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REPORT ON

Part Two Amendment Motivation Report for the Kendal Power Station's existing Ash Disposal Facility, Mpumalanga Province

Report No : 17126

Submitted on behalf of :

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LIST OF ACRONYMS

Abbreviation	Full Description
ADF	Ash Disposal Facility
COCs	Contaminants of Concern
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
Eskom	Eskom Holdings SOC Ltd
F	Fluoride
GHS	Globally Harmonised System
GN	Government Notice
KPS	Kendal Power Station
LC	Leachable Concentration
LCT	Leachable Concentration Threshold
Mn	Manganese
MW	megawatt
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMWA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NWMS	National Waste Management Strategy
SO4	Sulphate
WQPL	Water Quality Planning Limits

1 INTRODUCTION

Eskom Holdings SOC Ltd appointed Zitholele Consulting to conduct a Source-Pathway-Receptor (SPR) study for the extension of the Kendal Power Station's existing Ash Disposal Facility (ADF). The said study was commissioned to investigate the potential impact of a pollution source emanating from the proposed Ash Disposal Facility (ADF), as well as the likely pathway contaminants of Concern (COCs) could follow and the potential receptors that may be impacted by the pollution source.

This SPR study was therefore undertaken to assess whether alternative barrier systems may present sufficient protection to avoid adverse impacts on identified receptors. Zitholele Consulting was further appointed by Eskom Holdings SOC Ltd to conduct a Part two amendment of the Integrated Environmental Authorisation (IEA), based on the outcome of this SPR study, in terms of Regulation 31 of the EIA Regulations of 2014 (GN R. 982 of 4 December 2014), as amended, for the Kendal Power Station's existing Ash Disposal Facility (ADF).

The proposed amendment in itself does not trigger any new listed activities, as the proposed amendments are within the authorised development footprint.

1.1 Project Background

The last unit of the Kendal Power Station (KPS) became operational in 1993, eleven (11) years after construction of the Power Station commenced. Boasting as the world's largest coal-fired Power Station and holding several Eskom performance records, KPS can be regarded as one of Eskom's flagship projects. KPS's cooling towers are the largest structures of their kind in the world with a base diameter of 165 metres.

KPS has an indirect dry-cooling system that uses a closed system to circulate water within its cooling towers. The advantage of this closed system is that there is little loss of water due to evaporation and the system utilises less water in its cooling processes than conventional wet cooled Power Stations. Ash generated through the coal-burning process is transported per conveyor belt system to the KPS ADF where it is disposed through a duel stacker system. The development of the ADF occur in a phased approach where only a portion of the ADF footprint is prepared at a time large enough to allow operation of the duel stacker systems concurrently.

The existing ADF utilised by KPS for the disposal of ash from the electricity generation process is running out of capacity. This is, primarily, due to the KPS life span being extended from 40 to 60 years up to 2053, plus a 5-year contingency up to 2058, thereby requiring the construction of a continued and/or new ADF footprint to address disposal of ash for the next +/- 40 years. Therefore, in order to provide sufficient space to cater for ash generated during the extended lifespan of the power station, Kendal Power Station requires a new additional facility with an approximate footprint of 310 hectares and with a height of 60m, to accommodate an ash volume of 103 Million m^3. The full extended ashing area required therefore comprises of the extended current footprint and a new ADF site. The extended current footprint in this context refer to the existing ADF footprint as well as an authorised extension of the ADF footprint area towards the northwest of the existing ADF. This extended ADF footprint is referred to as the “Continuous ADF”.

KPS is expected to be decommissioned at the end of 2053. The Conceptual Engineering Designs show that ash may be accommodated at the proposed Continuous ADF up to approximately 2030. Thereafter an alternative / supplementary site will be required for the disposal of ash for the remaining period up to the end of 2053, excluding consideration of the 5-year contingency period that will require disposal up to 2058 (Zitholele Consulting, 2014a).

Eskom commissioned an integrated Environmental Assessment process to extend the existing ADF to enable the station to cater for ash that will be generated from the electricity generation process (coal burning) from the year 2031 to 2058 – approximately 27 years (Zitholele Consulting, 2016a). The Department of Environmental Affairs (DEA) granted the Environmental Authorisation (EA), DEA Reference No.: 14/12/16/3/3/3/63, on the 28 July 2015. According to Condition 17.2 of the Integrated Environmental Authorisation, “*Any development on the site must adhere to a Class C containment barrier design as described in Regulation 636, National Norms and Standards for Disposal of Waste to Landfill dated 23 August 2013*.”

Taking the aforementioned into account, the extent of the proposed KPS Continuous ADF footprint will have a bearing on the remaining required capacity of the additional ADF. The environmental authorisation process for the additional ADF was undertaken as a separate process (Zitholele Consulting, 2016a), and is currently pending the outcome of a wetland offset investigation, prior to submission to the Department of Environmental Affairs (DEA) for decision-making. Allowing for the maximum footprint of the proposed KPS Continuous ADF, and therefore disposal capacity, may result in a reduced footprint of the additional required ADF.

1.2 Objectives of this Motivation Report

The objective of this report is to provide details pertaining to the significance and impacts of the proposed change to the project description in order for interested and affected parties to be informed of the potential change in the project description and associated impacts, and for the competent authority to be able to reach an informed decision in this regard.

