). Specific opportunities identified for growth and development include manufacturing sector, tourism sector, energy sector and eco-focused development. It also recognises the need to create employment opportunities and ensure meaningful economic participation by all economic sectors and participants. There is a recognition that the economy must be diversified, this will enhance economic growth and job creation.

5.2.10 Agricultural land capability and economy

The entire site, and surrounding area, falls into a single land type, namely Bb4. The soils of this land type are predominantly deep, reasonably drained, red and yellow, sandy loams to sandy clay loams. The soils would predominantly fall into the Plinthic soil group, followed by the Oxidic, according to the classification of Fey. The Avalon soil form is the

most predominant soil type. The development layout map shown in **Figure 5-14** which shows the parts of the site that have been used for cultivation during the last ten years.

The site is located within a grain farming agricultural region with maize being the principal crop, while other crops include soya and sorghum. Seventy nine hectares is used for cultivation and most of it is dryland. The surrounding area, as well as parts of the site, is heavily impacted by mining and industrial activity.

Agricultural sensitivity to proposed development is defined by the value of the land from an agricultural production point of view. The cultivated areas therefore have a higher sensitivity, while the rest of the site, most of which is likely to be unsuitable for cultivation due to historical impact, has low sensitivity.

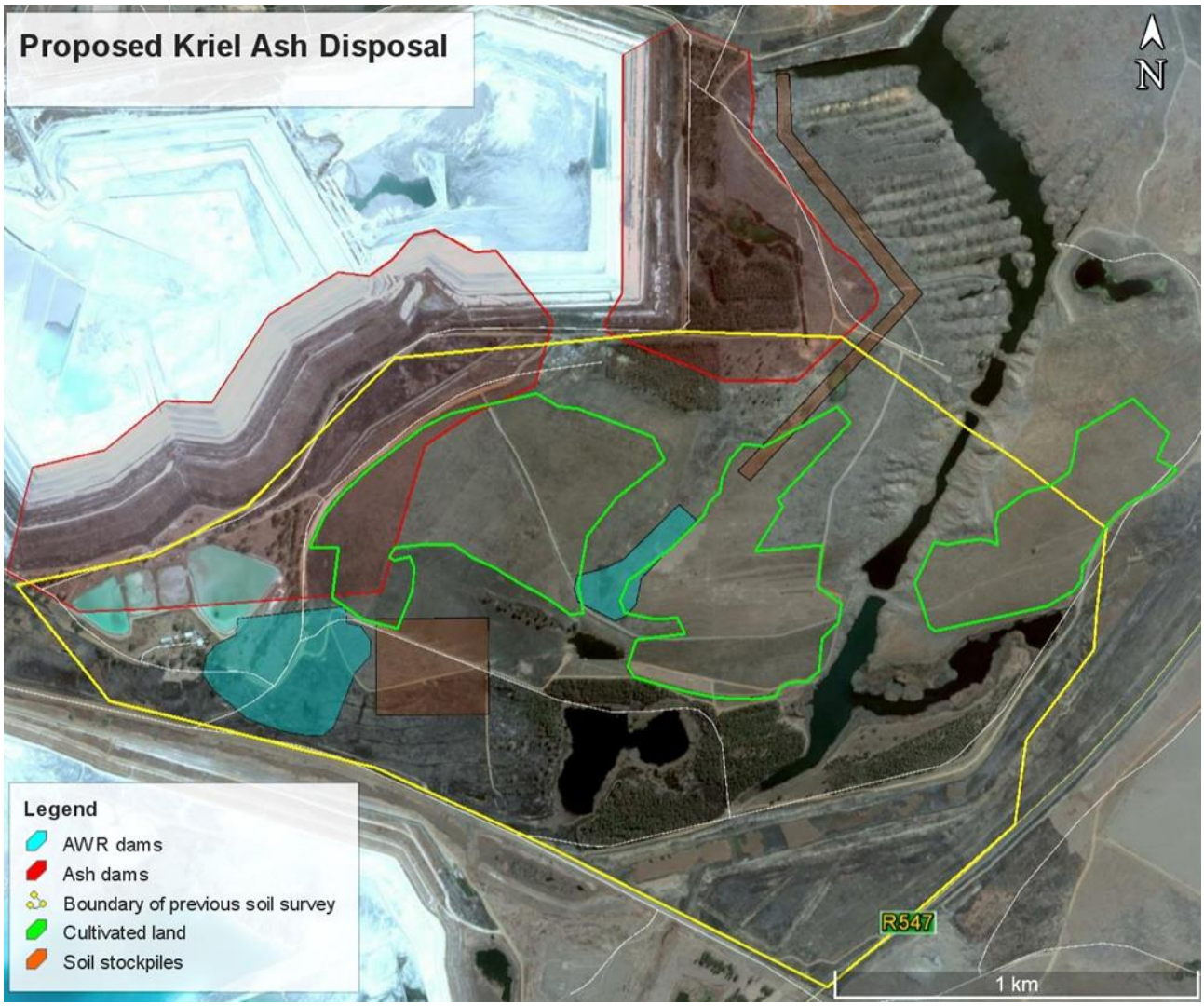


Figure 5-14 I Map of the proposed development layout showing its impact on cultivated lands on the site

5.2.11 Visual

The visual character of the area is determined by a combination of topography as well as the existing surrounding land use patterns. The general area surrounding Kriel Power Station is visually characterised by mining activities, including mine dumps and open cast mines. Grazing, maize cultivation, heavy industrial activities such as various power stations and rural and peri-urban land, forms the predominant land uses within the study area (see **Figure 5-15 to Figure 5-21**). Agricultural activities have transformed the landscape through the removal of natural vegetation to maize fields and grazing pastures. The Rietspruit dam, located north of the site, offers boating and other related recreational activities.

The broader study area can be described as being rural with a sense of industrialisation. Large industrial infrastructure already plays a significant role in the visual character of the area.

Figure 5-15 | View looking south from Kriel ash dam two towards Matla ash dams in the background

Figure 5-16 | Matla Power Station less than 3.8km west of Kriel ash dams

Figure 5-17 | Transmission lines running southwest from Kriel Power Station

Figure 5-18 | General landscape of the proposed development site

Figure 5-19 | Housing and offices north of the existing ash dams

Figure 5-20 | Atop the ash dams looking south, the ash dams are vast but little of it can be seen from ground level

Figure 5-21 | View towards south from existing Kriel ash dams

Figure 5-22 | R547 showing a typical coal truck and landscape composition of the area

5.2.12 Traffic

The site is currently accessible by a paved single-carriageway local road off R545, a regional road that connects the site to major regional and national routes: R555, N12 and N4. With the exception of the local access road and R545 intersection, the following regional roads and intersections are expected to be impacted the most by the traffic generated by proposed activities (see **Figure 5-23**):

- R545 and R547 at intersection 1 are paved single-carriageway roads which form an intersection situated southeast of the site. The R547 runs in a north east direction from its intersection with the R545 and functions as a collector/distributor road serving mainly two communities, Kriel and Thubelihle.
- R545 and R547 at intersection 2 are also paved single-carriageway roads in the immediate vicinity of the site in the northeast. Both roads function as collector/distributor roads serving mining and industrial activities.

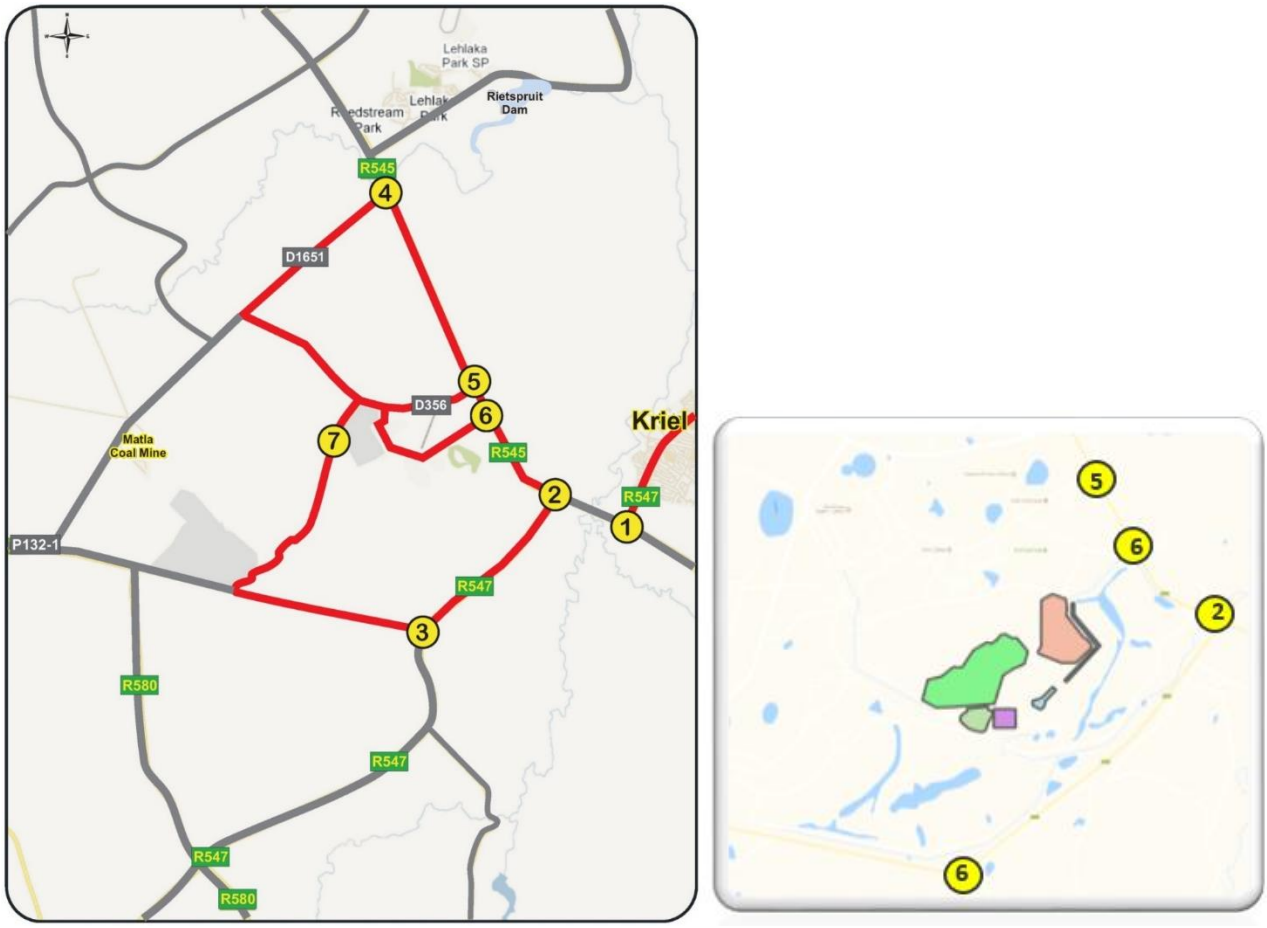


Figure 5-23| Traffic Impact Study Area and Traffic Count Locations in 2010 and 2011

The R547, at intersection 01, experiences the heaviest traffic volumes per hour, followed closely by R545. Traffic along the R545 during the AM peak north-bound direction ranges from as little as 112 vehicles per hour (vph) to 1032 vph. The heaviest traffic along this direction of the road, during the morning peak period, is experienced in the section of the R545 that is between intersections 01 and 02, where it intersects with the R547. In contrast, the heaviest south-bound traffic along the R545 is along the leg of the R545 intersecting with the D1651 (intersection 04), although relatively lower than the north-bound traffic. A vice-versa observation of the traffic volumes applies to the PM peak period. The R547 (from intersections 02 and 03) and the P132-1 experience the third and fourth highest traffic volumes, respectively. The access road at intersection 06, experiences the lowest traffic volumes, followed closely by the entrance to the North-West Shaft of the Kriel Colliery at intersection 07.

With regards to the existing public and non-motorised transport, minibus taxis and buses were the only mode of public transport observed travelling along the R545 and R547. No public transport lay-bys or stopping facilities were observed.

Relative to the roads, and in close proximity to the site, a notable number of pedestrians were observed along public roads such as the R545 and the R547 and no paved sidewalks, or any form of pedestrian facilities, were seen.

Intersection capacity analysis in the study area was undertaken using SIDRA software. The purpose of the analysis was to determine existing volume/capacity (v/c) ratios, delay (sec) and levels of service (LOS) for different years of assessment and the associated traffic impact of the development proposal. The results indicated that the overall operation of all intersections are acceptable, with the exception of the R545 and R547 intersection, where the LOS for the western approach during the afternoon peak is rated low, and the delay is significantly higher than other approaches in the same intersection, by approximately in excess of 140 seconds. This is primarily as a result of a significant number of vehicles, in the order of 400 per hour, turning right. However, this intersection will not be used for access to the site.

5.2.13 Noise

The existing residual noise climate in most of the local area is largely typical of a rural/agricultural environment as defined in SANS 10103:2008, that is, areas where ambient noise levels generally do not exceed 45dBA during the daytime period (06h00 to 22h00) and generally do not exceed 35dBA during the night-time period (22h00 to 06h00).

In the residential area of Kriel, in Thubilihle and Lehlaka Park, Rietstroom Park, Ga-Naka Village at the Kriel Power Station and in the informal settlements the existing residual noise climate is typical of a suburban environment as defined in SANS 10103:2008, that is, areas where ambient noise levels generally do not exceed 50dBA during the day and generally do not exceed 40dBA during the night-time.

There are also areas close to the two power stations and the mines where the ambient noise levels and maximum noise levels exceed that of various adjoining agricultural and residential areas. The noise footprint of the operations at the existing ash dams at Kriel Power Station is shown in Table 5-7 and Figure 5-24.

