environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
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Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 718, 2009

PROJECT TITLE

Proposed 30-year Ash Disposal Facility at Kendal Power Station, Mpumalanga

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4.2 The specialist appointed in terms of the Regulations_

I, Lee Boyd, declare that --

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Boyd

Signature of the specialist:

Golder Associates Africa (Pty)

Name of company (if applicable):

2016 - 05 - 20

Date:

June 2016

ZITHOLELE CONSULTING

Kendal 30 year ash disposal: Surface water impact assessment

Submitted to:
Zitholele Consulting

REPORT

Report Number: 13615231-12364-4

Distribution:

1 x Copy to client
1 x unbound copy to project file
1 x Copy to GAA library

Golder Associates

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1.0 INTRODUCTION

Golder Associates Africa (Pty) Ltd was appointed by Zitholele Consulting to undertake the baseline water quality and quantity assessment for the proposed site for the Kendal 30-year Ash Disposal Facility (ADF). The purpose of this surface wtaer report is to inform the site selection process being undertaken by Zitholele Consulting (Pty) Ltd (Zitholele) who are also undertaking the Environmental Impact Assessment (EIA) for the ADF.

The current ash disposal facility at Kendal Power Station is running out of space due to poor quality coal accessible for combustion, which is producing more ash than was anticipated in station planning processes. In addition the life span of Kendal has also been extended from 2043 to 2058, which would render the available ash disposal space inadequate to accommodate the continuation of disposal.

It is envisaged that the project will include the following components:

- A dry ash disposal facility of estimated 404.7 ha (including associated infrastructure such as stackers, ash water return dams, pipelines and conveyors);
- A conveyor belt for the transportation of ash to the ADF;
- The waste stream comprises of a combined bottom ash and fly ash waste stream;
- Services including electricity and water supply in the form of power lines, pipelines, and associated infrastructure; and
- Access and maintenance roads to the site.

Five alternative sites (Figure 1) were considered and Site H was identified as the site to be taken forward.

- Option B;
- Option C;
- Option D;
- Option F; and
- Option H.

1.1 Study Objectives

The objective of this study is to undertake a surface water quality assessment to determine the current quality within the area and determine how the quality will be impacted by the ash disposal activities.

2.0 DESCRIPTION OF THE CATCHMENT

Kendal Power Station is located in the Upper Olifants Catchment which falls within the Olifants Water Management Area (WMA 02), specifically in the B20E and B20F quaternary catchments within the Wilge River sub-catchment. The Wilge River catchment principally includes the towns of Bronkhorstspruit and Delmas as well as the Ezemvelo Game Reserve to the north. The catchments in the Olifants are further divided into Management Units (MU) and Kendal is located within MU 22 (Figure 1). The Wilge catchment incorporates four rivers/streams including the Grootspruit, Saalboomspruit, Bronkhorstspruit and the Wilge River. The areas of the relevant quaternary catchments are given in Table 1.

Table 1: Catchment areas of B20E, B20F and Wilge River

Catchment	Area (km^2)
Quaternary B20E	620.0
Quaternary B20F	505.0
Quaternary B20G	522.0

Catchment	Area (km^2)
Wilge River Catchment	4277.0
Loskop Dam	4356.0

2.1 Project area

The project area lies mainly within the Wilge water Management Unit. All the alternative sites lie within three quaternary catchments, namely B20E, B20F and B20G. The Wilge River is the main drainage feature of the area draining northwards to the west of the selected alternative ash disposal facilities. Tributaries associated with all other site alternatives drain westwards into the Wilge River. Except for the Leeufonteinspruit, most tributaries in this area are unnamed. The Saalboomspruit in quaternary B20G flows to the north of site F.

2.2 Classification of the resources

The Department of Water Affairs (DWA) has completed the classification process for the significant water resources of the Olifants WMA (DWA, 2013). The process included stakeholder engagement for input in recommending the classes for the Integrated Units of Analysis (IUA) defined for the WMA.

The Bronkhorstspruit, Saalboomspruit and Upper Wilge rivers are in a moderately modified state (category C) with less developed areas present in the catchment. Impacts within the catchment are related to urban areas, agriculture, dams and some mining. The importance of the resources is moderate especially in terms of good water quality that they contribute to the main stem Olifants River above Loskop Dam.

The management class for the Wilge River has been set as a Class II with an overall ecological category of a C for the IUA. This class implies moderate usage of the water resource in future and the status quo in the river system has to be at least maintained. The recommended classes resulting from the Water Resources Classification study as well as the Resource Quality Objectives (RQO) that have been determined, are yet to be gazetted for implementation.

In this respect the level of protection provided by a Class II means that any developments in the Wilge River catchment area will have to ensure that loads discharged to the receiving environment and the impacts on the flow are small.

2.3 Resource Water Quality Objectives

Kendal is located in the Olifants WMA and specifically, the B20E quaternary catchment. During 2010 a study was undertaken to develop an integrated water resources management plan for the Upper and Middle Olifants catchments. As part of this study the catchment was divided into management units (MU). Interim Resource Water Quality Objectives (RWQOs) were set for each of the MUs and remain in place until the RQOs are gazetted. Kendal Power Station falls within MU 22. The RWQOs for MU 22 as set out in Table 1 were used in the surface water quality assessment.