1.3 Project overview

The KPS and associated infrastructure is located approximately 40 km south-west of Emalahleni in the Mpumalanga Province. Within a regional context the Power Station falls within the borders of the Emalahleni Local Municipality which in turn forms part of the larger Nkangala District Municipal area. The regional setting of the proposed project area is shown in **Figure 1-1**.

The maximum volume option (refer to **Figure 1-2**), as considered in the Integrated Environmental Impact Assessment (EIA) and authorised by the DEA, falls outside the original design's footprint and require the diversion of the stream located to the north-east of the proposed Continuous ADF. The physical parameters of the Maximum Dump are provided in **Table 1-1**.

Table 1-1: Physical Parameters of the Maximum Dump

Total Footprint Area:	583 hectares
Remaining dump volume	98 Mm^3 from January 2015
Remaining life:	15 years from January 2015
Maximum Height	60 meters
Lined Area	224 hectares

Outcome of the EIAr dated September 2014

The results of the impact assessment showed that the most significant impacts on the receiving environment would include impacts on the ambient air quality, terrestrial ecology and sensitive landscapes, during the Construction and Operational Phases of the project lifecycle. Taking into account that the proposed Continuous ADF and emergency disposal facility, simply referred to as “E-Dump”, will be a continuation of the existing footprint thereof anticipated impacts on the landscape were deemed to be of moderate significance. However anticipated impacts on watercourses (e.g. Loss of wetland habitat) associated with the proposed Continuous ADF were rated as HIGH significance, prior to the implementation of mitigation measures, mostly due to the associated Cumulative Impacts.

It was concluded that the implementation of the proposed mitigation measures will however reduce the significance of the anticipated environmental impacts. The findings of the Impact Assessment showed that the proposed KPS Continuous ADF Project will not lead to unacceptable environmental costs.

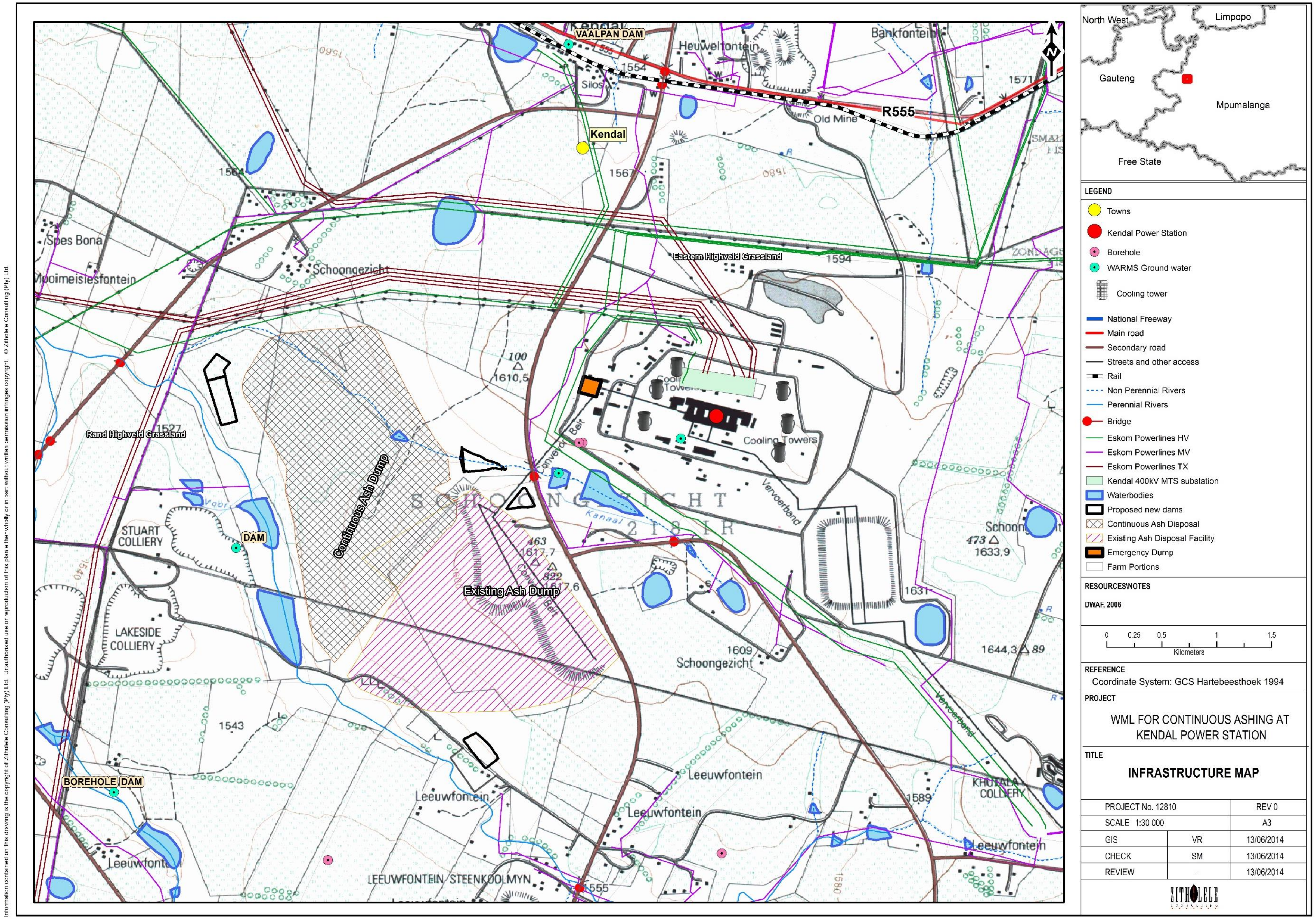

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Figure 1-1: Locality map for Kendal Power Station