Table 5-7 I Ambient noise conditions from existing operations at the Kriel Power Station Ash Disposal Facility

Time Period	Sound pressure level at given offset (dBA)						
	500m	1000m	1500m	2000m	2500m	3000m	3500m
Daytime $L_{Req,d}$ (06h00-22h00)	55.3	48.5	44.0	40.7	38.1	35.9	33.9
Night $L_{Req,n}$ (22h00-06h00)	55.3	48.5	44.0	40.7	38.1	35.9	33.9

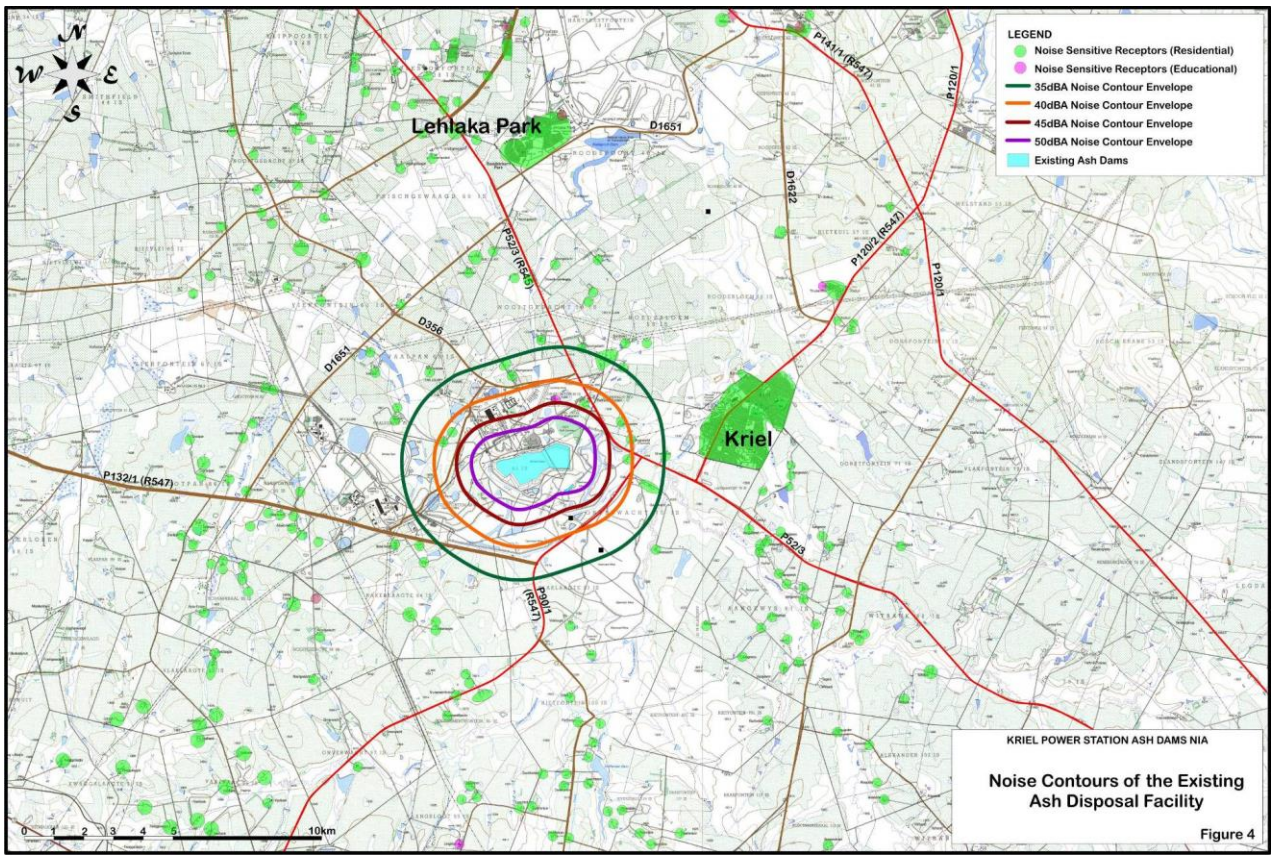


Figure 5-24 I Map showing residential (green) and eduational (pink) noise sensitive receptors, as well as the 35dBA, 40dBA, 45dBA and 50dBA noise contour envelope for the existing ash disposal facility

6 IMPACT ASSESSMENT

This Chapter aims to assess the potential impacts on the affected environment that could result from the proposed project. It contains the key findings from the specialist assessments on the affected biophysical and socio-economic environment, using the methodology described in Annexure F. Mitigation measures to enhance positive impacts and reduce negative impacts are also described.

The Scoping Phase identified various potential impacts on the biophysical and socio-economic environment which are anticipated to occur during the construction and/or operational phases as shown in **Table 6-1** below. Please note that impacts related to the local economy, existing infrastructure and services and health and safety have been addressed across the various specialist assessments (due to their interconnectedness) and are not discussed in separate sections.

Table 6-1| Specialist studies undertaken

Environment	Study	Specialist and Organisation
Biophysical	Terrestrial ecology impact assessment	Dr Brian Colloty, Scherman Colloty and Associates
	Aquatic ecology impact assessment	Dr Brian Colloty & Dr Patsy Sherman, Scherman Colloty and Associates
Biophysical and socio-economic	Groundwater assessment	Mr Louis Stroebel, Aurecon
	Air quality impact assessment	Ms Renee von Gruenewaldt, Airshed Planning Professionals
Socio-economic	Visual impact assessment	Mr Johan Goosen, Aurecon
	Heritage (including Palaeontology) impact assessment	Mr Polke Birkholtz, Professional Grave Solutions: Heritage Unit
	Noise impact assessment	Mr Derek Cosijn, Jongens Keet Associates
	Agricultural land capability and economic impact assessment	Mr Johann Lanz (2016 Update)[17]
	Traffic impact statement	Mr Werner Heyns, Aurecon

For each impact assessed, mitigation measures have been proposed to reduce and/or avoid negative impacts and enhance positive impacts. These mitigation measures are also incorporated into the Environmental Management Programme (EMPr) to ensure that they are implemented during the planning/pre-construction, construction, operational and decommissioning phases. The EMPr forms part of the EIR (**Annexure C**), as such its implementation will become a binding requirement should this project be authorised.

Each section in this chapter is divided into subsections which relate to the specific field of study. A brief introduction of the specialist which undertook the study is given and the basic Terms of Reference for their study. The context of each subsection is provided below:

- Findings of Assessment
- Impact Assessment
  - Assesses the environmental impact as it relates to the specific field of study for both construction and operation of the proposed facility with cognisance of mitigation measures that may be undertaken.
  - Provides a tabulated summary of the findings based on the methodology as provided in **Annexure F1**.
- Cumulative Impacts

[17] Please note that Mr Paul Vermaak was unable to undertake the assessment and was replaced with Mr Johann Lanz who is registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science. Please refer to **Annexure F1** for Mr Lanz's CV.

  - Provides an overview of the cumulative impacts on the specific field of study as it relates to other developments which fall within the same impact sphere.
- Mitigation Measures
  - A summary of mitigation measures which will either be included as part of the EIA recommendations or incorporated into the EMPr.
- Conclusion
  - A conclusion pertaining the feasibility of project in light of the identified impacts and the level to which they can be mitigated.

6.1 Terrestrial and aquatic ecology impact assessment

6.1.1 Findings of Assessment

The following subsections provides the key findings from the specialist assessment (see **Annexure F1**) with regards to fauna, vegetation, aquatic ecology and the ecological importance of Site 10.

A. **Fauna**

The table below provides the main findings of the specialist with regards to species richness, composition, conservation status and biodiversity value.

Table 6-2| Description of the specialist findings on mammals, ampibians, reptiles and birds

Aspect	Description
Mammals	
Species richness and composition	A total of 31 species could occur on site of which nine (9) were confirmed during the site visits. Among those confirmed were two antelope species, three rodents, one jackal, two herpestids and one hare. The mammal richness on the respective sites is considered low and reflected by opportunistic and widespread species with unspecialised life-histories. The observed richness is best explained by the absence of natural wetland features and previous disturbance regimes that contributed to large-scale habitat modification.
Species of conservation concern	Three species of conservation potential could potentially occur within the area: ■ Serval (*Leptailurus serval)* – "Near-threatened" – It is expected that the occurrence of servals on site would be rare due to the absence of suitable habitat. ■ Brown hyena (*Parahyaena brunnea*) – "Near-threatened" – It is expected that the occurrence of brown hyenas on site would be uncommon. ■ Shrew Taxa – "Data Deficient" – All shrew taxa are classified as "data deficient" and are by no means rare or uncommon.
Biodiversity value and ecological considerations	■ The proposed site sustains low mammal diversities. The observed richness on the site is best explained by the absence of primary grasslands and wetland features (the sites are dominated by cultivated land and secondary rehabilitated grassland). ■ The available habitat types provide ephemeral foraging habitat for larger mammal taxa (e.g. antelopes and meta-predators) which are seldom resident but nomadic in the area. ■ The proposed site is capable of sustaining a mammal community composed of widespread and opportunistic species.

Aspect	Description
Amphibians	
Species richness and composition	A total of 13 species could occur on the proposed study area. However, two of these have distribution patterns peripheral to the study area and are believed to be sporadic on the sites.
Species of conservation concern	Currently, none of the frog species under consideration are Red listed (Minter *et al.*, 2004).
Biodiversity value and ecological considerations	The void system on in the study area provides ephemeral breeding habitat for many of the expected species. It is worth mentioning that the species diversity consists of widespread species that are common within their respective distribution ranges.
Reptiles	
Species richness and composition	14 taxa (comprising of 9 snakes and 5 lizard species [scincids and gekkonids]) have been recorded from the QDG cells 2629AA, 2629AB and 2629AC (information obtained from the South African Reptile Conservation Assessment (SARCA)). The expected richness represents an underestimation of the reptile diversity likely to occur. Therefore, it is possible that many more species could occur although current distributional data is lacking in this regard.
Birds	
Species richness and composition	Available data suggests that the diversity of habitat types prevalent on the study site is likely to sustain approximately 50 species (www.sabap2.adu.org.za). A total of 27 species were however confirmed from surveys in the study area.
Red listed, "near-threatened" and "data deficient" species	A total of 16 Red listed bird species could potentially utilise the study area based on their respective breeding, roosting and foraging requirements. However, only two species were recorded, namely the "vulnerable" Southern Bald Ibis (*Geronticus calvus*) and the "near-threatened" Lanner Falcon (*Falco biarmicus*). Both these species were observed from the old void system near Site 10. Furthermore, the Southern Bald Ibis was observed breeding/roosting along a section of the same void system, but outside the proposed development footprint for AD4.1 and 4.2. Therefore, the nearest roosting individuals were observed approximately 940 m east of the site boundary.

B. **Flora**

The rehabilitated grasslands on Site 10 are poor in floristic richness and dominated by secondary taxa such as *Eragrostis curvula, E. plana* and *Hyparrhenia hirta*. The vegetation is also heavily grazed.

C. **Aquatic ecology**

Site 10 is located a significant distance away from important regional watercourses (i.e. the Steenkoolspruit, which is a tributary of the Olifants River) and any of the prescribed buffers of 30 m. Potential impacts would thus be limited to indirect impact such as failed pollution control dams or seepage into a groundwater system. All reports on the greater Olifants River systems indicated that these rivers are being placed under great pressure due to the mining and power generation activities. These as well as agriculture impact on the water quality and quantity of these rivers and have thus reduced the aquatic biodiversity within the region (Kotze & Louw, 2011).

The presence of the "Vulnerable" Marsh Sylph butterfly (*Metisella meninx),* African Grass Owl (*Tyto capensis*) and the African Marsh Harrier (*Circus ranivorus*) could not be confirmed during the site visit. It is unlikely that the two bird species occur due to the wetland habitat degradation that has occurred within the wetland area and the surrounding grasslands. The wetland habitat, of which much has been created by the existing ash water dams and disused open cast mines are depicted in **Figure 5-13.**

D. Ecological importance

The following aspects observed during the surveys highlighted the ecological importance of a number of habitats and were thus rated as ecologically important (High and Medium) (**Figure 6-1**).

1. The old void system on the eastern part of Site 10 provides structural roosting and breeding habitat for the "vulnerable" Southern Bald Ibis (*Geronticus calvus*) and "near-threatened" Lanner Falcon (*Falco biarmicus*) (. Both species were confirmed from the same void system on an area adjacent to the site.
2. Although artificial, the void system is regarded as an important daily dispersal corridor for certain wading and waterbird taxa (anatids and members of the P*halacrocoracidae*) that regularly utilise these areas to access the nearby Steenkoolspruit and Olifants Rivers.

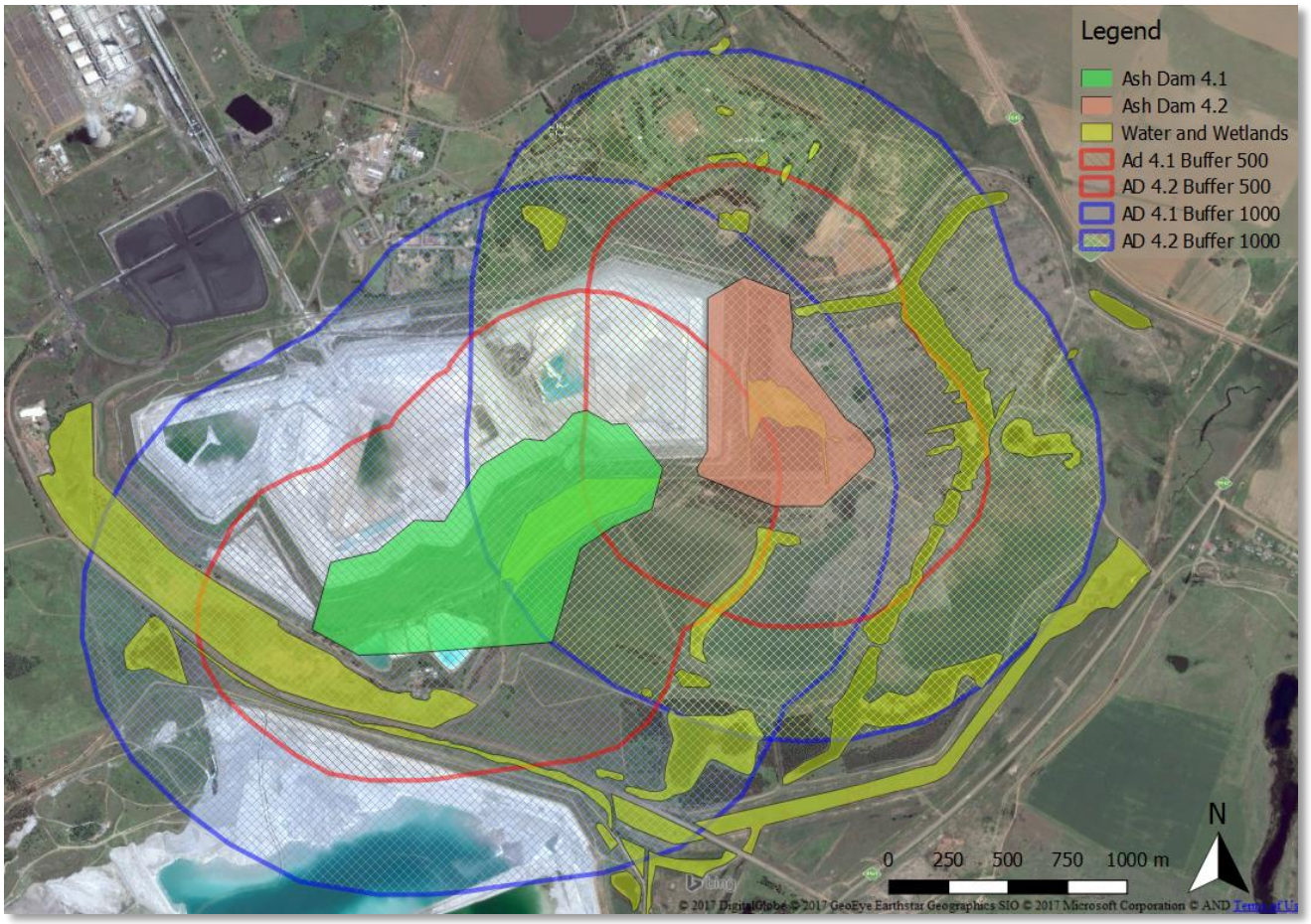


Figure 6-1| Waterbodies, wetlands and wetland associated vegetation within 1km of the proposed Ash Dam boundaries