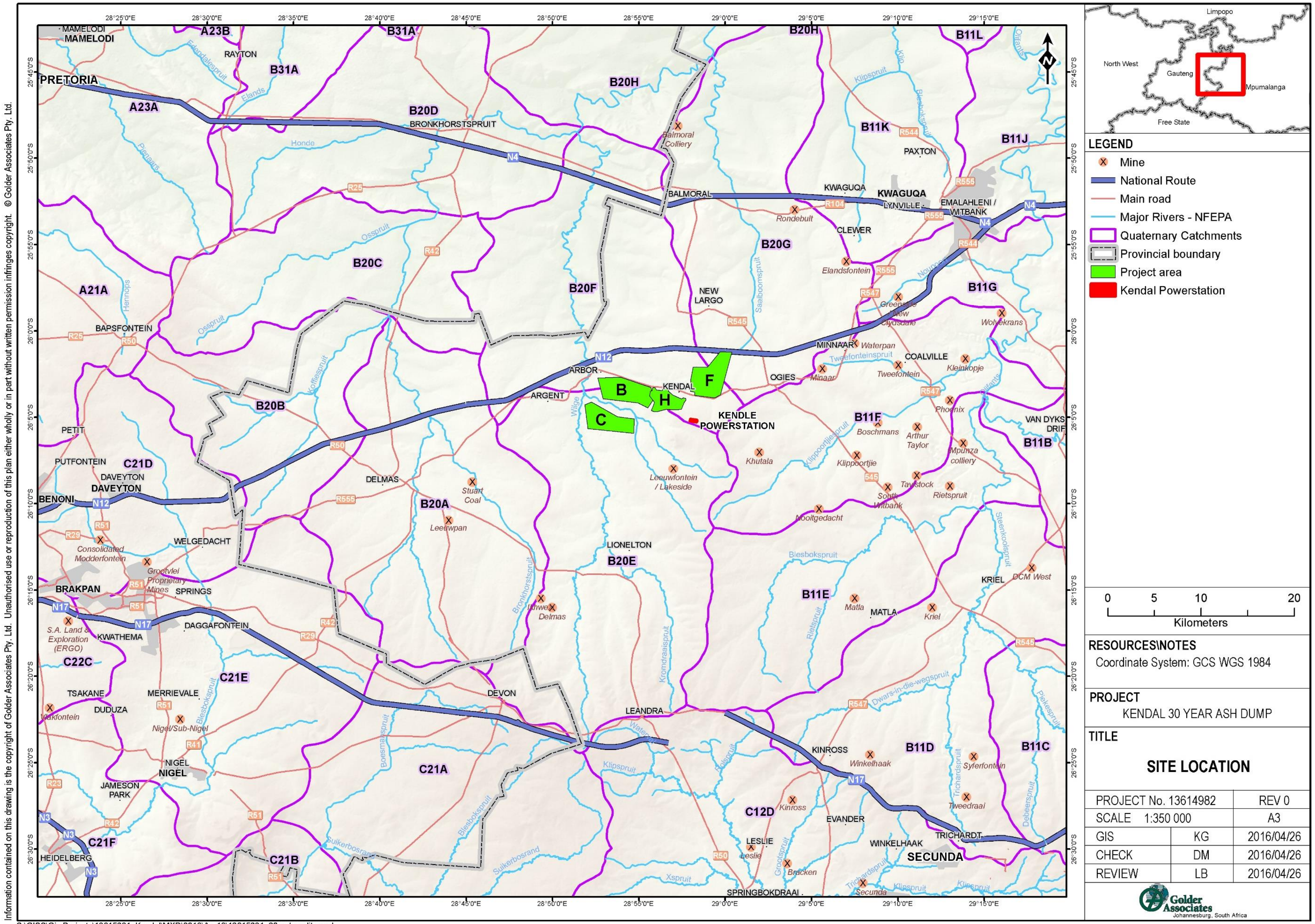

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Figure 1: Location of Kendal Power Station

Table 2: Interim RWQOs for Wilge, Management Unit 22

Water quality Variables	Units	Management Unit 22
PHYSICAL		
Conductivity	mS/m	40
Dissolved Oxygen	% Sat	70
pH	-	6.5-8.4
Suspended solids	mg/ă	-
Turbidity	NTU	-
CHEMICAL, INORGANIC		
Alkalinity	mg $CaCO_3$/λ	120
Boron	mg/ă	0.5
Calcium	mg/ă	25
Chloride	mg/ă	20
Fluoride	mg/ă	0.5
Magnesium	mg/ă	20
Potassium	mg/ă	10
Sodium	mg/ă	20
SAR	$meql^{0.5}$	1.0
Sulphate	mg/ă	60
Total Dissolved Solids	mg/ă	280
CHEMICAL, ORGANIC		
Dissolved Organic Carbon	mg/ă	10
METALS, DISSOLVED		
Iron	mg/ă	1.0
Manganese	mg/ă	0.18
Aluminium	mg/ă	0.02
Chromium VI	mg/ă	0.05
NUTRIENTS		
Ammonia*	mg/ăas N	0.007
Nitrate	mg/ăas N	6
Phosphate	mg/ăas P	0.05
Total Phosphorus	mg/ăas P	0.25
Total Inorganic Nitrogen	mg/ăas N	2.5
MICROBIOLOGICAL		
E Coli	# per 100mă	130
Chlorophyll a	mg/ă	0.02

2.4 Present Ecological State and Ecological Importance and Sensitivity

The Present Ecological State (PES) is defined as the current state or condition of a water resource in terms of its biophysical components (drivers) such as hydrology, geomorphology and water quality and biological responses viz. fish, invertebrates and riparian vegetation. The degree to which ecological conditions of an area have been modified from the natural (reference) condition and the Ecological Importance and Sensitivity (EIS) relate to the presence, representativeness and diversity of species of biota and habitat. Ecological Sensitivity relates to the vulnerability of the habitat and biota to modifications that may occur in flows, water levels and physico-chemical conditions.

PES and EIS were determined during the recently completed classification study. The Wilge River was found to be in a moderately modified state (category C) and with less developed areas present in the catchment. The importance of the resource is moderate especially in terms of good water quality contributed to the main stem Olifants River above Loskop Dam. Therefore it was proposed to maintain the current PES category within the catchment. A Management Class II was recommended. As defined in the Water Resource Classification process (DWA, 2007a and 2007b) this means that the area can be moderately used and that the water resource could be moderately altered from its pre-development condition.

2.5 Sampling points

The surface water sampling points are illustrated in Figure 2. The points were chosen to assess the water quality of the Wilge River in close proximity to the alternative sites and before the tributaries enter the main river.

Grab samples were taken at the points indicated in Figure 2 and Table 2 during July 2012 and January 2013. For January 2013, once off sampling was undertaken, where only pH, electrical conductivity and dissolved oxygen were measured on site. Two additional grab samples were taken at the beginning of October 2014 at the fountains located on non-perennial streams on the northern and southern sides of Site H. These samples were subjected to analysis using ICP-MS.

It is difficult to make any conclusions from the limited results however a summary of the results for each parameter against the interim RWQOs is shown in Table 3.

In this respect it is recommended that sampling be undertaken on a monthly basis, starting at least 6 months prior to the construction start-up. In light of the fact that certain heavy metals such as cadmium, arsenic, mercury, lead, manganese and zinc are thought to have endocrine disrupting properties at very low concentrations it is important that these are monitored and that sensitive laboratory techniques, such as ICP-MS, are used. This will enable the power station to get a good history of the full spectrum of metals present and changes over time.

3.0 DESCRIPTION OF THE PROPOSED ASH DISPOSAL FACILITIES

The ADF will be designed with a liner system which will essentially eliminate seepage from the facilities. The liner will have an underdrain system which will collect the seepage from the base of the facility and deliver the seepage to the storm water management system for management in the power station circuits. The storm water management system has been designed to meet Regulation 704 and spill into the river system on average once in 50 years. The ADF is essentially isolated from the catchment area and will contribute very little water to the surface water environment. The catchment isolated by the facilities will no longer contribute runoff or recharge to the groundwater system. The facilities will therefore reduce the volume of water reaching the surface water streams.

The ADF progression is proposed to be taken forward as set out in Table 3 for the period 2025 to 2058.