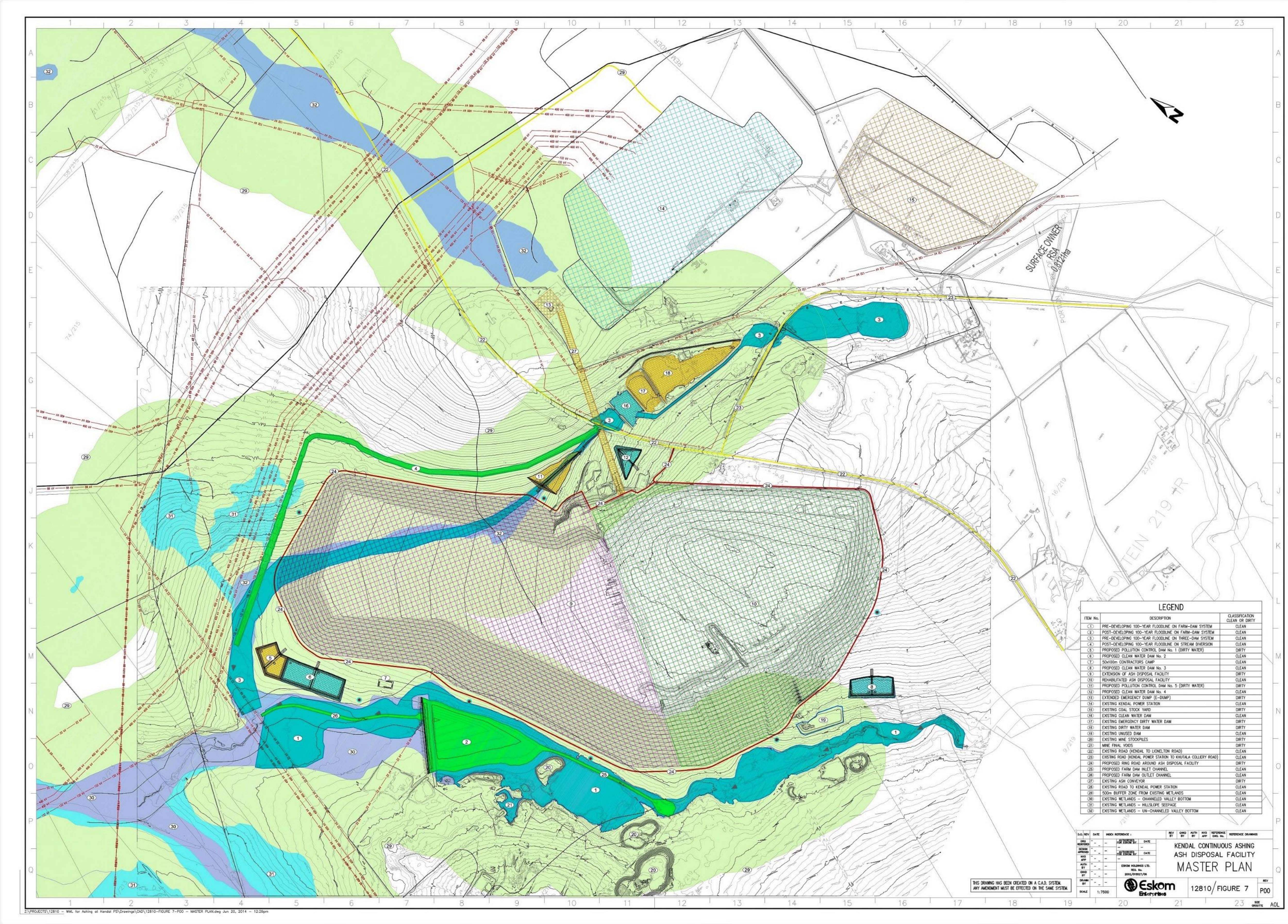

Figure 1-2: Masterplan for the maximum dump option authorised by the competent authority (Zitholele Consulting, 2014b)

2 PROPOSED AMENDMENT OF THE IEA

2.1 Amendment to the IEA proposed by the Applicant

Based on the findings of the SPR study relating to possible substitution of the currently authorised Class C barrier system for the future extension of the ADF, Eskom is proposing the amendment of Condition 17.3.1 of the Integrated Environmental Authorisation that was issued on 28 July 2015 as follows:

Change from:

"*Any development on the site must adhere to a Class C containment barrier design as described in Regulation 636, National Norms and Standards for Disposal of Waste to Landfill dated 23 August 2013*."

Change to:

"Any development on the site, excluding the Kendal Continuous Ash Disposal Facility footprint, must adhere to a Class C containment barrier design as described in Regulation 636, National Norms and Standards for Disposal of Waste to Landfill dated 23 August 2013. "The Kendal Continuous Ash Disposal Facility footprint must adhere to a Class D containment barrier design as described in Regulation 636, National Norms and Standards for Disposal of Waste to Landfill dated 23 August 2013 as recommended by the Source-Pathway-Receptor Study for the Kendal Power Station's existing Ash Disposal Facility, dated August 2018".