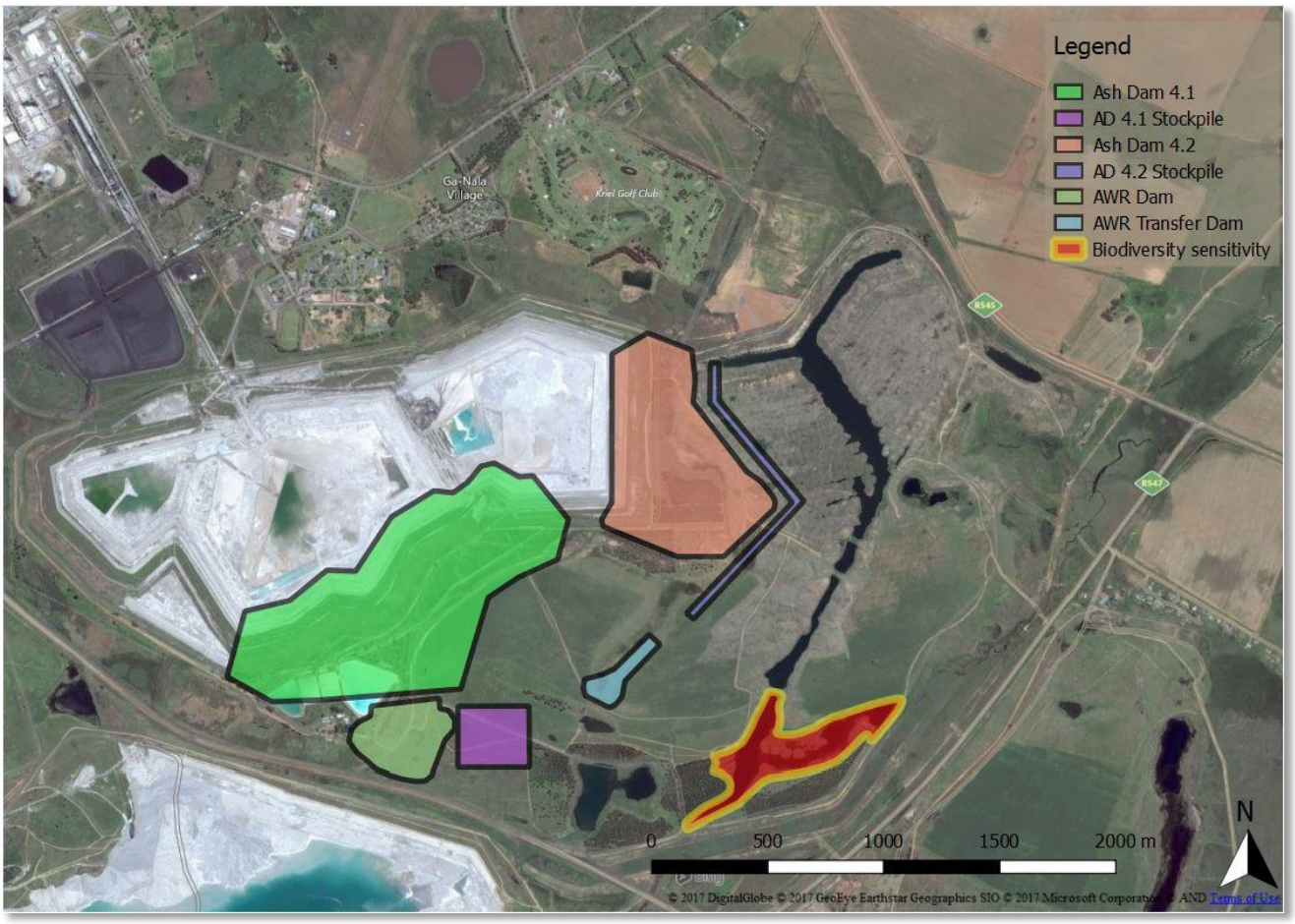


Figure 6-2 | A sensitivity map illustrating the biodiversity and ecosystem features on Site 10 (all remaining areas were rated as LOW)

6.1.2 Impact Assessment

Seven potential impacts were identified that could potentially result from the proposed construction and operation of AD4.1 and 4.2.

Phase	Construction	
Impact: Destruction of vegetation and loss of habitat	The construction of the ash dams would result in the removal and or destruction of the natural vegetation in the long-term. The significance of the impact would be LOW, with or without mitigation as most of the natural vegetation on the site is in a degraded or secondary state, thus the magnitude of the impact would be low and within a localised area.	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Long-term	Construction period
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible
Significance	Low	Low

Mitigation measures	▪ A search and rescue operation for both plants and fauna (particularly amphibians and reptiles) must be initiated prior to the commencement of any construction once the required permits are in place. Applications must be submitted to relevant authorities where applicable. ▪ Re-vegetation as part of a rehabilitation plan is always advocated, however due the nature of the site, this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers, should the excavation exceed 0.5 m. When the construction has been completed, then the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas that will not form part of the proposed infrastructure. ▪ Alien plant regrowth should also be monitored, and any such species should be removed during the construction phase.	
Phase	**Operation**	
Impact: Destruction of vegetation and loss of habitat	The status quo of the areas surrounding the undeveloped portions of the site would remain the same in the operational phase, with possible continued degradation of the environment due to the ever-increasing spread in alien plant invaders (e.g. *Bidens pilosa*). This is if the monitoring of alien vegetation is not continued from the construction phase.	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Long-term	Long-term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible
Significance	Low	Low
Mitigation measures	▪ With the construction mitigations in place and considering the present layout, large portions of the site, although with degraded vegetation communities it is recommending best practise soil conservation measures, during the operational phase, and limiting the further spread of alien invasive plant species is continued.	
Phase	**Construction**	
Impact: Possible impact on surface water quality	Construction activities, most linked to clearing of the site, could result in erosion and downstream sedimentation of water courses, should surface runoff not be controlled. The impacts would be on a regional scale due to the current state of the Olifants Rivercatchment (low water quality).	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Regional	Regional
Magnitude	High	Low
Duration	Long-term	Long-term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible
Significance	High	Low
Mitigation measures	▪ With mitigation, i.e. appropriate stormwater control, and immediate rehabilitation of areas that won't be developed the impact would be LOW. It is also recommended that downstream areas are included into any of the existing monitoring plans, ensuring that the mitigations listed above are being effective.	

Phase	Operation	
Impact: Possible impact on surface water quality	This situation would mainly only occur in the operation phase of the project. There exists the potential for surface water contamination due to uncontrolled run-off entering any local rivers or streams or seeping into subsurface systems from the ash dams. The impacts would be on a regional scale due to the current state of the Olifants catchment (low water quality).	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Regional	Regional
Magnitude	High	Low
Duration	Long-term	Long-term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible
Significance	High	Low
Mitigation measures	▪ With mitigation, i.e. appropriate stormwater control, installation of attenuation dams and cut-off drains, and lining the ash dam facilities (with appropriate monitoring and maintenance) the impact would be LOW. It is also recommended that downstream areas are included into any of the existing monitoring plans, ensuring that the mitigations listed above are being effective.	
Phase	**Construction**	
Impact: Displacement of non-wetland associated fauna	Faunal displacement (disturbances) during construction activities would be limited to those species observed during this study. The significance of the impact would be rated LOW as there is still significant habitat found within in the region, and most of the species (e.g. Gerbils, Jackals & Mongoose) have already adapted to living within mining and agricultural areas. Thus, the impact would be short-term within the site, with a low magnitude.	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Short-term	Short-term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible
Significance	Low	Low
Mitigation measures	▪ With regard mitigation, it is recommended that the contractors during the initial construction limit the disturbance to areas that will remain, i.e. will not be development by the dams thus allowing and that these species to disperse naturally into the surrounding areas, assuming that access to surrounding areas / habitats are not prevented.	

Phase	Operation	
Impact: Displacement of non-wetland associated fauna	Faunal displacement (disturbances) will be minimal during this phase, as all the observed species have already adapted to the present land use activities and will then return to any remaining areas.	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Short-term	Short-term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible
Significance	Low	Low
Mitigation measures	▪ No animals must be disturbed within the remaining areas.	
Phase	**Construction**	
Impact: Possible loss Red Data Bird habitat	This would be a national impact due to the conservation status of these birds. However, as the favoured site within the old workings would remain, and that these birds have adapted to the adjacent ash dams, they would remain within these sites.	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	National	National
Magnitude	High	Low
Duration	Long-term	Long-term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible
Significance	High	Low
Mitigation measures	▪ Mitigation would be to not allow the ash dam to extend its proposed eastern boundary, in order to retain these water bodies and cliff habitats. The impact would thus be Low to Moderate, as there is sufficient habitat within the region, thus the magnitude would be low. Should the project not go ahead, the birds would remain.	
Phase	**Operation**	
Impact: Possible loss Red Data Bird habitat	Once the facilities have been constructed or in operation, no new impacts regard these species are anticipated. Assuming the mitigation is upheld	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	National	National
Magnitude	High	Low
Duration	Long-term	Long-term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible

Significance	High	Low
Mitigation measures	▪ Mitigation would be to not allow the ash dam to extend its proposed eastern boundary, in order to retain these water bodies and cliff habitats. The impact would thus be Low to Moderate, as there is sufficient habitat within the region, thus the magnitude would be low.	

6.1.3 Cumulative Impacts

Phase	Construction	
Impact: Cumulative Impacts	The construction of the ash dams would result in the removal and or destruction of the natural vegetation in the long-term. Thus adding to the loss of natural vegetation within the region. However, the site has been chosen on the fact that area is already degraded (secondary grasslands). Furthermore, the consolidation of the ash dams into one area, thus limits the loss of habitat in the greater area, the need for additional services such as new roads and conveyors, which all in term lead to habitat fragmentation.	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Long-term	Construction period
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Reversible	Reversible
Significance	Low	Low
Mitigation measures	▪ A search and rescue operation for fauna (particularly amphibians and reptiles) must be initiated prior to the commencement of any construction once the required permits are in place. Applications must be submitted to relevant authorities where applicable. ▪ Re-vegetation as part of a rehabilitation plan is always advocated, however due the nature of the site, this may not be practical. It is suggested that the shallow topsoil layer be stockpiled separately from the subsoil layers, should the excavation exceed 0.5 m. When the construction has been completed, then the topsoil layers, which contain seed and vegetative material, should be reinstated last thus allowing plants to rapidly re-colonise the bare soil areas that will not form part of the proposed infrastructure. ▪ Alien plant regrowth should also be monitored, and any such species should be removed during the construction phase.	
Phase	**Operation**	
Impact: Possible loss Red Data Bird habitat	The status quo of the areas surrounding the undeveloped portions of the site would remain the same in the operational phase, with the only threat being the increase in alien plant invader cover. This is if the monitoring of alien vegetation is not continued from the construction phase.	
	Pre-Mitigation	**Post-mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Long-term	Long-term
Probability	Probable	Probable
Confidence	Certain	Certain

Reversibility	Reversible	Reversible
Significance	Low	Low
Mitigation measures	▪ With the construction mitigations in place and considering the present layout, large portions of the site, although with degraded vegetation communities it is recommending best practise soil conservation measures and limiting the further spread of alien invasive plant species is continued.	

6.1.4 No-go Alternative

The anticipated ecological impacts are directly related to the proposed project and would therefore not occur with the no-go alternative proceeding.

6.1.5 Conclusion

Site 10 is entirely composed of artificial habitat types (e.g. rehabilitated grassland) and is also adjacent to the existing ash disposal facility. Impacts on the regional vegetation would be minimal due to the degraded nature of the site. Furthermore, operational disturbances should be limited by the allocation of an appropriate buffer (i.e. 300m) from the void / cliff areas (the breeding and roosting area of two Red Data bird species)[18].

6.2 Groundwater impact assessment

6.2.1 Findings of Assessment

Based on the detailed groundwater analyses, the following sources were identified as potential key pollutants for assessment in Section 7.2:

1. Hydrocarbon (mainly oil and diesel) pollution during the construction phase
2. Inorganic (e.g. sulphate, chloride) pollution during operation
3. Hydrocarbon (again oil and diesel) pollution during the decommissioning phase
4. Decanting of Pit3E during the construction, operation and decommissioning phases.

The assessment further determined that seepage from the existing ash disposal occurs currently. However, very few of the ash water's components are carried into the underlying aquifer due to the unstable chemistry of the ash water. It was also determined through modelling that at worst case, there could be an additional 1 000 m^3/day inflow from AD4.1 and 4.2 into the Pit3 opencast that could add to the current decanting rate. This could increase only somewhat to approximately 1 500 m^3/day for a seriously leaking liner. It is however expected that the decanting would not significantly increase groundwater levels as the main sources for water in Pit3 are the flow from the existing ash disposal facility and natural recharge process. Therefore, the slight increase of infiltration from the new AD4.1 and AD4.2 do not affect the eventual amount of water to the defunct opencast to any significant degree.

6.2.2 Impact Assessment

Three potential impacts were identified that could potentially result from the proposed construction and operation of AD4.1 and 4.2. Even though potential pollution during the decommissioning phase was considered by the specialist, it is important that this impact be re-assessed during the planning phase for decommissioning to take into account the actual situation on site and in the changed landscape.

[18] The proposed layout meets these requirements as the sensitive bird habitat is between 500m and 700m away.

Phase	Construction, Operation and Decommissioning	
Impact: Potential hydrocarbon pollution through spillages and handling	The potential exists for hydrocarbon pollution of groundwater resources (mainly oil and diesel) to occur during the lifespan of AD4.1 and 4.2. The significance of the groundwater being polluted by hydrocarbon spillages can be rated as **VERY LOW** during construction, operation and the decommissioning phase before, and after mitigation.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Site specific	Site specific
Magnitude	Low	Low
Duration	Short term	Short term
Probability	Probable	Probable
Confidence	Unsure	Unsure
Reversibility	Reversible	Reversible
Significance	**VERY LOW**	**VERY LOW**
Mitigation measures	▪ Monitor the water quality and water levels of the sampling points as mentioned in Section 10 the Geohydrology Assessment (Annexure F1). ▪ Assess the groundwater water quality inside, upstream and downstream of AD4.1 and AD4.2 annually, and recommend mitigation measures if needed. ▪ Audit the suitability of monitoring network annually. ▪ Maintain the groundwater water monitoring network.	
Phase	**Operation**	
Impact: Potential inorganic pollution from fly ash disposal	The disposal of wet fly ash could marginally increase the pollution emanating from AD4.1 and AD4.2 for a temporary period during construction. However, the deposit from AD4.1 and AD4.2 would most likely be a dry deposit, and can thus be mitigated. The only long term impact identified by the assessment is the pollution plume spreading from the existing ash disposal facility. The marginal contribution of the lined AD4.1 and 4.2 are considered to be insignificant in comparison to the existing plume. The significance of the groundwater being polluted by inorganic substances can be rated as **MEDIUM** during the operation phase without mitigation. If mitigation measures are put in place significance of the impact can be rated as **LOW**.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Medium	Low
Duration	Medium term	Medium term
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible
Significance	**MEDIUM**	**LOW**
Mitigation measures	▪ Ensure that AD4.1 and AD4.2 are equipped with a suitable lining and seepage interception system. ▪ Install suitable seepage monitoring systems below the lining of AD4.1 and AD4.2 and procedures for correction in the event of leakage.	

Phase	Decommissioning	
Impact: Potential inorganic pollution from fly ash disposal	The significance of the groundwater being polluted by inorganic substances can be rated as **LOW** during the decommissioning phase with and without mitigation.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Long term	Long term
Probability	Definite	Definite
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible
Significance	**LOW**	**LOW**
Mitigation measures	▪ Ensure that AD4.1 and AD4.2 are equipped with a suitable lining and seepage interception system. ▪ Install suitable seepage monitoring systems below the lining of AD4.1 and AD4.2 and procedures for correction in the event of leakage.	
Phase	**Construction and Decommissioning**	
Impact: Decanting of Pit1	The impact to the groundwater is relatively insensitive to slight leaking of the liners. The significance of the groundwater decanting can be rated as **LOW** during construction and the decommissioning phase before, and after mitigation.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Regional	Local
Magnitude	Low	Low
Duration	Medium term	Medium term
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Reversible	Reversible
Significance	**LOW**	**LOW**
Mitigation measures	▪ Ensure that AD4.1 and AD4.2 are equipped with a suitable lining and seepage interception system. ▪ Install suitable seepage monitoring systems below the lining of AD4.1 and AD4.2 and procedures for correction in the event of leakage.	
Phase	**Operation**	
Impact: Decanting of Pit1	The impact to the groundwater is relative insensitive to slight leaking of the liners. During the operational phase, the significance of the impact is expected to be **MEDIUM** without mitigation and **LOW** with mitigation	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Regional	Local
Magnitude	Medium	Low
Duration	Medium term	Medium term
Probability	Probable	Probable

Confidence	Sure	Sure
Reversibility	Reversible	Reversible
Significance	**MEDIUM**	**LOW**
Mitigation measures	▪ Ensure that AD4.1 and AD4.2 are equipped with a suitable lining and seepage interception system. ▪ Install suitable seepage monitoring systems below the lining of AD4.1 and AD4.2 and procedures for correction in the event of leakage.	