Table 3: ADF progression

Period	Ash body
2025 - 2030	96.6 hectares of first 5 years liner to be constructed including removal and stockpiling of topsoil to designated area

Period	Ash body
2030 - 2035	1.) 96.6 hectares of first 5 years liner to be ashed on 2.) 74 hectares of 2nd 5 years liner to be constructed including removal and stockpiling of topsoil to designated area
2035 - 2040	1.) 74 hectares of 2nd 5 years liner to be ashed on 2.) 58.6 hectares of 3rd 5 years liner to be constructed including removal and stockpiling of topsoil to designated area 3.) 96.6 hectares of 1st 5 years open ash area to be topsoiled and grassed
2040 - 2045	1.) 58.6 hectares of 3rd 5 years liner to be ashed on 2.) 60 hectares of 4th 5 years liner to be constructed including removal and stockpiling of topsoil to designated area 3.) 74 hectares of 2nd 5 years open ash area to be topsoiled and grassed
2045 - 2052	1.) 60 hectares of fourth 5 years liner to be ashed on 2.) 115.5 hectares of fifth 5 years liner to be constructed including removal and stockpiling of topsoil to designated area 3.) 58.6 hectares of 3rd 5 years open ash area to be topsoiled and grassed
2052 ï 2058	1.) 115.5 hectares of fourth 5 years liner to be ashed on 2.) 60 hectares of 4th 5 years open ash area to be topsoiled and grassed

The catchment areas of the preliminary ADF options and the potentially impacted quaternary catchments are listed in Table 4. The percentages of the estimated areas of the ADF options of the total of quaternary catchment areas are also given in Table 4. The percentages are relatively low ranging from 0.51% to 1.49%. Site H, however was the only site on which design was done.

Table 4: Areas of ADF Options and quaternary catchments

Catchment/ADF Option	Area (km^2)	% ash storage facility of B20F and B20E
Site B	11.37	1.01
Site C	9.50	1.5
Site F	15.32	1.49
Site H	5.78	0.51
Quaternary B20E	620.0	-
Quaternary B20F	505.0	-
Quaternary B20G	522.0	-
Wilge River Catchment	4277.0	-

4.0 BASELINE WATER QUALITY

The surface water sampling points are illustrated in Figure 2. The points were chosen to assess the water quality of the Wilge River in close proximity to the existing and proposed ash disposal facilities and the tributaries within the area.

4.1.1 Wilge River area

The chemical water quality within the study area is generally good. However some sample points indicate high levels of sulphate (SO_4), aluminium (Al), magnesium (Mg) and ammonia (NH_4). Sampling undertaken in 2013 and 2014 showed elevated levels, exceeding the RWQOs, at most of the points. it should b enoted that while the high aluminium levels might be attributed to the geology of the area these parameters are related to mining activities. These parameters were mainly detected at the following sample points:

- CSW01 ï On the Wilge main stem in close proximity to site C;
- CSW02 ï On the tributary downstream of site C before flowing into Wilge River; and
- CSW03 ï On the tributary downstream of site B before flowing into Wilge River.

4.1.2 Saalboomspruit

CSW13 and CSW14 are located on the Saalboomspruit that drains towards the north of site F. These sample points indicated high levels of conductivity (EC), sulphates (SO_4), aluminium (Al), magnesium (Mg) and manganese (Mn). These parameters are indicators of mining activities within the area.

Sampling points SCH02/KEN30-F11 and KEN30-F12 are fountains located on non-perennial streams located on the northern and southern sides of site H. Monitoring point *Pan* is the pan located on the southern border of Site H.

Table 5: Surface water quality monitoring points

Monitoring points	Location	
	Latitude (S)	Longitude (E)
CSW01	-26.08818	28.85870
CSW02	-26.06045	28.86524
CSW03	-26.02776	28.87286
CSW13	-25.98400	29.02659
CSW14	-26.00645	29.02542
SCH02/KEN30-F11	-26.08263	28.93350
KEN30-F12	-26.06427	28.95979
Pan	-26.07200	28.94957

Table 6: Water quality results for the Wilge River and tributaries during July 2012, January 2013 and October 2014

Parameter	RWQO	Sampled during: July 2012/ January 2013					October 2014		
		CSW01	CSW02	CSW03	CSW13	CSW14	KEN30-F12	SCH02/KEN30-F11	Pan
Potassium (K) (mg/L)	10	3.3	2.5	1.5	13	13.1	3.41	3.48	9.47
Sodium (Na) (mg/L)	20	35.6	36.5	17	57.5	37	16.3	73.6	38.8
Alkalinity as $CaCO_3$ (mg/L)	120	167.7	121.5	110.2	88	88	-	-	-
Total Dissolved Solids (mg/L)	280	43	57	39	45	50	140	708	644
Conductivity (mS/m)	40	4.83	5.99	3.57	75.1	69.5	24	94.7	90.1
Chloride (Cl) (mg/L)	20	18.01	13.05	7.72	37.9	36.3	16.6	16.4	16.7
Fluoride (F) (mg/L)	0.5	0.33	0.26	0.33	0.25	0.32	<0.1	0.44	0.69
Nitrate (NO_3) as N (mg/L)	6	bdl	1.12	2.33	2.59	1.46	13.3	0.3	<0.3
Sulphate (SO_4) (mg/L)	60	62.55	153.2	52.88	158	194.3	26.1	259	236
Aluminium (Al) (ug/L)	20	21	49	79	36	147	49**	16**	<50**
Iron (Fe) (ug/L)	1000	49	171	220	392	271	60	210	50
Manganese (Mn) (mg/L)	180	15	59	188	332	191	<0.05	0.39	<0.05
Calcium (Ca) (mg/L)	25	34.8	53.3	40.2	43	43.9	16.1	91.3	72.8
Magnesium (Mg) (mg/L)	20	23.9	27.9	16.5	24.2	29.4	7.25	29.9	56.9
Ammonia as N (mg/L)	0.007	0.145	0.085	0.075	11	3.8	-	-	-
pH	6.5-8.4	8.2	8.4	8.3	7.4	7.2	6.41	7.7	8.7

bdl ï below detection limit; **method (ICP-OES) used was not sensitive enough to detect <0.02 mg/l, so it is not clear whether aluminium exceeds the standards.