2.2 Motivation for the proposed amendment

Eskom Holdings SOC Ltd commissioned a Source-Pathway Receptor Study to investigate site-specific conditions at the Kendal Power Station ADF site offered sufficient protection against pollution from the identified pollution source, i.e. the ADF itself, to allow consideration of alternative barrier system designs for implementation that could provide sufficient protection against pollution to the receiving environment. The SPR study focused on the characteristics of the ash body (source), the underlying geology and aquifer systems and proximity and nature of sensitive human and environmental receptors that may be impacted.

Zitholele Consulting and the appointed groundwater specialist, GHES, completed the SPR study and numerical groundwater investigation for the Continuous Ash Disposal Facility of the Kendal Power Station (Refer to **Appendix B)**. The assessment considered alternative liner systems and the level of protection these liners offer by acting as a physical barrier between the identified Contaminants of Concern (CoCs) emanating from the pollution source, i.e. Kendal Continuous ADF, and the underlying groundwater resources. The degree of protection a specific liner system offer is related to the component layers making up the whole.

Five alternative liner systems (Class C liner, 2 variations to the Class C liner, an intermediate liner and Class D liner) were modelled with simulations run over a 5, 10 and 40-year period after the ADF is decommissioned.

The main difference between the alternative liner systems is the composition of the liner systems, cost associated with each composite liner system and associated leakage rate as calculated from literature (Giroud & Touze-Foltz, 2005). The liner alternatives that were simulated were considered against the findings of the SPR study in the sections below.

2.2.1 Consideration of appropriate liner alternative

The assessment of alternative liner systems largely hinges on the level of protection these liners offer by acting as a physical barrier between the ash body and CoCs and the underlying groundwater resources. The degree of protection a specific liner system offer is related to the component layers making up the whole. Five alternative liner systems (Class C liner, 2 variations to the Class C liner, an intermediate liner and Class D liner) were modelled with simulations run over a 5, 10 and 40-year period after the ADF is decommissioned.

The main difference between the alternative liner systems is the composition of the liner systems, cost associated with each composite liner system and associated leakage rate as calculated from literature (Giroud & Touze-Foltz, 2005). The liner alternatives that were simulated were considered against the findings of the SPR study in the sections below.

a. Class C liner and variations alternatives

The Class C liner system has been authorised for installation for the Continuous ADF in terms of Kendal Power Station’s Environmental Authorisation (EA) and Water Use Licence (WUL). It therefore represents the default liner system against which the other liner alternatives has been considered. It is furthermore also the costliest liner system of the 5 alternative liner systems to implement at an expected unit price of R424/m^2.

When the simulated leakage rates were considered, it was evident that when the pollution plume is simulated at a 40-year period after completion of the Continuous ADF the pollution plume would have migrated north-westward across the 2-dimentional footprint of the Schoongezicht Spruit tributary. It is unclear whether the groundwater pollution plume would interact with the surface water carried by the tributary, however the simulated SO_4 concentrations, which is in the range of 1.5 – 2 mg/l at the 2-D interface with the Schoongezicht Spruit, is well below the SANS, SAWQG and WQPLs stipulated for the Wilge catchment. The pollution plume does not extend across the 2-dimentional interface of the Leeuwfontein Spruit located to the south-west of the Continuous ADF.

The simulation furthermore calculated that the SO_4 concentration does not reach borehole FBB56, which is the privately-owned borehole.

The Class C variation 1 and 2 liners offer the same protection as the Class C liner system. However, these two variations demonstrate minor differences in liner component make-up which is reflected in the differences in unit cost per liner alternative. The Class C liner, including the 2 variations to the Class C liner, is therefore effective in providing sufficient protection to the groundwater resources.

b. Intermediate liner

The intermediate Class C liner alternative represents a reduction in the Class C liner requirements, but does introduce a cuspated sheet layer, which together with the geomembrane layers effectively increases the permeability of the composite liner system. The removal of some of the Class C layers reduces the unit cost for the composite liner by approximately 35% to R278.22/m^2, while furthermore decreasing the anticipated leakage rate to approximately 7 litres/ha/day.

When the simulated leakage rates are considered, it is evident that the plume formation pattern is very similar to that Class C liner plume. When the pollution plume is simulated at a 40-year period after completion of the Continuous ADF the pollution plume would have migrated north-westward across the 2-dimentional footprint of the Schoongezicht Spruit tributary as in the case with the Class C liner plume. It is unclear whether the groundwater pollution plume would interact with the surface water carried by the tributary, however as in the case of the Class C Liner, the simulated SO_4 concentrations, which is in the range of 0.6 mg/l at the 2-D interface with the Schoongezicht Spruit, is well below the SANS, SAWQG and WQPLs stipulated for the Wilge catchment. The pollution plume does not extend across the 2-dimentional interface of the Leeuwfontein Spruit located to the south-west of the Continuous ADF. The simulation calculated that the SO_4 concentration also does not reach borehole FBB56.

The Intermediate Class C liner alternative is therefore also effective in providing sufficient protection to the groundwater resources.

c. Class D liner

The Class D liner alternative has the lowest liner component requirements and largely represent rip and decompaction of a base preparation layer. This alternative is also the least costly alternative with a unit cost of R10.61/m^2.