In addition to the above, the following general mitigation measures shall also apply:

- Concerns and complaints of affected parties regarding the ground water issues shall be addressed.
- All remedial action shall be done in close liaison with the Department of Water and Sanitation.
- The liabilities and proposed preventative and remedial actions shall be quantified.
- Ensure that all surface water and storm water related EMP's are adhered to.

It was also recommended by the specialist that future investigations should be undertaken to determine if the ash can be used to neutralise decant water as a pre-treatment method.

6.2.3 Cumulative Impacts

Cumulative groundwater impacts are envisaged as mining operations (both opencast and underground) in close proximity to the project area already had a detrimental impact on the groundwater environment both in terms of quality and the regional groundwater table.

Please note the following background and assumptions:

- It is only the decant water that could spread to a regional extent due to surface water transport of pollutants. However, this can be mitigated through decant control measures currently in place.
- The disposal of wet fly ash could marginally increase the pollution emanating from the new ash dam for a temporary period during construction.
- The only long term impact is the pollution plume spreading from the existing ash disposal facility. The marginal contribution of AD4.1 and 4.2 is judged to be insignificant in comparison to the existing plume.

6.2.4 No-go Alternative

Should the project not proceed, no direct impacts caused by the construction, operation and decommissioning of the project components would occur.

6.2.5 Conclusion

In this study it was found that the construction of AD4.1 and AD4.2 with liners are very effective to contain additional impacts, and that only an additional amount of water would be added to the current decant volume.

What could also be important is that the pH of ash dam water is characteristically higher than that of an opencast. It is thus very likely that the water draining from the entire ash disposal facility to the opencast below would rather increase the buffer capacity of the opencast backfill and reduce AMD in the long term.

6.3 Air quality impact assessment

6.3.1 Findings of Assessment

The table below provides the main findings of the specialist assessment with regards to baseline condition and potential impacts related to the proposed development of Site 10.

Table 6-3| Description of the main findings of the air quality assessment

Aspect	Description
Baseline conditions	
Main particulate sources	The main sources likely to contribute to cumulative particulate ground-level concentrations near Kriel Power Station are: ■ Matla Power Station ■ Matla coal mine ■ Surrounding agricultural activities ■ Other mining activities, especially open cast mining ■ Biomass and domestic fuel burning ■ Vehicle entrainment on unpaved road surfaces ■ Persistent pollutants from more distant industrial sources
Sensitive receptors	The nearest sensitive receptors to the proposed ash dam extension is the town of Kriel (see **Figure 6-3**).
Particulate concentrations	Measured ambient PM_{10} concentrations at the Kriel monitoring station were non-compliant with the National Ambient Air Quality Standards (NAAQS) (for daily and annual averaging periods) for the three-years assessed (2013 to 2015).
Post development conditions	
Particulate concentrations	The highest $PM_{2.5}$ and PM_{10} concentrations due to proposed project operations were in compliance with NAAQS at the closest sensitive receptors. The highest daily dust depositions due to proposed operations were below the Dust Control Regulations (NDCR) of 600 mg/m²/day for residential areas at all sensitive receptors within the study area.

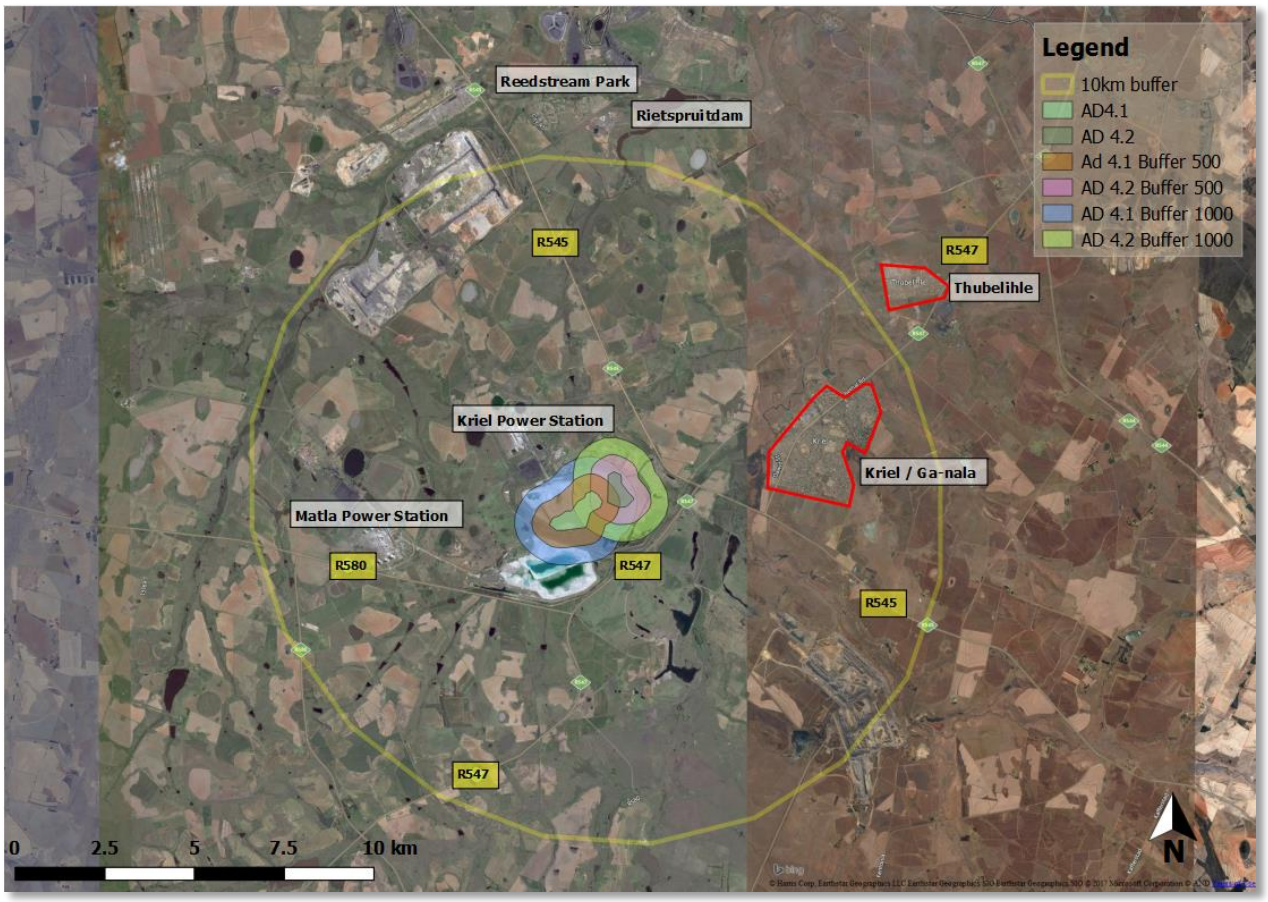


Figure 6-3 | Location of the receptors to the proposed operations

6.3.2 Impact Assessment

Three potential impacts were identified as a result of a degraded ambient air quality.

Phase	Construction	
Impact: Degraded ambient air quality	The extent of dust emissions would vary substantially from day to day depending on the level of activity, the specific operations, and the prevailing meteorological conditions. Unmitigated construction activities provide the potential for impacts on local communities, primarily due to nuisance and aesthetic impacts associated with fugitive dust emissions. On-site dustfall may also represent a nuisance to employees. This can however be mitigated to have a **VERY LOW** impact.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Site-specific
Magnitude	Medium	Low
Duration	Short-term	Short-term
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Reversible	Reversible
Significance	**MEDIUM**	**VERY LOW**
Mitigation measures	▪ Implement dust control measures, including control techniques for fugitive dust sources such as watering, chemical stabilization, and the reduction of surface wind speed though the use of windbreaks and source enclosures.	
Phase	**Operation**	
Impact: Degraded ambient air quality impacting on human and animal health	Simulations were undertaken to determine the particulate matter concentrations as well as total daily dust deposition from operations due to the Kriel ash dam extension. The proposed impacts were assessed with the current operations of the Kriel Power Station boilers as well as the existing ash disposal facilities. The highest $PM_{2.5}$ and PM_{10} concentrations are in compliance with NAAQS at the closest sensitive receptors. The highest daily dust depositions are below the NDCR of 600 mg/m²/day for residential areas at all sensitive receptors within the study area. Dustfall may have an impact on vegetation/ crops although there is little evidence of that in the South African context.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Site specific	Site specific
Magnitude	Medium	Low
Duration	Long-term	Long-term
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Reversible	Reversible
Significance	**MEDIUM**	**LOW**
Mitigation measures	▪ The sidewalls of the ash dams shall be vegetated to such an extent as to ensure at least 80% control efficiency. ▪ The top surface area of the ash dams could have 40% wet beach area. ▪ A water spraying system shall be implemented on the surface of the ash dam covering the outer perimeter of the dam spraying water when winds exceed 4 m/s. ▪ Ambient monitoring shall be done.	

Phase	Decommissioning	
Impact: Degraded ambient air quality impacting on human and animal health	The potential for air quality impacts during this phase would depend on the extent of demolition and rehabilitation efforts during closure. Impacts would be caused by the generation of TSP, $PM_{2.5}$ and PM_{10} with the recovery of topsoil from stockpiles for rehabilitation and re-vegetation of the ash dams. This can however be mitigated to have a **LOW** impact.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Site specific	Site specific
Magnitude	Medium	Low
Duration	Long-term	Medium-term
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Reversible	Reversible
Significance	**MEDIUM**	**LOW**
Mitigation measures	▪ Dust control measures for open areas, consisting of wet suppression, chemical suppressants, vegetation, wind breaks, etc. shall be implemented.	

6.3.3 Cumulative Impacts

The main sources likely to contribute to cumulative particulate ground-level concentrations in the vicinity of Kriel Power Station are: Matla Power Station, Matla coal mine, surrounding agricultural activities, biomass burning, domestic fuel burning, other mining activities (especially open cast mining), vehicle entrainment on unpaved road surfaces and persistent pollutants from more distant industrial sources.

Given the potential for cumulative impacts, it is recommended that control measures (as described in the above section) be implemented throughout the life of the operations at the proposed ash dams and that Eskom commit itself to dust management planning.

6.3.4 No-go Alternative

As mentioned in Section 5.2.2, the ambient PM_{10} concentrations recorded at the Kriel Village station were in non-compliance with the NAAQS. Elevated PM_{10} concentrations (80 µg/m³ or above) originate to the north-westerly sector at wind speeds greater than 4 m/s (likely due the mining activities 10 km north-west of the monitoring station). Similarly, low wind speeds (<1 m/s) result in an almost equal contribution to PM10 concentrations from all wind sectors, with daily average concentrations of approximately 60 µg/m³. This situation is not anticipated to change significantly under the no-go alternative.

6.3.5 Conclusion

The specialist assessment determined that the highest $PM_{2.5}$ and PM_{10} concentrations due to proposed project operations were in compliance with NAAQS at the closest sensitive receptors. The highest daily dust depositions due to proposed operations were below the NDCR of 600 mg/m²/day for residential areas at all sensitive receptors within the study area. It was however recommended that a dust fallout monitoring network be implemented, as well as mitigation measures on main sources of fugitive dust (which has an elevated ambient air quality rating for baseline conditions).

6.4 Visual impact assessment

6.4.1 Findings of Assessment

Despite the physical characteristics of the area (topography and vegetation cover) which allows for wide vistas, the nature of land uses (existing mining infrastructure) ensures a low level of visual sensitivity and a visual absorption capacity (VAC). During the initial years of the lifespan of AD4.1 and 4.2, the visual impact can even be considered as negligible. It would however increase in relation to the years.

AD4.1 and 4.2 would be visually absorbed into the surrounding context and would not be in contrast to the present activities found within the immediate context of the site. Visual intrusion would be much lower as it would relate to the existing ash disposal facility with regards to colour, shape and scale. Furthermore, the maximum rate of rise for the ash dam would also be notably less than if it were a separate greenfields development.

Viewer sensitivity can also be considered to be lower as regular travellers and people residing in Kriel, Thubelihle and the informal settlement are familiar with the visual scene related to existing mining and power station activities (see **Figure 6-4 and Figure 6-5**).