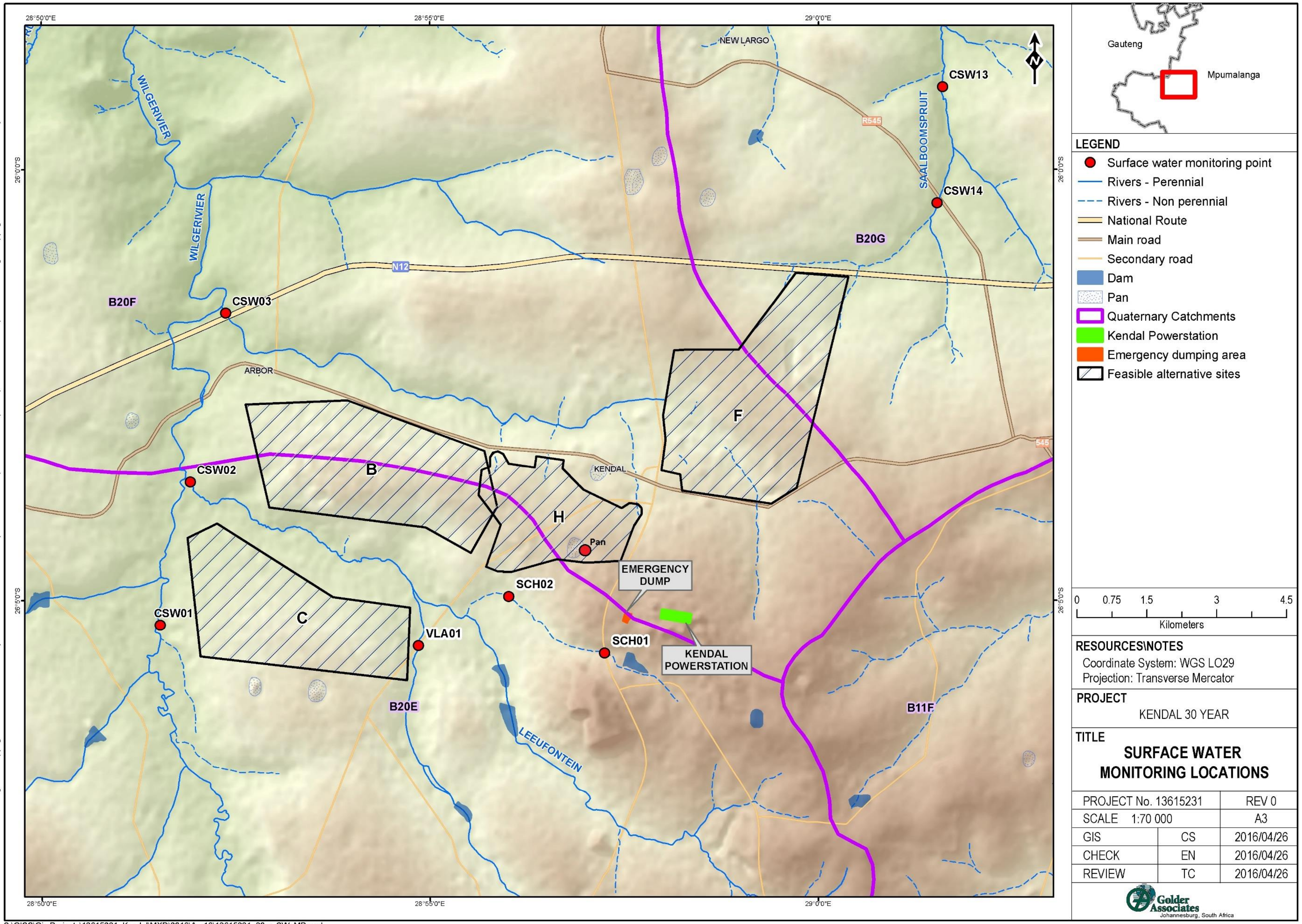

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Figure 2: Surface water monitoring points

5.0 SITE SELECTION DESCRIPTION

The sites that were screened as part of the site selection process described below. The Wilge River is the dominant surface water resource within the area. This river drains northwards to the west of Kendal Power Station. In relation to the location of the proposed ADF at Site H, it is likely that it could have an impact on the Wilge River from the tributaries (Leeufonteinspruit) downstream of the Power Station and ADF site.

All the sites screened are located within the quaternary catchments B20E, B20F and B20G. The preferred Site H straddles quaternary catchments B20E and B20F (Figure 3). The site is dominated by agricultural land and a pan located within the site. It is drained on both sides by two unnamed perennial tributaries. The tributary on the southern side confluences with the Leeufonteinspruit which flows into the Wilge River. There are two sample points (SCH01 and SCH02) on the southern non-perennial tributary however the sites have been dry when samples have been taken, and sample point CSW02 on the Leeuwfonteinspruit just before it confluences with the Wilge River. The water quality results at site CSW02 indicate elevated levels of sulphate (SO_4), aluminium (Al) and magnesium (Mg) all exceeding the RWQOs. These may be as a result of impacts from upstream mining, industrial and activities. The planned conveyor route will not cross any water resources.