The simulated SO_4 plume for the Class D liner alternative is more pronounced than those of the other liner alternatives. Even within 5 years the pollution plume would reach the 2-dimentional footprint of the Schoongezicht Spruit and Leeuwfontein Spruit, albeit at concentrations in the range of 0.5 – 5 mg/l.

When the pollution plume is simulated at a 40-year post-closure period the pollution plume would have migrated north-westward and westward across the 2-dimentional footprint of the Schoongezicht Spruit and Leeuwfontein Spruit. As with the Class C and Intermediate liner, it is unclear whether the groundwater pollution plume would interact with the surface water carried by the tributary.

It is also clear that the simulated pollution plume will reach the privately-owned borehole FBB56 within 40 years. The simulated data therefore suggest that the implementation of the Class D liner alternative is expected to result in CoCs migrating through the groundwater pathway to reach the identified receptors, but levels of the CoCs will be within acceptable limits. It is therefore argued that based on the SPR study and underlying geological conditions the Class D liner can be implemented without exceeding the set water quality limits of the SANS, SAWQG and WQPLs stipulated for the Wilge catchment.

2.2.2 Critical factors considered in reaching the SPR Report recommendations

The following critical factors were considered in the conclusions and recommendations reached in the SPR Report attached as Appendix B:

- A high-level human health risk assessment undertaken by Golder Associates, (2016, as referenced in the SPR Report), for Eskom's pulverised coal-fired fly ash in 2016 concluded that concentrations of all **CoCs in groundwater of an on-site borehole will be within acceptable levels**, i.e. less than South African Water Quality Guidelines for Domestic use, even after a simulated period of 100 years.
- When the dynamics and characteristics of the ash body itself was considered (see Chapter 2), it is evident that when ash deposited on the ADF comes into contact with water for extended periods of time, the **pozzolanic properties of the ash would create a cementitious effect, hardening the ash body and thereby making it less permeable**. Therefore, it is expected that the exposure of the ash body to water would result in a less permeable ash body thereby resulting in less water accumulating at the base of the ADF.
- The operational and maintenance philosophy underpinning the management of the ADF structures results in the **ash body being reshaped to appropriate angles that will allow drainage of storm water to the natural environment, therefore limiting the infiltration of water into the ash body beneath**.
- Kendal Power Station's existing ADF was not lined with any barrier system at the time the power station commenced operations. The main geological features (lithology) encountered during drilling on at the Continuous ADF site consisted of clay, granites and dolerites of the Karoo Supergroup. This clay layer will therefore tend to form a natural impermeable barrier that could help explain why **no significant impacts from the operation of the existing unlined ADF has not picked up** in routine surface and groundwater monitoring.
- The wetland study conducted by Wetland Consulting Services (Wetland Consulting Services, 2014) in October 2014, for the continuous ADF do not suggest any clear dependence of the local wetlands on shallow saturated groundwater flow. Surface runoff inflow and interflow inflow are likely to be the main hydrological drivers supporting the overall wetness within a wetland.

- Feasible mitigation measures have been identified to monitor and reduce any groundwater pollution to acceptable limits.

2.2.3 Conclusion

Based on the assessment of the above mentioned liners, the following conclusions were reached:

- The continuous ADF with its associated dirty water management infrastructures constitutes the potential sources of contaminants which are specifically associated with this SPR study. The potential contaminants of concern include Mn, SO_4, Fe, and F;
- Local groundwater is one of the potential pathways for the migration of the contaminants to receptors (borehole water users and receiving surface water). Potential contamination from ground surface will mostly impact on the shallow weathered and fractured aquifer system;
- The thickness of the local shallow aquifer was estimated to be between 5 and 25 m, and consists mainly of clay, granites and dolerites of the Karoo Supergroup;
- The thickness and the geometry of local sill and lineaments in the area are expected to control the groundwater flow and possible pollution emanating from ground surface;
- One privately owned borehole (Kendal2/ FBB56) is located within less than 1 km to the north-west of the Continuous ADF site, and risks to be impacted by potential contaminants from the project.
- The wetland study conducted by Wetland Consulting Services for the Kendal Continuous ADF suggest that surface runoff inflow and interflow inflow are likely to be the main hydrological drivers supporting the overall wetness within a wetland, and that minor dependence of the local wetlands on shallow saturated groundwater flow may be expected.
- The increases in the concentrations of sulphate in the local aquifer were simulated for each alternative over 40 years after closure using a finite element numerical model. Intermediate Class C is preferred above the other alternatives if only the migration of contaminants into the aquifer is considered since the induced increase of sulphate's concentration after 40 years of simulation at FBB56, is less than 0.01 mg/l, compare to an increase of 0.02 mg/l and 22 mg/l, respectively, for "Class C" and "Class D".
- However, when characteristics of the underlying lithology, geology and aquifer are considered, the **implementation of the Class D liner will not result in contaminant levels in groundwater quality at identified receptors above the legislated standards** of SANS 241-2:2015, SAWQG and WQPLs. From this perspective implementation of the Class D liner is recommended.

3 Impact Assessment

In terms of Regulation 32(1)(i), the following section provides an assessment of the impacts related to the proposed change. Understanding the nature of the proposed amendments the following has been considered:

- Groundwater impacts

The potential for change in the significance of ground water impacts based on the proposed amendments as described within this motivation report is discussed below.