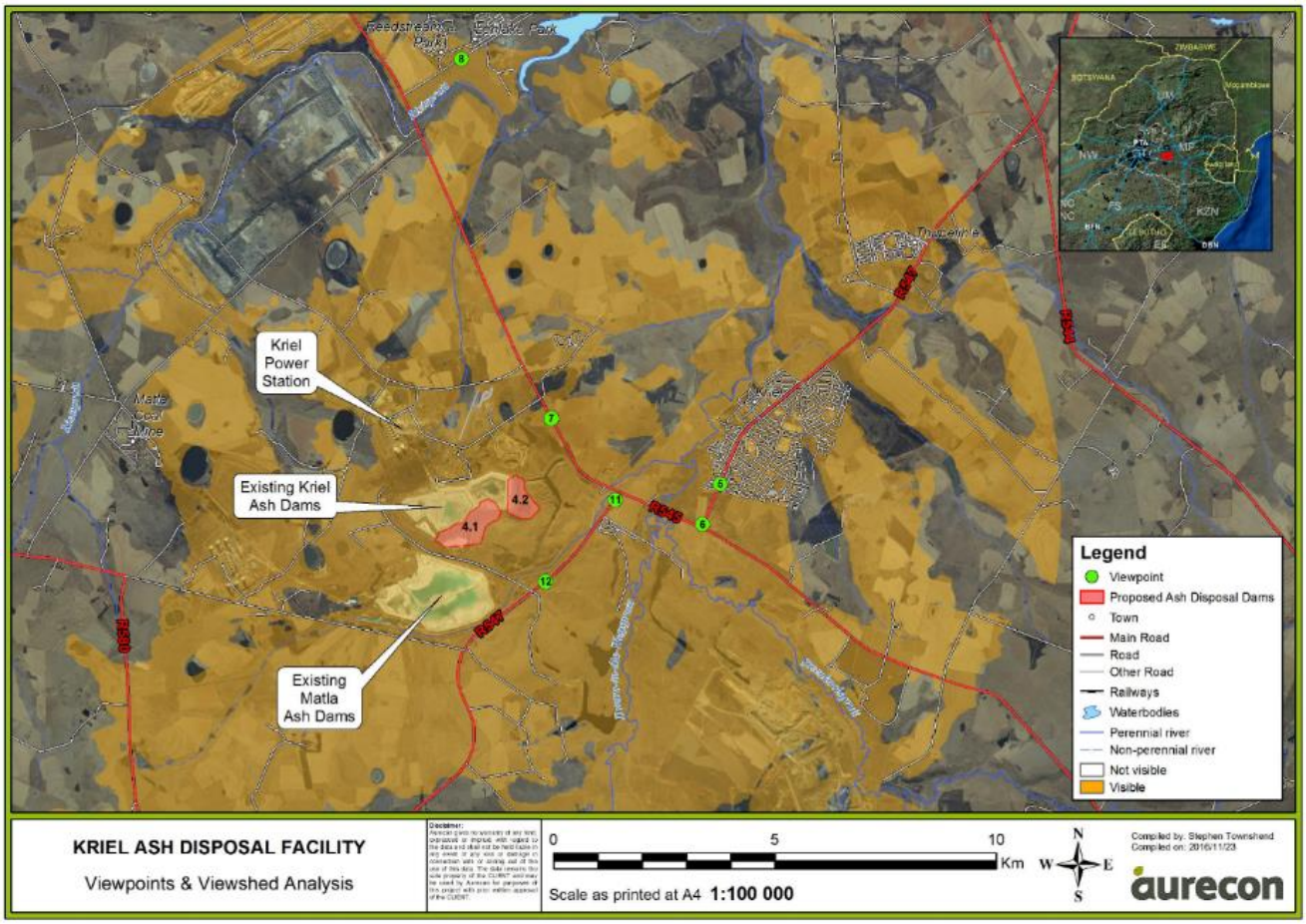


Figure 6-4 I Key observation points identified by the Visual Impact Assessment

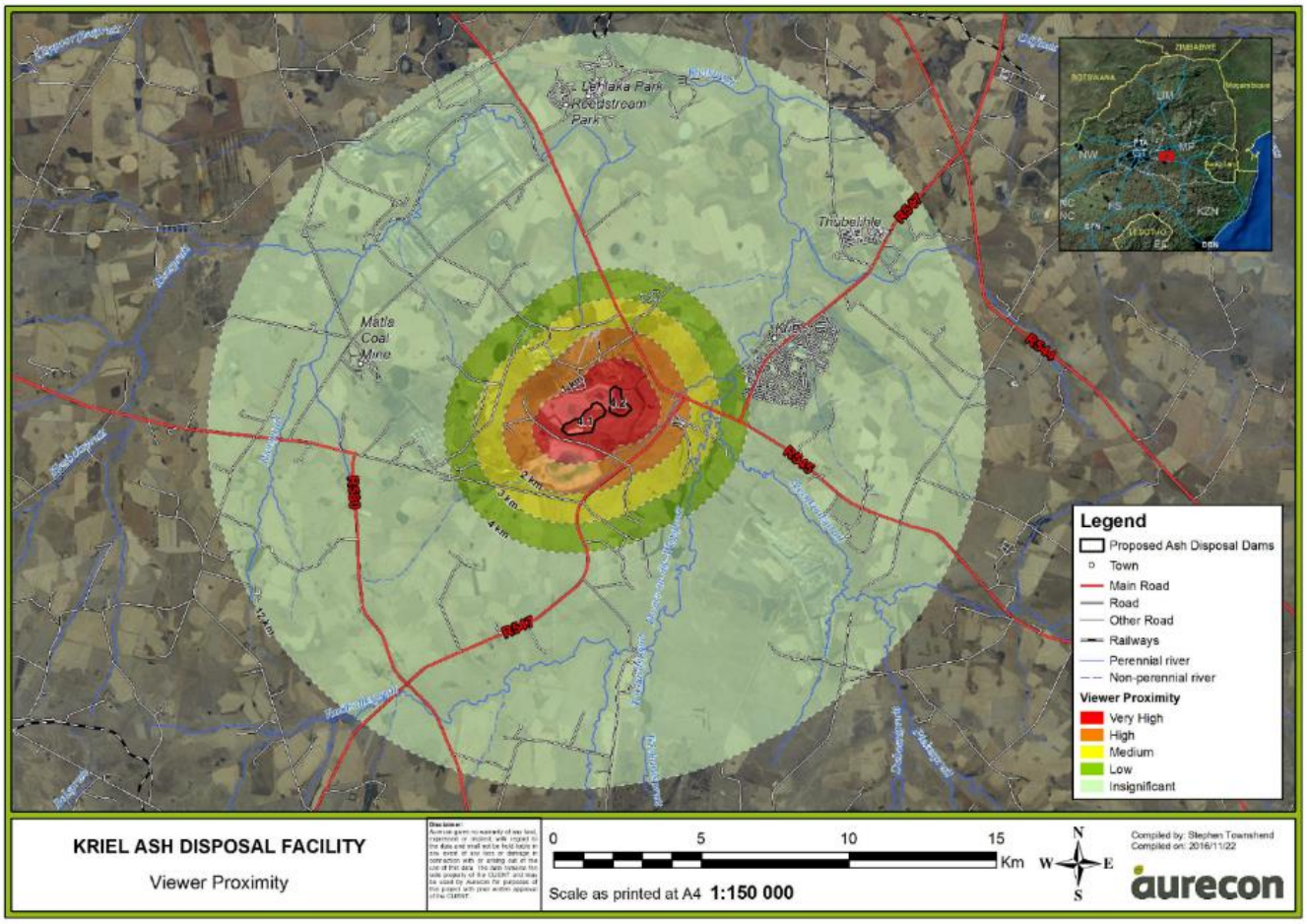


Figure 6-5 I Impact zones with regards to viewer proximity

6.4.2 Impact Assessment

The potential visual impacts associated with the proposed AD4.1 and 4.2 are provided in the table below.

Phase	Construction, Operation and Decommissioning	
Impact: Visibility of the project	Even though Site 10 is reasonably visible from populated areas, the significance will be low with medium visibility. As a result of the natural topography Site 10 will not be visible from areas lying to the north. The low significance is as a result of the proximity and location of existing mining related infrastructure.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Regional	Regional
Magnitude	Very low	Very low
Duration	Long term	Long term
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Irreversible	Irreversible
Significance	**LOW**	**LOW**
Mitigation measures	▪ None. Even though the proposed ash dam will be effectively screened and anchored in the existing context the topography of the greater area around the ash dam facility will not change.	

Phase	Construction, Operation and Decommissioning	
Impact: Viewer incidence and perception	Viewer incidence for the site is rated as low significance. Clear views would be from key observation points 5, 6 and 11, turning from the R545 onto the R547 (**Figure 6-4**). The viewer sensitivity would be low due to the actual familiarity of the scene as well as the positioning of the ash dam within the existing mine context. Occurrence of a negative perception must be expected especially during the construction phase of the project due to a potential increase in dust pollution.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Very low
Duration	Long term	Long term
Probability	Probable	Probable
Confidence	Sure	Sure
Reversibility	Irreversible	Irreversible
Significance	**LOW**	**VERY LOW**
Mitigation measures	▪ The topsoil shall be stripped and stockpiled for use during rehabilitation. The presence of degraded areas and disused construction roads, which are not rehabilitated, would increase the overall visual impact. ▪ Cut and fill slopes shall mimic the shapes and angles found in the adjacent area. ▪ All cut and fill slopes and areas affected by construction work shall be progressively topsoiled and re-vegetated as soon as possible. ▪ New ancillary structures shall be built in the same style to ensure visual continuity and may also be very effectively screened with vegetation and tree lines of indigenous species. ▪ Position the ash dam on site in such a way that travellers on the R545 and R547 receive minimum perpendicular views towards the proposed impact. ▪ Once construction is completed, the construction camps (including temporary access roads, laydown areas and worker camps) and all other areas affected by the construction works shall be rehabilitated. The implementer and its contractor shall fully comply with the rehabilitation requirements as depicted in the approved EMPr. ▪ When vegetation is cleared for servitudes and roads, the edges of the cleared area should be organic or curvilinear rather than straight and sharp, if feasible. Organic and irregular lines would blend in with the natural formation of the landscape and as a result minimise the visual impact. ▪ Dust, as a result of construction activities and haulage, must to be suppressed through regular watering of surface areas. ▪ Where possible, suitable tree species should be planted in front of the proposed ash dam embankment in order to soften the ash dam's linear profile, without the potential to compromise the stability of the facility. ▪ Slopes should be vegetated using suitable indigenous grass species (or as specified in the mine's existing rehabilitation plan) as this will allow the ash dam to blend in with the existing landscape colours. ▪ After operations the ash dam should be shaped and rehabilitated appropriately according to the mine's existing rehabilitation plans.	

Phase	Construction, Operation and Decommissioning	
Impact: Visual absorption capacity	The presence of similar infrastructure is an important factor in the determination of visual absorption capacity. The majority of the area, surrounding the proposed site has an industrial characteristic and additional similar facilities would not be incongruent in this setting. As a result, the landscape has a high visual absorption capacity within the context of the proposed AD4.1 and 4.2 for as well as the ancillary structures of pump houses and seepage catchment dams. The visual absorption capacity's significance is rated as low.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Very low
Duration	Long term	Long term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible
Significance	**LOW**	**VERY LOW**
Mitigation measures	■ Specifications with regards to the placement of construction camps, as well as a site plan to of the construction camp, indicating waste areas, storage areas and placement of ablution facilities shall be included in the Environmental Management Program. These areas shall either be screened or positioned in areas where it is less visible from human settlements and main roads (such as the R545 or the R547), and as agreed with Site Engineer and ECO. ■ Where applicable related ancillary structures shall be shielded with appropriate landscaping techniques. ■ Slopes shall be vegetated using suitable indigenous grass species (or as specified in the mine's rehabilitation plan) as this will allow the ash dam to blend in with the existing landscape colours.	
Phase	Construction, Operation and Decommissioning	
Impact: Lighting	The assumption was made that a high concentration of light sources would be found around the ash dam periphery. Impacts will most likely occur as a result of light trespass and glare. Possible affected areas include farm houses and settlements closer than 2km from the light source.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Regional	Local
Magnitude	Low	Very low
Duration	Long term	Long term
Probability	Definite	Definite
Confidence	Unsure	Unsure
Reversibility	Reversible	Reversible
Significance	**LOW**	**LOW**

Mitigation measures	▪ Security and construction lighting shall, as far as possible, not be focused on temporary structures and construction works. Where this is unavoidable, lighting shall be as unobtrusive as possible and reflectors can be used to avoid light spillage. ▪ The use of mass lighting shall be avoided. ▪ All light sources shall be directed downwards. ▪ Lighting sources shall be shielded where possible. ▪ Where possible trees shall be planted around ancillary structures that would be visible from human settlements and main roads (such as the R545 and R547). ▪ The development of a lighting policy for all phases of the project is recommended.

6.4.3 Cumulative Impacts

While it is usually preferable to consolidate any new impacts with existing visual impacts of the same type rather than impose it on a different landscape, the cumulative effects of several negative impacts tends to compound the perceived negativity associated with them. However, mitigation measures that help to blend the new development with the existing landscape can effectively neutralise this potential increase in negative perception. Since the Kriel ash disposal facility and the nearby Matla ash dam are in relatively close proximity, cumulative impact must be considered. It is thus important to ensure that mitigation measures of the potential visual intrusion are effective for the new developments.

6.4.4 No-go Alternative

The anticipated visual impacts are directly related to the proposed project and would therefore not occur with the no-go alternative proceeding.

6.4.5 Conclusion

AD4.1 and 4.2 would be visually absorbed into the surrounding context and would not be in contrast to the present activities found within the immediate context of the site. Viewer sensitivity can also be considered to be lower as regular travellers and people residing in Kriel, Thubelihle and the informal settlement are familiar with the visual scene related to existing mining and power station activities. Mitigation measures should however be regarded as just as important as if the impact were to occur in a pristine landscape due to the potential for large negative cumulative impacts.

6.5 Heritage impact assessment (including palaeontology)

6.5.1 Findings of Assessment

Due to the previous mining activities in the general area, extensive sections of the site can be described as disturbed. No heritage resources sites were identified within the study area from the fieldwork. However, it was determined that the site is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Vryheid Formation (Ecca Group, Karoo Supergroup). The formation is considered to be of high palaeontological sensitivity, with a moderate to high likelihood that plant and ichno fossil assemblages may be present where outcrops occur. The likelihood of finding fossils in disturbed and old backfilled areas, or before actual excavations into intact sedimentary rocks take place is however considered fairly low.

6.5.2 Impact Assessment

No impact assessment was undertaken for heritage resources as no heritage resource sites were found during the survey. One potential impact associated with the proposed development on palaeontological resources has however been identified and is evaluated in the table below.

Phase	Construction	
Impact: Destruction of palaeontologically significant material	Destruction of palaeontologically significant material in the fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Ecca Group Vryheid Formation.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Medium	Low
Duration	Long term	Long term
Probability	Probable	Probable
Confidence	Certain	Certain
Reversibility	Irreversible	Irreversible
Significance	**HIGH**	**Low**
Mitigation measures	In the case of possible excavation into fresh sedimentary bedrock: ■ A qualified palaeontologist shall be employed to record and remove any fossils. ■ A collection and destruction permit shall be obtained from XXXX for all fossil material encountered during the process.	

In addition to the above, the following general mitigation measure shall be applied:

- Any changes to the existing layout of any of the proposed development footprints (i.e. site boundaries and associated infrastructure) will be surveyed by a suitably qualified heritage specialist.

6.5.3 Cumulative Impacts

As no heritage resources sites were found during the survey of the study area the potential cumulative impact is neutral. Archaeological and palaeontological impacts are site specific.

6.5.4 No-go Alternative

Should the proposed project not proceed, any paleontological features that do occur would continue to weather naturally over time. No additional impacts are anticipated.

6.5.5 Conclusion

No heritage resources were identified on site. The palaeontological desktop study did however reveal that the proposed development footprint is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Ecca Group Vryheid Formation which has a moderate to high likelihood for fossil assemblages to be present where outcrops occur. Excavations into unweathered/*in situ* sedimentary bedrock within the proposed development footprint will require palaeontological monitoring with the possibility that this may lead to the identification and removal of fossil material and implementation of appropriate mitigation procedures.

On the condition that the above recommendations are adhered to, no heritage reasons can be given for the construction of AD4.1 and 4.2 not to take place.

6.6 Noise impact assessment

6.6.1 Findings of Assessment

The following subsections provides the key findings from the specialist assessment (see Annexure F1) with regards to construction and operational phases of AD4.1 and 4.2

Table 6-4| Description of the noise specialist's findings

<table>
<tr><th>Aspect</th><th>Description</th></tr>
<tr><td colspan="2">Construction</td></tr>
<tr><td>General</td><td>The daily construction related traffic will vary over the period of the construction. It has been estimated that the construction activities at the site will, on average, generate no more than about 50 vehicle trips (two way trips) daily. A large percentage of the trips will be concentrated in the morning and evening peak periods.</td></tr>
<tr><td>Construction noise conditions</td><td>Construction would likely be carried out during the daytime only (07h00 to 18h00 or 20h00). It should however be noted that certain activities may occasionally extend into the late evening period, while others such as de-watering operations may need to take place over a 24-hour period. It is estimated that the basic development of the project would take place over a period of about 12 months. Note that the construction of AD4.1 and 4.2 would in fact be an ongoing activity throughout the life of the operational phase.</td></tr>
<tr><td>Sources of noise</td><td>The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. Typical noise levels generated by various types of construction equipment include camp establishment, earthworks, relocation of services, etc. (see Section 6.21 of Annexure F1). These noise levels assume that the equipment is maintained in good order. Conservative attenuation conditions (related to intervening ground conditions and screening) have been applied.

Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme for the various components, work modus operandi and type of equipment have not been finalised. Using baseline data from typical construction sites, the ambient noise conditions at various offsets from the following main construction activities (i.e. concrete batching plant and general concrete construction) have been predicted as follow:

<table>
<tr><th rowspan="2">Equipment</th><th colspan="6">Sound pressure level at given offset(dBA)</th></tr>
<tr><th>500m</th><th>1000m</th><th>1500m</th><th>2000m</th><th>2500m</th><th>3000m</th></tr>
<tr><td>Concrete Batching Plant</td><td>53.6</td><td>46.0</td><td>41.1</td><td>37.5</td><td>34.7</td><td>32.3</td></tr>
<tr><td>Concreting Operations</td><td>57.2</td><td>49.1</td><td>43.9</td><td>40.1</td><td>37.1</td><td>34.6</td></tr>
</table>
</td></tr>
<tr><td>Noise impact</td><td>From the details presently available, it appears that the construction noise impact is not likely to be severe if good noise management procedures are applied on site and various mitigation measures implemented.

The general nature of the noise impacts from the construction sites is predicted to be as follows:

■ Source noise levels from many of the construction activities will be high. Noise levels from all work areas would vary constantly and in many instances significantly over short periods during any day working period.
■ Working on a worst case scenario basis, it is estimated that the ambient noise level from general construction activities could negatively affect noise sensitive sites within a distance of 1400 metres of the construction site. Note that this is the offset of the 45dBA noise contour from the construction.
■ Night-time construction could have a significant impact on noise sensitive sites within a radius of 3000 metres of the construction site.</td></tr>
</table>

<table>
<tr><th>Aspect</th><th>Description</th></tr>
<tr><td></td><td>

There are some short-term noises that may, at times, be heard beyond the indicated positions of the respective 35dBA contours (e.g. blasting). There are likely to be some significant noise nuisance effects from these intermittent loud noises on some people living in the area.
It has been estimated that the construction activities would on average generate about 50 vehicle trips (two way trips) daily. In general, the construction traffic will have a relatively minor effect on the noise climate alongside the main external roads in the area. Because of the character of the traffic (namely heavy vehicles), there is likely to be some noise nuisance factor with the passing of each vehicle at noise sensitive receptors along the access routes.
There are a number of noise sensitive receptors in the vicinity of the development site that are likely to be affected by construction noise. The nature of the impact will be related to more to noise nuisance (annoyance) than to noise disturbance.