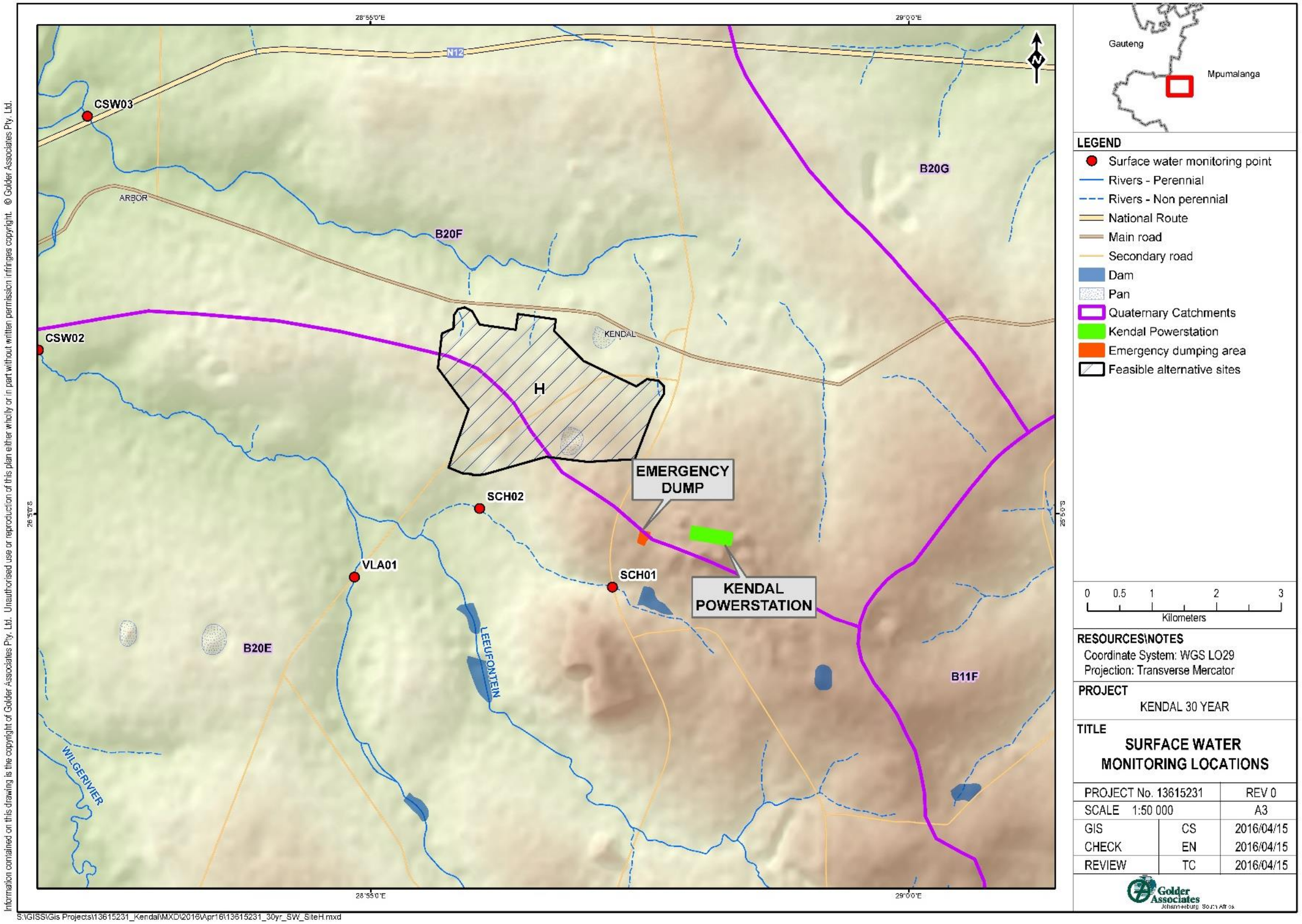

Figure 3: Site H Location

6.0 IMPACT ASSESSMENT

The impact assessment is conducted by determining how the proposed activity will affect the state of the environment previously described. Specific requirements are:

- Undertake a comparative assessment to identify and quantify the environmental and/or social aspects of the various activities associated with the proposed project;
- Assess the impacts that may accrue and the significance of those impacts using the methodology as described below; and
- Identify and assess cumulative impacts utilising the same rating system.

The impacts have been rated according to the methodology described below. Where possible, mitigation measures must be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology was utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance assessment;
- Spatial scale;
- Duration or temporal scale;
- Degree of probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology is used to describe impacts for each of the aforementioned assessment criteria.

A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 7.

Table 7: Quantitative rating and equivalent descriptors for the impact assessment criteria

Rating	Significance	Extent Scale	Temporal Scale
1	VERY LOW	*Proposed site*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the sections to follow.

6.1.1 Significance 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 (1 000 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 detailed description of the impact significance rating scale is given in Table 8.

Table 8: Description of the significance rating scale

Rating		Description
5	Very high	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

Rating		Description
4		could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	High	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.
3	Moderate	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.
2	Low	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.
1	Very low	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity are 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.
0	No impact	There is no impact at all - not even a very low impact on a party or system.

6.1.2 Spatial scale

The spatial scale refers to the extent of the impact. In other words the impact is at a local, regional or global scale. The spatial assessment scale is described in more detail in Table 9.

Table 9: Description of the spatial scale

Rating		Description
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 10 km from the proposed site.
2	Study Site	The impact will affect an area not exceeding the Eskom property.
1	Proposed site	The impact will affect an area no bigger than the ash disposal site.

6.1.3 Duration 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 10.

Table 10: Description of the temporal rating scale

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	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.
3	Medium term	The environmental impact identified will operate for the duration of life of facility.

Rating		Description
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

6.1.4 Degree of probability

Probability or likelihood of an impact occurring is described in Table 11.

Table 11: Description of the degree of probability of an impact occurring

Rating	Description
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	Itõs going to happen / has occurred

6.1.5 Degree of certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard ñdegree of certaintyò scale is used as set out in Table 12. 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 12: Description of the degree of certainty rating scale

	Description
Definite	More than 90% sure of a particular fact
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring
Canõt know	The consultant believes an assessment is not possible even with additional research
Donõt know	The consultant cannot, or is unwilling, to make an assessment given available information

6.1.6 Quantitative description of impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, 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 the function of significance, spatial and temporal scale:

$$\textbf{\textit{Impact Risk}} = ((\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal}) \div 3) \;\; \text{X} \;\; (\text{Probability} \div 5)$$

The impact risk is classified according to five classes described in Table 13.

Table 13: Impact Risk Classes

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

6.1.7 Cumulative Impacts

It is a requirement that the impact assessments take cognisance of cumulative impacts. In fulfilment of this requirement the impact assessment will take cognisance of any existing impact sustained by the operations, any mitigation already in place, any additional impact to environment through continued and proposed future activities, and the residual impact after mitigation.

It is important to note that cumulative impacts at the national or provincial level will not be considered in this assessment, as the total quantification of external companies on resources is not possible at the project level due to the lack of information and research documenting the effects of existing activities. Such cumulative impacts that may occur across industry boundaries can also only be effectively addressed at Provincial and National Government levels.

7.0 ASSESSMENT OF IMPACTS

Ash from Kendal was sampled and analysed for both organic and inorganic constituents according to the Department of Water Affairs and Forestry (1998) Minimum Requirements (Jones and Wagener Consulting Civil Engineers, 2013). Dry leach assessment was also undertaken mainly to classify waste in terms of the Department of Environmental Affairs (2009) waste classification requirements.

The DEAǿs waste classification system classified it as a Type 3 waste (low hazard waste). The Type 3 waste classification was the result of boron (B) exceeding its Leach Concentration value of 0.50 mg/ǎ and barium (Ba) and fluoride (F) exceeding their respective Total Concentrations of 570 mg/kg and 112 mg/kg respectively.

It can be expected that these variables of concern will impact on the surface water resources. However this can be mitigated by disposing the ash on a barrier system that meets the requirements of hazardous waste disposal and will be sufficient to protect the environment in the long-term.

The watercourses that could be affected are the Leeufonteinspruit and Wilge River, and to a lesser extent the unnmaed tributary flowing on the northern boundary of the ADF. This stream is however north of the R555 road.

7.1 Site H impact assessment

7.1.1 Construction Phase

Status quo

Site H straddles quaternary catchments B20F and B20E. There are a few non-perennial surface water resources adjacent to Site H with a pan located within the site. The site is located west of the power station and drainage would be towards the unnamed tributary flowing to the Wilge River in B20F and an unnamed tributary that joins the Leeufonteinspruit south of the site in B20E. The footprint of the Site H is currently utilised extensively for agriculture.

Project impact (Unmitigated)

A number of impacts are expected to materialise as a consequence of the construction activities required for the establishment of the 30 year ADF and the associated infrastructure such as conveyors, access roads and storm water management facilities:

- Altered flows;
- Disturbance to adjacent streams;
- Increased erosion;
- Increased sediment transport into water resources; and
- Water quality deterioration in adjacent water resources because of sediments and spills from mechanical equipment.

Water resources falling within the footprint of the ADF and associated infrastructure will be lost, however except for the pan there are very limited surface water resources on the site. Earth works relating to the construction of these facilities will permanently destroy the water resources within the construction footprint. Loss of flow at the outlet of catchment B20F and B20E due to construction within the footprint of Site H is therefore expected to be very low.

Construction activities are likely to increase the disturbance footprint beyond the boundaries of the actual development footprint through temporary stockpiles, laydown areas, construction camps and uncontrolled driving of machinery leading to increased flow velocities off the site, increasing the risk of erosion with sediments potentially transported down the water resources and finally deposited in the Wilge River.