3.1 Impact Assessment Methodology employed in EIAr (2014)

A qualitative approach was adopted in rating each of the anticipated / predicted environmental impacts and assigning a significance score. The criteria which is used to determine the Impact Risk include the magnitude, duration and temporal scale of the impact as well as the degree of certainty and degree of probability. The scoring which is assigned to each of the aforementioned rating factors is used to calculate Impact Risk. Below follows an overview for each of the rating factors.

3.1.1 Magnitude Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in **Table 3-1** below.

Table 3-1: Description of the significance rating scale

Rating	Symbol	Score	Description
No Impact	No	0	There is no impact at all - not even a very low impact on a party or system.
Very Low	VL	1	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.

Rating	Symbol	Score	Description
Low	L	2	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
Moderate	M	3	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
High	H	4	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
Very High	VH	5	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.

3.1.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 3-2.**

Table 3-2: Description of the spatial rating scale

Rating	Symbol	Score	Description
Isolated Sites / proposed site	S	1	The impact will affect specific areas within the development footprint.
Study Area	SA	2	The impact will affect the area within the development footprint not exceeding the boundary of the development footprint.
Local	L	3	The impact will affect an area up to 5 km from the boundary of the development footprint.
Regional/Provincial	R	4	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level).
Global/National	N	5	The maximum extent of any impact.

3.1.3 Duration / Temporal Scale

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in **Table 3-3**.

Table 3-3: Description of the temporal rating scale.

Rating	Symbol	Score	Description
Incidental	I	1	The impact will be limited to isolated incidences that are expected to occur very sporadically.
Short-term	ST	2	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
Medium-term	MT	3	The environmental impact identified will operate for the duration of life.
Long-term	LT	4	The environmental impact identified will operate beyond the life of operation.
Permanent	P	5	The environmental impact will be permanent.

3.1.4 Degree of Probability

The probability or likelihood of an impact occurring will be described as shown in **Table 3-4**.

Table 3-4: Description of the degree of probability of an impact accruing

Rating	Symbol	Score	Description
Practically Impossible	IMP	1	Practically Impossible
Unlikely	UN	2	Unlikely
Could Happen	CH	3	Could Happen
Very Likely	VL	4	Very Likely
Is going to happen / Will Happen	WH	5	Is going to happen / has occurred.

3.1.5 Degree of Certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in **Table 3-5**. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 3-5: Description of the degree of certainty rating scale

Rating	Symbol	Description
Can't know	CN	The consultant believes an assessment is not possible even with additional research.
Unsure	UN	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Possible	PO	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Probable	PR	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Definite	DE	More than 90% sure of a particular fact.

3.1.6 Impact Risk Calculation

To allow for impacts to be described in a quantitative manner in addition to the qualitative description, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as a risk and can be expressed as the function of the consequence and the probability of the impact occurring. Consequence is the average of the MAGNITUDE, Spatial, and Temporal Scale Ratings; whilst probability is seen as a fraction of 1 on a scale of 1 to 5 as described above. The Impact Risk formula can be expressed mathematically as:

$$\text{Impact Risk} = \frac{\text{Magnitude} + \text{Spatial} + \text{Temporal}}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown in **Table 3-6**.

Table 3-6: Example of rating scale

Impact	Magnitude	Spatial Scale	Temporal Scale	Probability	Rating
Greenhouse gas emissions	2	*3*	<u>3</u>	3	1.6
	LOW	*Local*	<u>Medium Term</u>	<u>*Could Happen*</u>	

***Note**: The magnitude, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a consequence rating of 2.67. The probability (3) is divided by 5 to give a probability rating of 0.6. The consequence rating of 2.67 is then multiplied by the probability rating (0.6) to give the final rating of 1.6.*

The impact risk is classified according to 5 classes as described in **Table 3-7**.

Table 3-7: Impact Risk Classes

Rating	Impact Class	Description
0.1 – 1.0	1	**Very Low**
1.1 – 2.0	2	**Low**
2.1 – 3.0	3	**Moderate**
3.1 – 4.0	4	**High**
4.1 – 5.0	5	**Very High**

Therefore with reference to the example used for greenhouse gas emissions above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a Low impact.

3.1.7 Weighting and Combining Impacts

In most cases there are numerous impacts to each environmental element. Each environmental impact is not necessarily equally important, thus it becomes necessary to give a weight to each impact when combining the impact rating into a single score that can be used in the EIS. Impact weightings are also made on a scale of 1 to 5. Where 1 is of least importance and 5 is the most importance. It is important to note that impact weightings are not like impact rankings i.e. two impacts may have the same score, which simply means the impacts are equally important.

3.1.8 Notation of Impacts

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

Significance or magnitude- IN CAPITALS
Duration – <u>in underline</u>
Probability – <u>*in italics and underlined.*</u>
Degree of certainty - **in bold**
Spatial Scale – *in italics*

3.2 Groundwater Impacts as assessed in the EIAr (2104)

The findings of the groundwater study (conducted as part of the EIAr dated 2014) concluded that the existing ADF and E-Dump have limited impact on the surrounding groundwater quality. The initial regional groundwater conceptual model identified three aquifer zones namely weathered, fractured and deep fractured to fresh aquifer zones.