The general nature of the noise impacts from road construction (access roads) activities is predicted to be as follows:

The level and character of the construction noise would be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.
As no specific construction details or possible locations of major ancillary activity sites are available at this stage, the anticipated noise from various types of construction activities cannot be calculated accurately. In general at this stage, it can be said that the typical noise levels of construction equipment at a distance of 15 metres lie in the range of 75 decibels (dBA) to 100dBA. Based on data from similar “linear” construction sites, a one-hour equivalent noise level of between 75dBA and 78dBA at a point 50 metres from the construction would be typical for the earthmoving phase.
There are no noise sensitive receptors in the vicinity of the development site that are likely to be affected by noise from the road construction.

</td></tr>
<tr><td colspan="2">Operation</td></tr>
<tr><td>General</td><td>In general, it is not anticipated that the noise levels from these existing sources (traffic on main roads, Matla and Kriel power stations, mines and general farming activities) would increase significantly in the future, with the exception of road traffic noise.

The noise generated by AD4.1 and 4.2 and its ancillary works would be added to the noise climate prevailing in the area (cumulative effects).</td></tr>
<tr><td>Noise sensitive areas</td><td>Existing noise sensitive receptors that are likely or could potentially be impacted by the proposed expanded ash disposal facility includes various suburban and rural residences and schools (see Figure 6-3).</td></tr>
<tr><td>Sources of noise</td><td>The following sources could have additional noise impacts:

Construction of daywalls / continuous pumping of ash slurry to AD4.1 and 4.2.
Return water pumps

Noise generated by traffic would have a minor effect.</td></tr>
<tr><td>Ash disposal</td><td>The ash dam construction operations for the wet ash would not extend at one time over the whole area of the ash dam, but the area will be worked incrementally. As a result, there would not be a static noise footprint from the facility. The noise levels from the respective sections being worked would also vary as the height of the dam increases. As the height of the dam increases, the overall noise footprint would increase, but at the same time, the noise sensitive sites closer to the dam would be shielded from the noise. This is due to the shielding effect of the sides of the ash dam.

The main sources of noise from the wet ashing process would be from excavators, front-end loaders, dozers, compactors and trucks:
<table>
<tr><th rowspan="2">Time Period</th><th colspan="7">Sound pressure level at given offset (dBA)</th></tr>
<tr><th>500m</th><th>1000m</th><th>1500m</th><th>2000m</th><th>2500m</th><th>3000m</th><th>3500m</th></tr>
<tr><td>Daytime $L_{Req,d}$ (06h00-22h00)</td><td>55.3</td><td>48.5</td><td>44.0</td><td>40.7</td><td>38.1</td><td>35.9</td><td>33.9</td></tr>
<tr><td>Night $L_{Req,n}$ (22h00-06h00)</td><td>55.3</td><td>48.5</td><td>44.0</td><td>40.7</td><td>38.1</td><td>35.9</td><td>33.9</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Aspect</th><th>Description</th></tr>
<tr><td>Return water dams</td><td>Water from the ash disposal facility is continuously pumped back to the power station for re-use via the return water dam and pipeline. The main source of virtually continuous noise from the return water dam complex would be from the pumps. The noise footprint of the pump station is relatively small when compared to the noise generated by the ash dam construction, that is, the pump station 35dBA footprint is contained within the 45dBA footprint of the ash dam. For the underground return pipeline, no noise will be generated above surface. The anticipated ambient noise conditions are as follow:
<table>
<tr><th rowspan="2">Time Period</th><th colspan="7">Sound pressure level at given offset (dBA)</th></tr>
<tr><th>100m</th><th>200m</th><th>300m</th><th>400m</th><th>500m</th><th>600m</th><th>800m</th></tr>
<tr><td>Daytime $L_{Req,d}$ (06h00-22h00)</td><td>54.4</td><td>48.0</td><td>44.1</td><td>41.3</td><td>39.1</td><td>37.2</td><td>34.2</td></tr>
<tr><td>Night $L_{Req,n}$ (22h00-06h00)</td><td>54.4</td><td>48.0</td><td>44.1</td><td>41.3</td><td>39.1</td><td>37.2</td><td>34.2</td></tr>
</table></td></tr>
</table>

6.6.2 Impact Assessment

The potential impact of noise on the surrounding environment is shown in the table below.

<table>
<tr><th>Phase</th><th colspan="2">Construction and Operation</th></tr>
<tr><td>Impact:
Noise disturbance</td><td colspan="2">There are several noise sensitive receptors (NSR) to the east and north-west of the ash disposal facility. The Ga-Nala Village at the Kriel Power Station lies within the 50dBA noise contour. This village would experience higher noise levels that are allowable for daytime suburban residential conditions (SANS 10103). The rural residential NSRs within the 45dBA contour would be impacted by daytime operations. If night-time operations of dam wall construction are allowed, the suburban residential areas within the 40dBA noise contour and the rural residential areas within the 35dBA contour would be negatively impacted. Essentially the construction of AD4.1 and 4.2 would extend the noise footprint eastwards.</td></tr>
<tr><td></td><td>Pre-Mitigation</td><td>Post-Mitigation</td></tr>
<tr><td>Type</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Extent</td><td>Local</td><td>Local</td></tr>
<tr><td>Magnitude</td><td>Medium</td><td>Medium</td></tr>
<tr><td>Duration</td><td>Long term</td><td>Long term</td></tr>
<tr><td>Probability</td><td>Probable</td><td>Probable</td></tr>
<tr><td>Confidence</td><td>Certain</td><td>Certain</td></tr>
<tr><td>Reversibility</td><td>Irreversible</td><td>Irreversible</td></tr>
<tr><td>Significance</td><td>MEDIUM</td><td>MEDIUM</td></tr>
<tr><td>Mitigation measures</td><td colspan="2">Pre-construction (finalisation of design):
■ The design process shall consider the insulation of particularly noisy plant and equipment.
■ Local residents shall be notified of any potentially noisy field survey works or other works during the planning and design phase and these activities shall be undertaken at reasonable times of the day. These works shall not take place at night or on weekends.
■ Consideration must be given to the noise mitigation measures required during the construction phase and which shall be included in the tender document specifications and the design.
Construction
■ Construction site yards and other noisy fixed facilities shall be located well away from noise sensitive areas adjacent to the development sites.</td></tr>
</table>

	▪ All construction vehicles and equipment shall be kept in good repair. ▪ Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) shall be encapsulated in acoustic covers, screens or sheds. ▪ Portable acoustic shields shall be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators). ▪ Construction activities, and particularly the noisy ones, shall be contained to reasonable hours during the day and early evening. ▪ With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the power station shall liaise with local residents on how best to minimise the impact. ▪ Machines in intermittent use shall be shut down in the intervening periods between work or throttled down to a minimum. ▪ In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993). ▪ Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA shall wear ear protection equipment. **Operation** ▪ The design of all major plant for the project shall incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (LRdn), namely a noise level of 70dBA (just inside the property projection plane, namely the property boundary of the power station and the boundary of the pipeline/conveyor servitude) as specified for industrial districts in SANS 10103. ▪ The design shall take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the power station property and the boundary of the pipeline/conveyor servitude. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103. ▪ The latest technology incorporating maximum noise mitigation measures for components of the project shall be designed into the system. When ordering plant and machinery, manufacturers shall be requested to provide details of the sound power level (SPL). Where possible, those with the lowest SPL (most quiet) should be selected. ▪ All plant, equipment and vehicles shall be kept in good repair. ▪ Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00).

In addition to the above, the following recommendations should be considered by Eskom:

- The National Noise Control Regulations and SANS 10103 should be used as the main guidelines for addressing any future noise issues on this project.
- Various measures to reduce the potential noise impact from the Ash Disposal Facility and ancillary works are possible, and the mitigation measures indicated in Section 9 need to be considered.
- The noise mitigation measures will need to be designed and/or checked by an acoustical engineer in order to optimise the design parameters and ensure that the cost/benefit of the measure is optimised.
- Once the details of the scheme is finalised and the actual sound power levels of plant and equipment are known, the position of the noise contours should be checked.
- At commissioning of the scheme, the noise footprint of each discrete element should be established by measurement in accordance with the relevant standards, namely SANS ISO 8297:1994 and SANS 10103. The character of the noise (qualitative aspect) should also be checked to ascertain whether there is any nuisance factor associated with the operations.

6.6.3 Cumulative Impacts

The total noise envelope covering the noise generated by the entire ash disposal complex for all situations over the full operational phase of AD4.1 and 4.2 has been considered. The assessment thus indicates the worst situation that could occur at any specific receiver point. It is for this reason as well as the very conservative (i.e. worst meteorological conditions, hard ground, no barriers, etc.) approach to the analysis that the cumulative effects with any of the other noise zones of the ash disposal facility has been described as a separate item by the specialist. If problems are anticipated at any one noise sensitive site, a more detailed analysis of that specific site would need to be undertaken.

6.6.4 No-go Alternative

The noise impacts are caused directly by the proposed project and would therefore not occur with the no-go alternative proceeding.

6.6.5 Conclusion

The sections of the proposed project outside the Kriel Power Station property are located primarily in a rural agricultural area surrounded by more intensive residential, mining and industrial activities. The ambient noise levels alongside the main roads exceed the acceptable maximum ambient noise level standards as recommended in SANS 10103 with respect to rural, suburban and urban residential living and for other noise sensitive land uses. The noise climates in these areas can be defined as being severely degraded for these land uses. Furthermore, numerous noise sensitive receptors where identified in the area that could potentially be impacted by AD4.1 and 4.2. However, the significance of this impact can be reduced by implementing the proposed mitigation measures.

6.7 Agricultural land capability and economic impact assessment

6.7.1 Findings of Assessment

The following subsection provides the key findings from the specialist assessment (see **Annexure F1**).

Table 6-5| Description of the noise specialist's findings

Aspect	Description
Soil type	Soils on the site are predominantly moderately deep, sandy loams of the Clovelly, Glencoe and Pinedene soil forms.
Land use	The site and general area has been highly impacted historically from mining and industrial use. The site includes previously rehabilitated soils. 79 hectares of the site has been utilised for cultivation within the last ten years. These cultivated areas have a higher agricultural sensitivity because of the value of this land from an agricultural production point of view. The rest of the site, much of which is probably unsuitable for cultivation due to historical impact, has low sensitivity.
Land capability	Class 2 which is high potential arable land.

6.7.2 Impact Assessment

Only one potential impact on agricultural resources were identified as described in the table below.

Phase	Construction
Impact: Loss of agricultural land	Permanent loss of 7.7 hectares of agricultural land caused by direct occupation of the land by AD4.1 and 4.2 and other infrastructure. Once the land is buried under the ash disposal facility, and therefore lost to agriculture, there can be no further impacts to the agricultural potential of that land. Permanent loss of agricultural land is therefore the only impact. Whether there is mitigation or not, the land is still permanently lost to agricultural production. Mitigation would however allow for some degree of rehabilitation of the site to occur after closure.

	Pre-Mitigation	Post-Mitigation
Type	Negative	Negative
Extent	Site-specific	Site-specific
Magnitude	Low	Low
Duration	Long term	Long term
Probability	Definite	Definite
Confidence	Sure	Sure
Reversibility	Irreversible	Irreversible
Significance	**LOW**	**LOW**
Mitigation measures	▪ Compile a detailed soil stripping plan of all areas from which soil will be stripped and stockpiled prior to construction. Soil should be stripped from the entire footprint of the development, excluding the stockpiles.	

6.7.3 Cumulative Impacts

The cumulative impact, of all developments that result in a loss of agricultural land within this agricultural region, is significant, although the contribution of this project is small.

6.7.4 No-go Alternative

The loss of agricultural land is directly related to the proposed project and would therefore not occur with the no-go alternative proceeding.

6.7.5 Conclusion

The permanent loss of 7.7 hectares of agriculturally suitable, arable land is the only identified agricultural impact of the development. Due to the small extent, its loss as agricultural land is assessed as being of low significance and no changes to the layout are recommended.

6.8 Traffic impact assessment

6.8.1 Findings of Assessment

The proposed project is expected to generate less than 10 additional vehicle trips during the construction and operational phases. As a result, a detailed analysis of these traffic volumes on the surrounding road network is not required[19] as the impact is expected to be negligible. The specialist assessment did however undertake an intersection capacity analysis and it was determined that the immediate road network has adequate capacity to accommodate the existing traffic and the anticipated development traffic.

6.8.2 Impact Assessment

Only one potential impact on agricultural resources were identified as described in the table below.

[19] In accordance with the Technical Methods for Highways (TMH) 16 South African Traffic Impact and Site Traffic Assessment Manual (2012), developments that generate over 50 vehicles per hour, in peak hours, require a full Traffic Impact Assessment (TIA), while those generating less than 50 vehicles per hour only require a Traffic Impact Statement (TIS).

Phase	Construction	
Impact: Traffic conditions	Additional traffic is expected to have direct or indirect impacts on the following: ■ Increase in traffic volumes and vehicle delays; ■ Increase in delays for cyclists and pedestrians as a result of the additional traffic on the network; ■ Road safety conditions due to an increase in heavy vehicles; and ■ Impact on road surface conditions of the local road network as a result of an increase in heavy vehicles.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Very Low	Very Low
Duration	Construction Period	Construction Period
Probability	Definite	Definite
Confidence	Sure	Sure
Reversibility	Reversible	Reversible
Significance	**VERY LOW**	**VERY LOW**
Mitigation measures	■ Drivers of heavy vehicles should attend a specialised road safety and driving course that sensitizes them to the impact that they have on driving conditions for other vehicles and non-motorised transport users.	
Phase	**Operation**	
Impact: Traffic conditions	Additional traffic is expected to have direct or indirect impacts on the following: ■ Increase in traffic volumes and vehicle delays; ■ Increase in delays for cyclists and pedestrians as a result of the additional traffic on the network; ■ Road safety conditions could be impacted negatively by an increase in heavy vehicles; and ■ Impact on road surface conditions of the local road network as a result of an increase in heavy vehicles.	
	Pre-Mitigation	**Post-Mitigation**
Type	Negative	Negative
Extent	Local	Local
Magnitude	Low	Low
Duration	Long-term	Long-term
Probability	Definite	Definite
Confidence	Sure	Sure
Reversibility	Irreversible	Irreversible
Significance	**LOW**	**LOW**
Mitigation measures	■ Drivers of heavy vehicles should attend a specialised road safety and driving course that sensitizes them to the impact that they have on driving conditions for other vehicles and non-motorised transport users.	

6.8.3 Cumulative Impacts

The significance of the cumulative traffic impacts associated with the proposed project activities during construction and operations are considered negligible to minor.

6.8.4 No-go Alternative

The impact on traffic conditions is directly related to the proposed project and would therefore not occur with the no-go alternative proceeding.

6.8.5 Conclusion

From the analysis, it was determined that the immediate road network has adequate capacity to accommodate the existing traffic and the proposed AD4.1 and 4.2 development traffic. Provided that the comments and recommendations included in this report are adhered to, the project is supported from a traffic engineering and transport planning perspective.