During the construction phase it is likely that spills and leaks of hazardous substances such as cement, oil and diesel, sewage spills from temporary ablutions may occur. Run-off from the site would therefore lead to water quality deterioration in downstream streams.

The combined weighted project impact to water resources (prior to mitigation) will be of a negative LOW to MODERATE significance, affecting the *study site to local area*. The impact will act in the short/ medium term to permanent where loss of streams occurs, and is very likely to occur. The impact risk class is thus **Low to Moderate** (Table 14).

Cumulative Impact

The agricultural activities on site have had limited impact on the water resources quality although some impacts very likely due to existing industries, mines and upstream urban development are noted. Farm dam construction in the area, albeit not necessarily on Site H, has resulted in some flow alteration in the area. In addition thee tenant currently pumps farm dam water to the pan.

The baseline impacts are considered to be low and additional project impact (if no mitigation measures are implemented) will only marginally increase the significance of the existing baseline impacts, the cumulative unmitigated impact will likely be of a LOW/ MODERATE negative significance, affecting the *study/ local area* in extent. The impact is very likely and will be short/ medium term to permanent where loss of streams occurs. The impact risk class is thus **Low to Moderate** (Table 14).

Mitigation Measures

Mitigation during construction would be to:

- Optimise design of the ADF to minimise the size of the footprint;
- Minimise area of vegetation clearing;
- Where practically possible, undertake the clearing of vegetation during the dry season to minimise erosion;
- Comply with GN704 in relation to storm water measures so that sediment transport off site is minimised and clean water is diverted around the cleared area;
- The storm water management plan should be in place prior to construction being initiated;
- Install sediment traps as part of the storm water management plan where necessary and especially upstream of discharge points where erosion protection measures and energy dissipaters should be in place;
- Design infrastructure adequately to prevent spillages;
- Clean spills as quickly as possible;
- Store and handle potentially polluting substances and waste in designated bunded facilities;
- Waste should be regularly removed from the construction site by suitably equipped and qualified operators and disposed of in approved facilities;
- Locate temporary waste and hazardous substance storage facilities out of the 1:00 floodlines;
- Locate temporary sanitation facilities out of the 1: 100 year floodlines; and

- Implement a water quality monitoring programme.

Residual Impact

The residual impact of the construction of the ADF will include the permanent loss of water resources (flow), as well as a potential decline in water quality. Most of these impacts are expected to be mostly restricted to the local scale; however the potential deterioration of water quality within the Wilge River will increase the extent of the impacts.

The residual impact to water resources beyond the construction phase of the project will be reduced through mitigation. After mitigation the impacts to the water resources will probably be of a VERY LOW to LOW negative significance, affecting the *study site to local area* in extent. The impact *could happen and certain* cases related to water quality is *very likely.* The duration will be short term except for the stream losses which will be permanent. The impact risk class is however **Low** (Table 14).

Table 14: Pre-construction and Construction Phase Impacts

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
Clearing of vegetation	Erosion	Existing	2	2	3	4	1.9 - LOW	Minimise footprint size by phasing; vegetation clearing only where necessary and preferably during dry season; stabilisation/ rehabilitation of exposed areas as soon as possible	Limited erosion occurs with the existing land use
		Cumulative	2	2	3	4	1.9 - LOW		The land clearing associated with the construction of the ADF will not contribute significantly to the risk rating
		Residual	2	2	2	2	0.8 ï V LOW		The impact can be mitigated to a very low risk rating by applying mitigation described
	Loss of streams and altered flows	Existing	1	5	1	4	1.9 - LOW	Site H is only 0.51 % of the B20F and B20E quaternary catchments; a storm water management plan that will direct clean water around the site to the Leeufonteinspruit will be put in place	No major streams located on the site
		Cumulative	1	5	1	4	1.9 - LOW		The construction activities will not contribute significantly to the loss of streams/ altered flow in the area
		Residual	1	5	1	4	1.9 - LOW		Limited mitigation to ensure clean water reaches steams
	Increased sediment transport into water resources	Existing	3	2	2	4	1.9 - LOW	Vegetation clearing only where necessary; Stabilisation/ rehabilitation of exposed areas as soon as possible; storm water management will be incorporated to limit sediment transported to the Leeufonteinspruit	Limited erosion occurs with the existing land use
		Cumulative	3	2	2	4	1.9 - LOW		The land clearing associated with the construction of the ADF will not contribute significantly to the risk rating
		Residual	2	2	2	3	1.2 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described
	Water quality deterioration in	Existing	3	3	3	4	2.4 - MOD	Store and handle potentially	Limited polution from the current land uses

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
	adjacent water resources because of spills from mechanical equipment	Cumulative	3	3	3	4	2.4 - MOD	polluting substances and waste in designated bunded facilities; spills cleaned up immediately; storm water management will be incorporated to limit contaminated water entering the Leeufonteinspruit; stay out of 1:100 floodlines; implement water quality monitoring programme	Contamination of the site from spills from mechanical equipment may occur and impact the Leeufonteinspruit
		Residual	2	2	2	4	1.6 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described
Construction of dams and associated storm water drains	Erosion with increased sediment transport into water resources	Existing	2	2	3	4	1.9 - LOW	Minimise footprint size; Stabilisation/ rehabilitation of exposed areas as soon as possible; storm water management will be incorporated to limit sediment transported to the Leeufonteinspruit	Limited erosion occurs with the existing land use.
		Cumulative	2	2	3	4	1.9 - LOW		The construction of the dams and associated infrastructure will not contribute significantly to the risk rating.
		Residual	2	2	2	2	0.8 ï V LOW		The impact can be mitigated to a very low risk rating by applying mitigation described.
	Water quality deterioration in adjacent water resources because of spills from mechanical equipment	Existing	3	3	3	4	2.4 - MOD	Store and handle potentially polluting substances and waste in designated bunded facilities; spills cleaned up immediately; storm water management will be incorporated to limit contaminated water entering the	Limited pollution from the current land uses
		Cumulative	3	3	3	4	2.4 - MOD		Contamination of the site from spills from mechanical equipment may occur and impact the Leeufonteinspruit
		Residual	2	2	2	4	1.6 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
								Leeufonteinspruit; stay out of 1:100 floodlines; implement water quality monitoring programme	
Construction of site access road	Erosion with increased sediment transport into water resources	Existing	2	2	3	4	1.9 - LOW	Minimise footprint size; Stabilisation/ rehabilitation of exposed areas as soon as possible; storm water management will be incorporated to limit sediment transported to the Leeufonteinspruit	Limited erosion occurs with the existing land use
		Cumulative	2	2	3	4	1.9 - LOW		The construction of the dams and associated infrastructure will not contribute significantly to the risk rating
		Residual	2	2	2	2	0.8 - V LOW		The impact can be mitigated to a very low risk rating by applying mitigation described
	Water quality deterioration in adjacent water resources because spills from mechanical equipment	Existing	3	3	3	4	2.4 - MOD	Store and handle potentially polluting substances and waste in designated bunded facilities; spills cleaned up immediately; storm water management will be incorporated to limit contaminated water entering the Leeufonteinspruit; stay out of 1:100 floodlines; implement water quality monitoring programme	Limited pollution from the current land uses
		Cumulative	3	3	3	4	2.4 - MOD		The land clearing associated with the construction of the ADF will not contribute significantly to the risk rating
		Residual	2	2	2	4	1.6 - LOW		The impact can be mitigated to a very low risk rating by applying mitigation described