An additional study is however required to confirm and update the hydraulic parameters. Additionally, survey monitoring boreholes will also be required to confirm the presence of shallow (perched) aquifer within the weathered zone, whereas the deep monitoring boreholes target the aquifer in the fracture zones of the host formation. Additional information specific to the aquifer zones is critical for understanding the possible contamination impacts on the different zones. Taking the aforementioned into account the excavation activities required for the installation of the Continuous ADF liner may breach shallow perched aquifers. In the event of such occurrence the shallow aquifer zones will be cased and sealed off in the deeper boreholes to minimise the risk of cross contamination.

In addition, significant spills of hazardous substances that will be used during the construction phase, e.g. solvents and hydrocarbons introduces an environmental risk. Spills which may occur during the storage, handling, and use of such dangerous chemicals could infiltrate shallow aquifers leading to groundwater contamination.

3.3 Direct Impact in the IEIAr

<u>*Construction Phase*</u>

The contamination of groundwater resources (i.e. aquifers) will be confined to the Study Area. As additional information specific to the aquifer zones is still required to thrash out the possible contamination impacts on the different zones, this groundwater impact *could happen*. The contamination of groundwater resources will be a permanent impact and is regarded as a HIGH significance impact (prior to mitigation). **The impact significance after mitigation is rated Moderate significance.**

Table 3-8: Construction Phase Groundwater Impact Assessment

Impact	Magnitude (before mitigation)	Magnitude (after mitigation)	Spatial Scale	Temporal Scale	Probability	Degree of Certainty	Rating
Contamination of groundwater resources.	4	3	2	5	3	**Possible**	2.2
	HIGH	MODERATE	*Study Area*	Permanent	*Could Happen*		

Operation Phase

The combined weighted project impact on groundwater quality (prior to mitigation) as a result of the operational activities associated with the Continuous ADF *could happen* and will be of MEDIUM significance. The impact on groundwater quality will however not exceed beyond the *Study Area* and will occur over a medium-term. **The impact significance (risk class) is thus LOW.**

Table 3-9: Groundwater Impact Assessment

Impact	Magnitude (before mitigation)	Magnitude (after mitigation)	Spatial Scale	Temporal Scale	Probability	Degree of Certainty	Rating
Impact on groundwater quality.	3	2	2	4	3	**Possible**	1.8
	MODERATE	LOW	*Study Area*	Long Term	*Could Happen*		

Closure / Decommissioning Phase

The combined weighted project impact to the groundwater environment (prior to mitigation), as a result of closure activities will **possibly** be of a LOW negative significance, affecting only the *study area* and acting in the long term. The impact *could happen*. **The impact significance (risk class) is thus Low.**

Table 3-10: Closure Phase Terrestrial Ecology Impact Assessment

Impact	Magnitude (before mitigation)	Magnitude (after mitigation)	Spatial Scale	Temporal Scale	Probability	Degree of Certainty	Rating
Hydrocarbon spillage may contaminate groundwater resources.	2	1	2	3	3	**Possible**	1.4
	LOW	VERY LOW	*Study Area*	Long Term	*Could Happen*		

3.4 Key considerations for comparison between 2014 and 2018 impact assessments

A number of key aspects must be considered for the comparison of the groundwater impact assessments undertaken in the original EIAr in 2014 and the current impact assessment for potential groundwater impacts investigated in the SPR Study Report, and assessed in this motivational report, in order to accurately contextualise the change in impact. These aspects are discussed in the table below:

Key aspect considered	**Groundwater Impact Assessment, 2014 (Golder Associates)**	**Groundwater Impact Assessment, 2018 (GHES)**	**Kendal Power Station SPR Study, 2018 (Zitholele Consulting)**
Level of impact assessment	Numerical groundwater model not developed, thus impact assessment was based in a qualitative assessment of the potential impact on groundwater	Several studies and monitoring reports completed between 2014 and 2018, which were used to develop a detailed groundwater numerical model for the Kendal Power Station and ADF footprint.	An assessment on the impacts was undertaken based on the outcome of the SPR study.
Focus of impact assessment	Impacts on groundwater resources identified and assessed based on the potential for the change in groundwater quality from baseline groundwater quality. Thus, higher concentrations of contaminants entering groundwater resource expected to result in higher impact significance.	Impacts on groundwater resources identified and assessed based on the potential for the change in groundwater quality from baseline groundwater quality. Thus, higher concentrations of contaminants entering groundwater resource expected to result in higher impact significance.	The focus of SPR Study to identify whether identified downstream sensitive receptors would be exposed to unacceptable levels of pollution. Groundwater resource identified as “pathway”, therefore concentrations of contaminants and direction of plume migration were assessed through detailed groundwater numerical model. Simulated levels of contaminants at the identified sensitive receptors were considered against water quality standards applicable to the catchment in question.

3.5 Groundwater Impacts based on the proposed amendment

Based on the recommendation of a Class D liner, refer to **Appendix A**.

Construction Phase

The risk impacts that result in te groundwater quality deterioration is probable and the significance is rated low. **With a strict application of the proposed mitigation measures, the**

significance of the residual impacts risk at the construction phase can be reduced to "very low".