7 CONCLUSIONS AND WAY FORWARD

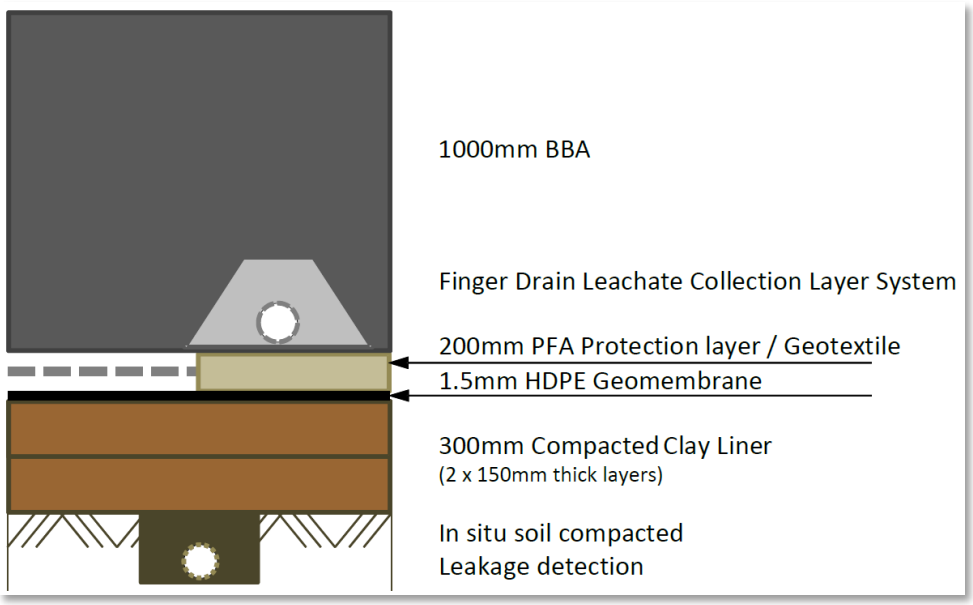
The purpose of this Chapter is to summarise the impact assessment, conclude the Environmental Impact Assessment Report and describe the way forward.

7.1 Conclusions

As per the requirements of NEMA, this EIR documents the assessment of the environmental impacts and respective mitigation or enhancement measures and recommendations for the proposed expansion of the Kriel Power Station's ash disposal facility. **Table** 7-1 below provides a summary of the description of the proposed project components (Chapter 4).

Table 7-1 | Summary of proposed project description

Aspect	Description
General	
Development phases	It is proposed to develop two of the three ash dams that have been identified as options for Kriel Power Station: ■ AD4.1: Overlying natural ground south of Ash Dams 1-3. ■ AD4.2: Overlying natural ground east of Ash Dam 3. This is to avoid development over the backfilled open pit areas while investigations are being undertaken to determine the feasibility for such an option. In addition to the above, AD4.1 and 4.2 serve as stability buttresses for the east and south sides of the existing ash dams (see **Figure 4-3**) that have stability concerns. Of particular importance is to note that AD4.1 is extended over the existing AWR dams to maximise the buttress of AD1.
Development sequence	Deposition was split between the existing and new dams in order to reduce the height of the preliminary starter walls, as well as the final height of the new dams. It is anticipated that deposition on the existing dams will continue for four years after the commissioning of AD4.2 in 2021 after which the existing dams would either be maintained as part of the overall ash dam complex or be decommissioned, and rehabilitated. It is anticipated that AD4.1 will be commissioned in July 2023.
Components	The project requires the following components: ■ An expanded ash disposal facility that would have sufficient capacity to store ash volumes produced up to 2045; ■ An AWR dam from where decant and drained water will be pumped back to the power station for re-use; ■ An AWR transfer dam; ■ Delivery and return infrastructure, including conveyor belts and/ or pipelines, transfer houses, pump stations; ■ Clean and dirty water channels; ■ Powerlines; and ■ Access roads.
Development footprint	The proposed ash disposal facility would have a total development footprint of approximately 171.76 ha, consisting of the following components:

Aspect	Description
	■ AD4.1 ■ AD4.2 ■ AWR dam ■ AWR transfer dam ■ AD4.1 stockpile ■ AD 4.2 stockpile ■ Access roads ■ Powerlines ■ Clean and dirty water channels
Design criteria	
Source of ash	The ash that requires disposal at the proposed ash disposal facilities originates from the Kriel Power Station and consists of fly ash and coarse ash from the coal burning operations.
Volume of ash	The total volume of ash produced by the Kriel Power Station is 3 700 000 tonnes per year. Also see **Table 4-2** for a breakdown of the ash produced at the power station.
Ash classification	The ash from Kriel Power Stations has been classified as a Type 3 waste (see Section 4.2.3 for more information on the waste classification process), which requires a Class C liner in accordance with GN 636 (2013) of NEMWA.
Liner system	The regulatory liner and liner component specification are shown below:  Note that a Class C liner would be provided on the wide horizontal bench approximately mid-height of the existing ash dam outer walls, to collect leachate from the upper slope areas. This is deemed a sufficient barrier as the side slopes are steep providing drainage towards the drain pipes at the toe and bench. This approach has also been approved by DWS. For more information on the liner requirements, please refer to section 3.5.6 of the conceptual design report included in **Annexure F1**.
Deposition method	The most common upstream method in South Africa for constructing a conceptual wet ash dam, which is also current operations on site, is referred to as the daywall method.
Maximum height	The maximum heights for the proposed AD4.1 and 4.2 are as follow: ■ AD4.1: 64m ■ AD4.2: 61m

Aspect	Description
Height and rate of rise limits	The maximum rate of rise specified as part of this project is at 3m/year for stability and 3.5m/year for operability. The operability limit was applied to determine the height of starter walls and the stability limit for final heights. These limits are empirical and are based on ash dams that are effectively managed within South Africa.
Pre-deposition works	
Pre-deposition works	The works required before operations can start on AD4.1 and 4.2 include the reshaping of the basin to allow proper drainage, construction of starter walls, lining the site and providing the necessary drainage boundaries between clean and dirty water systems[20]. For more information on the pre-deposition works, please refer to section 3.5 of the conceptual design report included in **Annexure D1**.
Clean and dirty water systems	
Slurry delivery system	The ash dams would be developed as a ring dyke with the outer walls raised continuously using machine packed day walls. Deposition would take place in a planned cycle so that: ■ The rate of rise of the outer wall exceeds or is at least equal to that of the basin; ■ The crest of the dam remains as level as practical within freeboard requirements; ■ Sufficient deposition area is available at any time; and ■ The pool is always located at the penstock inlet. The delivery lines (deposition lines) would be similar to the current system and consist of the following ■ Permanent main line for BBA – 1 x duty 300mm nominal diameter steel pipes. ■ Deposition stations – Every 300m – Open-ended deliveries. ■ Permanent main line for PFA – 2 x duty 450mm nominal diameter HDPE pipes. ■ Deposition stations – Every 300m ■ Open-ended deliveries For more information on the slurry delivery system, please refer to section 3.6 of the conceptual design report included in **Annexure D1**.
Decant system	Storm and supernatant water are to be decanted off the basin of the dam by means of a gravity penstock. The penstock would consist of vertical stacked concrete ring towers that is raised as the dam rises and a sub-horizontal thin walled steel outlet pipe that is encased in concrete to drain decant water to the toe of the dam. At the toe of the dam, the pipe would discharge into a solution trench that drains towards the AWR dam. Access to the inlet would be provided by means of a conceptual pool wall, timber catwalk and timber platform. A decant system would be required for each phase of development to be able to decant the water. Wing walls would also need to be constructed to assist in maintaining the pool at the inlet.

[20] Note that differential settlement and the mitigation thereof is not discussed as this relates only to AD4.3 which does not form part of this EIA application.

Aspect	Description
	For more information on the decant system, please refer to section 3.7 of the conceptual design report included in **Annexure D1**.
Return water system	Based on the preliminary findings of the water balance a new AWR would be required to accommodate the new ash dam(s) to ensure the site does not discharge to the environment more than once in 50 years (NWA, 1998 GN.704[21]). The location next to the East Wing Dam of the existing AWR is a suitable location for the construction of a new AWR or extension of the existing dam due to the fact that the dam is: ■ Situated on natural ground as opposed to backfill thereby reducing the risk of large settlements and possible cracking and failure of the water retaining embankments. ■ At one of the low points on site thereby maximising gravity flow of drain, decant and dirty storm water. Note that the whole site cannot drain to this point as discussed in the next section. ■ Near the existing AWR pump station allowing re-use of the facility. The following additional infrastructure would also be required as it would not be possible for the entire site to drain under gravity to the AWR dam: ■ A Transfer Dam to collect and channel all water from AD4.2, decant water from Ash Dam 3 and a portion of seepage water from AD4.1. The Transfer Dam would be excavated into the Cut 1 ash fill adjacent to the original starter wall. ■ The solution trench at the toe of AD4.1 west of the AWR is elevated to allow part of the storm water from AD4.1 and the decant water from Ash Dams 4.1 and 4.22 to flow under gravity into the AWR. ■ The AD4.1 underdrains east of the AWR would connect to a concrete manhole that would be equipped with a pump to transfer the water to the solution trench mentioned above. For more information on the return water system, please refer to Chapter 5 of the conceptual design report included in **Annexure D1**.

During the Scoping Phase, potential alternatives were scoped out and only the preferred alternative was assessed in this EIA Report (**Table 7-2**).

Table 7-2 | Preferred alternatives and main reasons for their preference

Preferred alternative	Reason for preferred alternative
Location alternative ■ Site 10 for the proposed ash disposal facility and associated conveyor system alignments.	Various site locations were considered within a 12km radius of the Kriel Power Station for the proposed extended ash disposal facility as described in Chapter 2 of this report. One site, i.e. Site 10, was identified as being the most suitable for the proposed extended Ash disposal facility for the following reasons: ■ located **close** to the Kriel Power Station and therefore requires less capital **costs**; ■ located on a brown field site **within the disturbance footprint** of the existing ash disposal facility; ■ **limited environmental and visual footprint** due to its proximity to the existing Ash disposal facility; and ■ located on **Eskom-owned land**.

[21] The NWA regulations on the use of Water for Mining and Related Activities Aimed at the Protection of Water Resources Section 4d (d), use any area or locate any sanitary convenience, fuel depots, reservoir or depots for any substance which causes or is likely to cause pollution of a water resource within the **1:50 year flood-line** of any watercourse or estuary.

Preferred alternative	Reason for preferred alternative
Site layout alternative ■ Ash dam 4 layout, consisting of only AD 4.1 and 4.2 (Figure 4-3).	The main aspect that influenced the design layouts relate to potential geotechnical issues due to subsidence. It was, however, determined that the proposed extended AD 4.1 and 4.2 do **not** hold any **potential geotechnical issues** since the backfilled mined area (located beneath AD 4.3, which does not form part of this application) is avoided.
Activity alternative ■ Wet ashing	Wet ashing is considered to be **financially the best** practical option in comparison to dry ash stacking which would require a change in the station's current **design**, and would entail considerable **costs** to change the existing wet ashing infrastructure and systems at Kriel Power Station. Secondly, even though dry ash stacking would require less water than the wet ashing option, the water that is used for the current (and proposed) wet ashing operations is recycled wastewater from the power station's cooling system (see Figure 4-2). Lastly, the footprint requirements for a dry ash dump is larger than for a wet ash dam and would thus increase the disturbance footprint of the Kriel Power Station
No-go alternative	The no-go alternative has been assessed in this EIR. This alternative assumes that the proposed expansion of the Kriel Power Station's ash disposal facility does not take place.

The potential impacts associated with the proposed expansion of the ash disposal facility at Kriel Power Station are summarised below in **Table** 7-3. Should the mitigation provided in the tables in Chapter 7, and detailed in the EMPr (**Annexure F**) be implemented, post-migration impacts are anticipated to range between very low to medium negative significance, and up to highly positive.

Table 7-3 | Summary of impact assessment

Aspect	Impact	Pre-mitigation	Post-mitigation
Pre-construction			
No impacts have been identified for the pre-construction phase.			
Construction			
Terrestrial and Aquatic Ecology	Possible impact on surface water quality	High (-)	Low (-)
	Displacement of non-wetland associated fauna	Low (-)	Low (-)
	Possible loss Red Data Bird habitat	High (-)	Low (-)
	Destruction of vegetation and loss of habitat	Low (-)	Low (-)
Groundwater	Potential hydrocarbon pollution through spillages and handling	Very low (-)	Very low (-)
	Decanting of Pit 1	Low (-)	Low (-)
Air Quality	Degraded ambient air quality	Medium (-)	Very low (-)
Visual	Visibility of the project	Low (-)	Low (-)
	Viewer incidence and perception	Low (-)	Very low (-)
	Visual absorption capacity	Low (-)	Very low (-)
	Lighting	Low (-)	Low (-)
Heritage	Destruction of paleontologically significant material	High (-)	Low (-)
Noise	Noise disturbance	Medium (-)	Medium (-)
Agricultural land capability and economics	Loss of agricultural land	Low (-)	Low (-)
Traffic	Traffic conditions	Very low (-)	Very low (-)
Operation			

Aspect	Impact	Pre-mitigation	Post-mitigation
Terrestrial and Aquatic Ecology	Displacement of non-wetland associated fauna	Low (-)	Low (-)
	Destruction of vegetation and loss of habitat	Low (-)	Low (-)
	Possible impact on surface water quality	High (-)	Low (-)
	Possible loss Red Data Bird habitat	High (-)	Low (-)
Groundwater	Potential hydrocarbon pollution through spillages and handling	Very low (-)	Very low (-)
	Potential inorganic pollution from fly ash disposal	Medium (-)	Low (-)
	Decanting in Pit 1	Medium (-)	Low (-)
Air Quality	Degraded ambient air quality impacting on human and animal health	Medium (-)	Very low (-)
Visual	Visibility of the project	Low (-)	Low (-)
	Viewer incidence and perception	Low (-)	Very low (-)
	Visual absorption capacity	Low (-)	Very low (-)
	Lighting	Low (-)	Low (-)
Noise	Noise disturbance	Medium (-)	Medium (-)
Traffic	Traffic conditions	Low (-)	Low (-)
Decommissioning			
Groundwater	Potential hydrocarbon pollution through spillages and handling	Very low (-)	Very low (-)
	Potential inorganic pollution from fly ash disposal	Low (-)	Low (-)
	Decanting of Pit 1	Low (-)	Low (-)
Air Quality	Degraded ambient air quality impacting on human and animal health	Medium (-)	Very low (-)
Visual	Visibility of the project	Low (-)	Low (-)
	Viewer incidence and perception	Low (-)	Very low (-)
	Visual absorption capacity	Low (-)	Very low (-)
	Lighting	Low (-)	Low (-)

7.2 Recommendations and Opinion of the EAP

It is the opinion of the EAP that no fatal flaws or significant impacts were identified for the proposed expansion project. Furthermore, all specialists are in support of the proposed project with none having identified fatal flaws. All identified impacts can be mitigated to be of low (-) or very low (-) significance, except for noise which will remain at medium (-) due to the nature of the works required to operation the Kriel Power Station and its ash disposal facility. This would however not be a new impact introduction to the current environmental conditions. Should any changes be required to the conceptual layout (Figure 4-3), an application for amendment of environmental authorisation should be undertaken in accordance with the applicable EIA requirements.

The mitigation measures proposed by the EAP and relevant specialists (Chapter 6; Annexures G1), as presented in the EMPr are recommended to manage the identified potential impacts associated with the proposed expansion of the ash disposal facility at Kriel Power Station. We request that the following conditions be considered by the decision makers and included in the environmental authorisation, should one be granted.

Condition 1: The holder of the EA shall appoint an environmental control officer (ECO) for the construction phase of the development that will have the responsibility to provide assurance to external stakeholders and Eskom that

the mitigation/ rehabilitation measures and recommendations are implemented correctly. The operator should appoint an environmental officer during the operational phase.