7.1.2 Operational Phase

The impacts from the operational phase are likely to include:

- Water quality impacts (sedimentation and chemical contamination) from operation of the ADF;
- Water quality impacts from potential overflows from contaminated dams;
- Erosion and increased sediment transport into water resources as the ADF construction progresses;
- Loss of streams and altered flows as the ADF construction progresses;
- Water quality deterioration in adjacent water resources because of spills from mechanical equipment during ADF operation and as the ADF construction progresses;
- Erosion with increased sediment transport into water resources from cleared areas as the ADF construction progresses;
- Emptying of dam and disposal of contaminated sediment during rehabilitation of dirty storm water dams to clean water dams.

The combined weighted project impact to water resources (prior to mitigation) during the operational phase will be of a LOW to MODERATE negative significance, affecting the *site and local area*. The impact will act in the short term to permanent (where water resources such as streams and pans may be removed) and is *likely* to occur. The impact risk class is **Low to Moderate** (Table 15).

Cumulative impacts

The construction phase, if inadequately mitigated will have had some impact on the water quality of the local water resources and ultimately the Wilge River.

Additional project impact (if no mitigation measures are implement) will increase the significance of the existing baseline impacts. The cumulative unmitigated impact will probably be of a LOW to MODERATE negative significance, affecting the *study/ local area* in extent. The impact *is very likely* and will be short term to permanent (where water resources such as streams and pans may be removed). The impact risk class is **Low to Moderate** (Table 15).

Mitigation Measures

Because of the 5 year footprint extension, mitigation during operation would be similar to the construction mitigation:

- As the construction will take place in a phased approach it is important to optimise design of ADF to minimise size of footprint throughout the life-cycle;
- Minimise area of vegetation clearing for same reasons as above;
- Where practically possible, undertake the clearing of vegetation during the dry season to minimise erosion;
- Comply with GN704 in relation to storm water measures so that sediment transport off site is minimised and clean water is diverted around the cleared area;
- Maintain sediment traps as part of the storm water management plan where necessary and especially upstream of discharge points where erosion protection measures and energy dissipaters should be in place;
- Clean spills as quickly as possible;
- Store and handle potentially polluting substances and waste in designated, bunded facilities;
- Waste should be regularly removed from the construction site by suitably equipped and qualified operators and disposed of in approved facilities;
- Maintain infrastructure adequately to prevent spillages; and

- Maintain a water quality monitoring programme.

Residual Impact

The residual impact of the construction (as the ADF progresses over the period 2030 to 2058) and operation of the ADF will include the permanent loss of water resources however in the case of Site H these will be limited; as well as a potential decline in water quality. Most of these impacts are expected to be mostly restricted to the local area, however the potential deterioration of water quality within the Wilge River will increase the extent of the impacts.

The residual impact to water resources of the construction (as the ADF progresses over the period 2030 to 2058) and operation of the ADF of the project will be reduced through mitigation. After mitigation the impacts to the water resources will probably be of a LOW to MODERATE negative significance, affecting the site/ *local area* in extent. The impact *is likely* and will be short term to permanent where loss of water resources occur. The impact risk class is likley be reduced to **Low** (Table 15).

Table 15: Operational Phase Impact Assessment

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
Operation of ADF	Water quality impacts (sedimentation and chemical contamination)	Existing	2	2	3	4	1.9 - LOW	Maintenance of the storm water management system and compliance to GN704 to keep clean and dirty water separated; implement water quality monitoring programme; Store and handle potentially polluting substances and waste in designated bunded facilities;	Construction phase will have had some negative impacts on site
		Cumulative	3	2	4	4	2.4 - MOD		Operation of the ADF will have additional impacts
		Residual	3	2	3	3	1.6 - LOW		The impact can be mitigated to a very low risk rating by applying mitigation described
Operation of ADF Dams	Water quality impacts from overflows from contaminated dams	Existing	2	2	3	4	1.9 - LOW	Adequate design and operation of the dams in compliance to GN704 to maintain freeboard of 0.8m for each dam and prevent overflows (1:50).	Construction phase will have had some negative impacts on site
		Cumulative	3	3	4	4	2.7 - MOD		Poor operation of the dams will have additional impacts
		Residual	3	2	3	3	1.6 - LOW		The impact can be mitigated to a very low risk rating by applying mitigation described
Clearing of vegetation over the period 2030 - 2058	Erosion and increased sediment transport into water resources	Existing	2	2	3	4	1.9 - LOW	Site H is only 0.54 % of the B20F and B20E quaternary catchments; a storm water management plan that will direct clean water around the site to the	No major streams located on the site
		Cumulative	2	2	3	4	1.9 - LOW		The construction activities will not contribute significantly to the loss of streams/

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
								Leeufonteinspruit will be put in place and upgraded as the phases proceed	altered flow in the area
		Residual	2	2	2	3	1.2 - LOW		Limited mitigation to ensure clean water reaches steams
	Loss of streams and altered flows	Existing	1	5	1	4	1.9 - LOW	Vegetation clearning only where necessary; Stabilisation/ rehabilitation of exposed areas as soon as possible; storm water management will be incorporated to limit sediment transported to the Leeufonteinspruit	Construction phases will have some negative impacts on site
		Cumulative	1	5	1	4	1.9 - LOW		The land clearing associated with the ongoing construction of the ADF should not contribute significantly to the risk rating
		Residual	1	5	1	4	1.9 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described
	Water quality deterioration in adjacent water resources because of spills from mechanical equipment	Existing	3	3	3	4	2.4 - MOD	Store and handle potentially polluting substances and waste in designated bunded facilities; spills cleaned up immediately; storm water management will be incorporated to limit contaminated water entering the	Construction phases will have some negative impacts on site
		Cumulative	3	3	3	4	2.4 - MOD		Contamination of the site from spills from mechanical equipment may occur and impact the Leeufonteinspruit