Operation Phase

Prior to mitigation, the risk impacts that result in the groundwater quality deterioration is possible. The significance of the risk impacts that result in the groundwater quality deterioration is rated low. The strict application of the proposed mitigation measure, **the significance of residual impacts risk during the operation phase will be kept at "low".**

Closure / Decommissioning Phase

The risk impacts that result in the groundwater quality deterioration is probable and the significance is rated low. With a strict application of the proposed mitigation measures, **the significance of the residual impacts risk at the closure phase can be reduced to "very low".**

Table 3-11: Groundwater Impact Assessment

Impact	Unmitigated / Residual Impact	Direction of Impact	Degree of Certainty	Magnitude (before mitigation)	Magnitude (after mitigation)	Spatial	Temporal	Probability	Significance Rating (Impact Risk)
Phase: Construction Phase Contamination of groundwater resource, due to construction activities (wastes, hydrocarbon spills)	Impact (Unmitigated)	Negative	Probable	3	2	2	3	3	1,6
				MOD	LOW	Site	Med	Could	LOW
	Residual Impact (Mitigated)	Negative	Possible	2	1	1	3	2	0,8
				LOW	VLOW	Iso	Med	Unlike	VLOW
Phase: Operational Phase Contamination of groundwater resource, due to seepage and leachate infiltration (leakage of the liner system) from ash dam, contaminated water trenches and pollution control dam.	Impact (Unmitigated)	Negative	Probable	3	3	3	3	3	1,8
				MOD	MOD	Loc	Med	Could	LOW
	Residual Impact (Mitigated)	Negative	Probable	2	1	1	3	3	1,2
				LOW	VLOW	Iso	Med	Could	LOW
Phase: Closure Phase Contamination of groundwater resource, due to seepage and leachate infiltration (leakage of the liner system) from ash dam, contaminated water trenches and pollution control dam, and from closure activities	Impact (Unmitigated)	Negative	Probable	3	3	3	3	3	1,8
				MOD	MOD	Loc	Med	Could	LOW
	Residual Impact (Mitigated)	Negative	Probable	2	1	1	3	2	0,8
				LOW	VLOW	Iso	Med	Unlike	VLOW

4 ADVANTAGES AND DISADVANTAGES OF THE AMENDMENT

In terms of Regulation 32(1)(a)(ii), this section provides the advantages and disadvantages of the proposed amendment.

Advantages of the Amendment:
The cost of implementing the class c liner will be considerable and will result in an increase in the baseload cents/kWh. This may result in an increase in the tariff rate which will ultimately impact on the consumer. The implementation on the Class D Liner will not cost as much as the Class D Liner and it is anticipated that the likelihood on an increase in the tariff rate will be low.

Disadvantages of the amendment:
The proposed amendment will result in an increase in the significance of the impacts identified and assessed within the EIA process. However appropriate mitigation measures have been proposed.

5 ADDITIONAL MITIGATION ASSOCIATED WITH THE PROPOSED AMENDMENTS

As required in terms of Regulation 32(1)(a)(iii), consideration was given to the requirement for additional measures to ensure avoidance, management and mitigation of impacts associated with the proposed change. From the specialist inputs provided to support the proposed amendment application, it is concluded that the mitigation measures proposed within the EIA would be sufficient to manage potential impacts within acceptable levels.

No changes to the EMPr (as required to be considered in terms of Regulation 32(1)(a)(iv)) are required at this stage.

6 PUBLIC PARTICIPATION PROCESS

A public participation process is being conducted in support of a Part 2 application for amendment of the Integrated Environmental Authorisation for the Continuous Ash Disposal Facility of the Kendal Power Station, Mpumalanga Province.

This public participation includes the following:

- This motivation report is available for a 30 day public review period between 12 November 2018 and 12 December 2018 at Zitholele's website and at the public venues listed in Table 6-1. Electronic copies can be provided to stakeholders on request.

Table 6-1: Amendment application reports placed during the SPR review period

Location	Address	Contact
Printed Copies		
Emalahleni Public Library	19 OR Thambo Street, Emalahleni	013 653 3116
Ogies Public Library,	61 Main Street, Ogies	Ntombi Jela Tel: 013 643 1150 or 643 1027
Phola Public Library	Qwabe Street, Phola Location	Tel: 013 645 0094
Kendal Power Station – Security Reception	Kendal Power Station, Off the R545, Kendal	013 647 6002
Electronic Copies		
Zitholele Consulting website: http://www.zitholele.co.za		
Available on CD on request		Dr Mathys Vosloo or Tebogo Mapinga Phone: 011 207 2060 E-mail: kendalspr@zitholele.co.za

- Notification of registered I&APs regarding the availability of the amendment motivation report.
- Placement of an advert in the printed press.
- Placement of site notices at the site on 12 November 2018.
- Comments received will be included in the final submission to the DEA for consideration in the decision-making process.

7 CONCLUSION

It is concluded that the proposed amendments will not result in significant changes to the assessed impacts within the EIA. In addition, there are no new impacts identified as a result of the proposed amendment. The amendment in itself does not constitute a listed or specified activity. Mitigation measures described in the original EIA document and the additional mitigation measures recommended are adequate to manage the identified potential impacts. Based on the outcome of the assessment of the potential impacts, this amendment is considered to acceptable.

8 REFERENCES

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APPENDIX A: ADDENDUM TO THE "CONTINUOUS ASH DISPOSAL FACILITY AT KENDAL POWER STATION GROUNDWATER NUMERICAL MODEL FOR SOURCE PATHWAY RECEPTOR STUDY"

APPENDIX B: SOURCE-PATHWAY-RECEPTOR STUDY FOR THE KENDAL POWER STATION'S EXISTING ASH DISPOSAL FACILITY