Condition 2: The Kriel Power Station's Operations and Maintenance Manual shall be updated based on the final design for the expanded ash disposal facility and include the applicable mitigation/ rehabilitation measures described in the EMPr.

7.3 Level of Confidence in Assessment

Assessment of potential environmental impacts requires prediction of the impacts of a defined activity against the collected baseline data, through application of professional judgement. It therefore depends on the level of information available describing the activity; the quality of the baseline data collected; and the skills and expertise of the specialists involved. The EIA project team is listed in Section A and Table 6-1 and CVs of the EAP are included in Annexure A1.

The level of information provided regarding the activity throughout the lifecycle of the project is considered to be adequate. To make up for the assumptions, limitations and gaps in knowledge (described in Section 2.4), a worst-case scenario was adopted as a precautionary measure.

It is acknowledged that the project details may evolve during the detailed design and construction phases. However, these are unlikely to change the overall environmental acceptability of the proposed project. Furthermore, any significant deviation from that assessed in this EIA should be subject to further assessment and may require an amendment to the authorisation granted by DEA, after due process has been met.

Each specialist study included a site visit to the area (except for the agricultural and air quality) and the time spent on site occurred in an appropriate season. Furthermore, all specialists (except for the agricultural specialist) has been involved with this project since 2010 and is very familiar with the area.

On this basis, the confidence in the environmental assessment undertaken is regarded as being acceptable for decision-making, specifically in terms of the environmental impacts and risks. The EAP believes that the information contained within the EIR is adequate to inform DEA to determine the environmental acceptability of the proposed expansion of the ash disposal facility.

7.4 Way Forward

This EIR has been updated following 30 days of public review where necessary. The Public Participation Report (Annexure E2) has been updated and included in the final EIA Report. The final EIA Report will be submitted to the DEA for review and decision-making (for 107 days) whereby an Environmental Authorisation would be granted or refused. All registered I&APs will be provided access to the EIA Report submitted to DEA and will also be notified of the outcome of DEA's decision-making process.

8 REFERENCES

8.1 General references

Airshed Planning Professionals. 2010. Air Quality Baseline Assessment for the Kriel Ash dam. Report No.: APP/09/AUR/05 Rev1.

Aurecon South Africa. 2010. Baseline Geohydrology for the EIA – Kriel Ash Dam Extension. Report No.: 105719-V1.1-2010.

Buchan, I.F., Baars, L.F. and Northcote, C.S. 1980. Opencast coal mining at Kriel Colliery. Journal of the South African Institute of Mining and Metallurgy.

DEA&DP. 2009. Draft Guideline on Alternatives, NEMA EIA Regulations Guideline and Information Document Series. Western Cape Department of Environmental Affairs& Development Planning. Unpublished.

DEA&DP. 2009. Draft Guideline on Public Participation, NEMA EIA Regulations Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning. Unpublished.

DEA&DP. 2009. Draft Guideline on Need and Desirability, NEMA EIA Regulations Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning. Unpublished.

DEA&DP. 2010. Guideline on Alternatives, EIA Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning (DEA&DP), Cape Town.

DEAT. 2002. Integrated Environmental Information Management, Information Series 2: Scoping. DEAT, Pretoria.

DEAT. 2002. Integrated Environmental Information Management, Information Series 3: Stakeholder Engagement. DEAT, Pretoria.

DEAT. 2002. Integrated Environmental Information Management, Information Series 4: Specialist Studies. DEAT, Pretoria.

DEAT. 2004. Integrated Environmental Management, Information Series 11: Criteria for determining Alternatives in EIA.DEAT, Pretoria.

DEAT. 2004. Integrated Environmental Information Management, Information Series 12: Environmental Management Plans. DEAT, Pretoria.

DEAT. 2005. Integrated Environmental Management Guideline Series, Guideline 3: General Guide to the Environmental Impact Assessment Regulations. Unpublished.

DEAT. 2005. Integrated Environmental Management Guideline Series, Guideline 4: Public Participation, in support of the EIA Regulations. Unpublished.

DEAT. 2007. Integrated Environmental Management Guideline Series, Guideline 7: Detailed Guide to Implementation of the Environmental Impact Assessment Regulations. Unpublished.

Emalahleni LM. 2009. Emalahleni Local Municipality Integrated Development Plan for 2009/10.

Emalahleni LM. 2009. Emalahleni Local Municipality Spatial Development Framework.

Eskom, Primary Energy Division: Water. 2010. Kriel Power Station Integrated Water Use Licence Application.

Eskom. 2016. Annual Waste Report 2015-2016. Kriel Power Station. Reporting period April 2015 – March 2016

Eskom. 2016 (A). Kriel Power Station Operations and Maintenance Manual. ECsoft (Pty) Ltd

Ferrar A.A. and Lötter, M.C. 2007. Mpumalanga Biodiversity Conservation Plan Handbook. Mpumalanga Tourism & Parks Agency, Nelspruit.

Jones and Wagener Consulting Civil Engineers. 2004. Kriel Power Station: Ash Dam 4 Interim Geotechnical Report.

Jones and Wagener Consulting Civil Engineers. 2006. Kriel Power Station: Ash Dam Feasibility Investigation.

Jones and Wagener Consulting Civil Engineers. 2010. Kriel Ash Dam Environmental Impact assessment: Site Selection Inputs. Report No.: JW71/10/A407 – Rev B.

Jones and Wagener Consulting Civil Engineers. 2016. Kriel Power Station Ash Dam 4 - Site 10 Concept Design Update. Report No.: JW164/13/D379 – Rev 0

Jones and Wagener Consulting Civil Engineers. 2016. Kriel Power Station Ash Dam 4 - Site 10 Concept Design Update. Report No.: JW044/16/E821 – Rev 0

Mucina, L. and Rutherford, M.C. (eds). 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nkangala District Municipality. 2009. IDP 2009/10

Professional Grave Solutions. 2010. Heritage Desktop Study on Three Possible Sites for the Proposed Ash Dam Facility at the Kriel Power Station. Report No.: AUR-KAD-HDS-1.

Roschcon (Pty) Ltd. 2008. Kriel Power Station: Ash Dam Complex Remaining and Extended Capacity of Ash Dams.

Scherman Colloty & Associates cc. 2010. Eskom Kriel Power Station Aquatic and Terrestrial Ecological Assessment: Desktop Site Description. Draft Report V2.

Strydom, H.A. and King, N.D. (eds.). 2009. Environmental Management in South Africa (2nd Edition). Juta, Cape Town.

Zitholele Consulting. 2016. Motivation for the application for exemption of waste management activity licences for specific uses of pulverised coal fired boiler ash in terms of GN R.634. Doc Ref. No. 16005-41-Rep-001-Eskom Ash GN R 634 Applcation-Rev2

8.2 Electronic resources

Eskom - Kriel Power Station: http://www.eskom.co.za/live/content.php?Item_ID=177 (accessed 16/03/2010)

Mpumalanga Provincial Government Department of Agriculture and Land Administration (DALA): http://www.mpu.agric.za/Web/index.htm (accessed 21/04/2010)

South African National Botanical Institute BGIS: http://bgis.sanbi.org/index.asp?screenwidth=1280 (accessed 21/04/2010)

http://www.thefreedictionary.com/supernatant(accessed in November 2010)

http://www.steinmuller.co.za/index.php/sm/company/company_history(accessed in November 2010)

Annexure A

Annexure A.1

Details of the expertise of the EAP, including a curriculum vitae

Annexure A.2

Application form, including EAP affirmation

Annexure B

Annexure B.1

DEA Communication

Annexure B.2

DWS WULA Submission proof

Annexure C

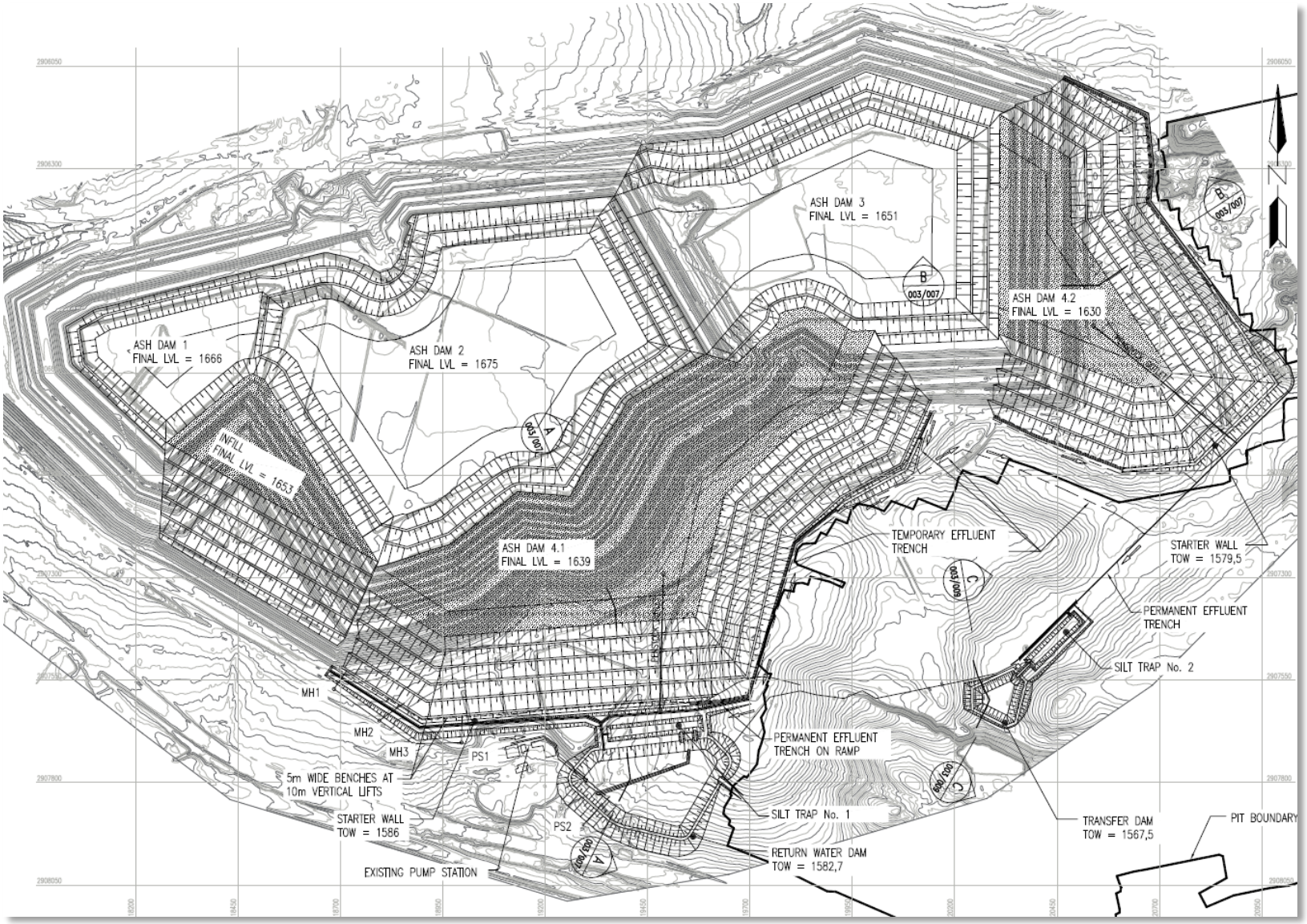
Annexure C.1

Need and Desirability

Annexure D

Annexure D.1

Ash Dam 4 Concept Design


ASH DAM 1
FINAL LVL = 1666
ASH DAM 2
FINAL LVL = 1675
ASH DAM 3
FINAL LVL = 1651
ASH DAM 4.2
FINAL LVL = 1630
INFILL
FINAL LVL = 1653
ASH DAM 4.1
FINAL LVL = 1639
TEMPORARY EFFLUENT
TRENCH
STARTER WALL
TOW = 1579,5
PERMANENT EFFLUENT
TRENCH
SILT TRAP No. 2
MH1
MH2
MH3
PS1
PS2
PERMANENT EFFLUENT
TRENCH ON RAMP
5m WIDE BENCHES AT
10m VERTICAL LIFTS
STARTER WALL
TOW = 1586
SILT TRAP No. 1
TRANSFER DAM
TOW = 1567,5
PIT BOUNDARY
RETURN WATER DAM
TOW = 1582,7
EXISTING PUMP STATION
N

Annexure E

Annexure E.1

List of potential I&APs

2011 Registered I&APs

TITLE	NAME / INITIAL	SURNAME	ORGANISATION / FARM NAME
Mr	Tinkie	Holl	Eskom Real Estate
Mr	Mmenako	Dludlu	PVT
Ms	Belinda		Ulula Ash
Mr	Andre	Boshoff	Plaas Bakenlaagte
Mr	Andries	van Niekerk	Private
Mr	Edmund Jnr	Muller	Private
Ms	Gloria	Moholi	Eskom
Ms	Liyanda	Mjingukena	Eskom
Ms	Precious	Lekau	Eskom
Ms	Lulama	Mxakaza	Eskom
Mr	Edwin	Seitei	Eskom
Mr	Sipo	Moroane	Tnt Trade and projects
	Director	-	Anglo America Kriel Colliery

Landowner

The applicant Eskom SOC limited (also see below correspondents).

TITLE	NAME/INITIALS	SURNAME	ORGANISATION/FARM NAME
Mr	Tobile (Contact Person)	Bokwe	Eskom : Senior Environmental Advisor
Mr	Tinkie	Holl	Eskom Real Estate

Adjacent landowners

TITLE	NAME/INITIALS	SURNAME
Mr	Tobile	Bokwe
	Director	Anglo Operations Ltd
Mr	G.J.	Claassen
Mr	A.J.	van Niekerk
Mr	Ngangasi	Joseph Mahlangu

Authorities identified

TITLE	NAME/INITIALS	SURNAME	ORGANISATION/FARM NAME
Ms	Matsidiso	Ogbobo	Civil Aviation Authority
Mr	Love	Shabane	Department of Agriculture, Forestry and fisheries
Mr	Sipho	Chiume	Department of Energy (Mpumalanga regional Energy director)
Ms	Wilma	Lutsch	Department of Environmental Affairs (DEA): Biodiversity Management
Mr	O	Baloyi	Department of Environmental Affairs (DEA): Chemical and Waste Management
Dr	Azrah	Essop	Department of Environmental Affairs (DEA)
Dr	Thulie	Khumalo	Department of Environmental Affairs (DEA): Climate Change and Air Quality

Mr	Aubrey	Tshivhandekano	Department of Mineral Resources
			Department of Transport
Mr	Sifiso	Mkhize	Department of Water and Sanitation (DWS)
Mr	PT	Mashaine	Emalahleni Local Municipality
Ms	S	Masoka	Mpumalanga Department of Agriculture and Rural Development and Land Administration
Mr	MC	Theledi	Mpumalanga Department of Economic Development, Environment and Tourism
	Matsemela	Moloi	Mpumalanga Department of Public Works, Roads and Transport
Mr	M	Mulaudzi	Mpumalanga Department of Water and Sanitation
			National Energy Regulator of South Africa
			Nkangala Department of Health
Cllr	SK	Mashilo	Nkangala District Municipality
Mr	Benjamin	Moduka	South Africa Heritage Resource Agency (SAHRA) Mpumalanga Provincial Office
	Katie	Smuts	South African Heritage Resources Agency
			South African National Road Agency Limited

Annexure E.2

Proof of public participation

Annexure E.3

Comment Response Report

Annexure F

Annexure F.1

Specialist Reports

- **Terrestrial and aquatic ecology impact assessment**
- **Groundwater impact assessment**
- **Air quality impact assessment**
- **Visual impact assessment**
- **Heritage impact assessment (including palaeontology)**
- **Noise impact assessment**
- **Agricultural land capability and economic impact assessment**
- **Traffic impact assessment**

Annexure G

Annexure G.1

Environmental Management Programme

Annexure H

Annexure H.1

Waste Classification

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