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
		Residual	2	2	2	4	1.6 - LOW	Leeufonteinspruit; stay out of 1:100 floodlines; implement water quality monitoring programme	The impact can be mitigated to a low risk rating by applying mitigation described
Dam construction	Erosion with increased sediment transport into water resources	Existing	2	2	3	4	1.9 - LOW	Stabilisation/ rehabilitation of exposed areas as soon as possible; storm water management will be incorporated to limit sediment transported to the Leeufonteinspruit	Construction phase will have some negative impacts on site
		Cumulative	2	2	3	4	1.9 - LOW		The construction of the dams and associated infrastructure will not contribute significantly to the risk rating
		Residual	2	2	2	3	1.2 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described
	Water quality deterioration in adjacent water resources because of spills from mechanical equipment	Existing	3	3	3	4	2.4 - MOD	Store and handle potentially polluting substances and waste in designated bunded facilities; spills cleaned up immediately; storm water management will be incorporated to limit contaminated water entering the Leeufonteinspruit; stay out of 1:100 floodlines; implement water quality monitoring programme	Construction phase will have some negative impacts on site
		Cumulative	3	3	3	4	2.4 - MOD		Contamination of the site from spills from mechanical equipment may occur and impact the Leeufonteinspruit
		Residual	2	2	2	4	1.6 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
Dam rehabilitation	Emptying of dam and disposal of contaminated sediment leading to wtaer quality impacts	Existing	2	2	4	3	1.6 - LOW	The removal and disposal of the sediment will be done in a manner such that the contaminated sediments will be disposed of to the ADF.	Existing dam will have had a low impact if operated correctly
		Cumulative	3	2	4	4	2.4 - MOD		Disposal of sediment may have an additional impact
		Residual	2	2	2	3	1.2 - LOW		The impact can be mitigated to a very low risk rating by applying mitigation described

7.1.3 Closure Phase

A number of impacts are expected to materialise as a consequence of the closure phase of the 30 year ADF and the associated infrastructure. Impacts relating to the rehabilitation of the ADF are also applicable to the operational phase of the project, as rehabilitation will take place concurrently. The decommissioning and removal of infrastructure during the closure phase is also likely to result in a number of impacts similar to the construction phase impacts.

- Disturbance to streams;
- Increased sediment transport into water resources;
- Increased erosion; and
- Water quality deterioration in adjacent water resources.

Rehabilitation of the ADF will include the placement of topsoil on the side slopes and crest of the ADF and the establishment of vegetation on the ADF. Surface runoff on the steep side slopes is likely to erode the topsoil in the initial stages prior to the establishment of sufficient vegetation.

The combined weighted project impact to water resources (prior to mitigation) will be of a LOW negative significance, affecting the *site/ local area*. The impact will act in the short term and is very likely to occur. The impact risk class is thus **Low** (Table 16).

Cumulative Impact

The cumulative impacts of the operational phase activities, if not mitigated successfully, as well as impacts from other developments (mines, industrial areas and urban development) in the area are likely to impact on the water resources.

In this respect additional project impact (if no mitigation measures are implemented) will increase the significance of the existing impacts, the cumulative unmitigated impact will probably be of a LOW-MODERATE negative significance, affecting the *site/ local area* in extent. The impact is very likely and will be *short term to permanent* where water resources have been removed throughout the various phases of the ADF development. The impact risk class is thus **Low to Moderate** (Table 16).

Mitigation Measures

Mitigation during closure would be to:

- Comply with GN704 in relation to storm water measures so that sediment transport off site is minimised and clean water is diverted around the cleared area;
- Maintain sediment traps as part of the storm water management plan where necessary and especially upstream of discharge points where erosion protection measures and energy dissipaters should be in place; and
- Maintain the water quality monitoring programme at closure and post-closure.

Residual Impact

The residual impact of the closure of the ADF will include the permanent loss of water resources (flow) although this is minimum, as well as a potential decline in water quality. Most of these impacts are expected to be restricted to the local scale, however the potential deterioration of water quality within the Wilge River will increase the extent of the impacts.

The residual impact to water resources beyond the closure phase of the project will be reduced through mitigation. After mitigation the impacts to the water resources will probably be of a LOW negative significance, affecting the *site/ local area* in extent. The residual impact from the closure phase is likely but will be short term. The impact risk class is therefore **Low to very low** (Table 16).

Table 16: Closure Impacts

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
Infrastructure removal	Disturbance to streams (Loss of streams and altered flows)	Existing	1	5	1	4	1.9 - LOW	Site H is only 0.51 % of the B20F and B20E quaternary catchments; a storm water management plan that will direct clean water around the site to the Leeufonteinspruit will be put in place to ensure clean water flows around the site after closure	Existing impacts from and operational phase are expected to be low
		Cumulative	1	5	1	4	1.9 - LOW		Additional impacts from the closure phase are unlikely to impact significantly to the loss of streams/ altered flow in the area
		Residual	1	5	1	4	1.9 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described
	Increased sediment transport into water resources	Existing	2	2	3	4	1.9 - LOW	Mainteannce of the storm water management system; rehabilitation of sloped areas to minimise erosion	Existing impacts from and operational phase are expected to be low
		Cumulative	3	2	3	4	2.1 - MOD		Additional impacts from the closure phase may add additional impacts
		Residual	2	2	2	3	1.2 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described
	Erosion	Existing	2	2	3	4	1.9 - LOW	Mainteannce of the storm water management system; rehabilitation of sloped areas to minimise erosion	Existing impacts from and operational phase are expected to be low
		Cumulative	3	2	3	4	2.1 - MOD		Additional impacts from the closure phase may add additional impacts
		Residual	2	2	2	3	1.2 - LOW		The impact can be mitigated to a low risk rating by applying mitigation described
	Water quality deterioration	Existing	3	2	2	3	1.4 - LOW	Store and handle potentially polluting substances and waste	Construction phases will have some negative impacts on site

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Interpretation
		Cumulative	3	2	2	3	1.4 - LOW	in designated bunded facilities; spills cleaned up immediately; storm water management will be incorporated to limit contaminated water entering the Leeufonteinspruit; implement water quality monitoring programme	Contamination of the site from spills from mechanical equipment and removal of infrastructure may occur and impact the Leeufonteinspruit
		Residual	2	2	1	3	1 - VERY LOW		The impact can be mitigated to a low risk rating by applying mitigation described

7.2 Cumulative impacts

The receiving water resources within the area are the Wilge River and the Saalboomspruit. The cumulative impact assessment considers the project within the context of other similar land uses, in the local study area and greater regional context.

Historical agricultural, mining practices and settlements development over the past few decades have had detrimental effects on the surface water environment in the area. This is mainly attributed to fertilizer application, erosion, siltation and point-source discharges by wastewater treatment works (WWTWs) into the surrounding watercourses.

The streams surrounding the existing ash disposal area and the proposed ash disposal area (Site H) are already impacted either by the existing dump or the mining activities within the area and are impacting on the Wilge River which has been classified as a Class II river.

All samples collected during July 2012 and January 2013 at sampling sites CSW01, CSW02, CSW03, CSW13 and CSW14 indicated high concentrations of sulphate (SO_4), aluminium (Al), magnesium (Mg) and ammonia (NH_4) indicative of impacts from existing mining, industrial and informal settlements.

The presence of several industrial and mining activities within one catchment may have severe effects on the surface water environment.

The impacts from the ADF are likely to impact on the Wilge River and not the Saalboomspruit. The Wilge River, a tributary of the Olifants River, flows northwards until it is joined by the Saalboomspruit. Considering the development in the catchment there is concern that the Wilge River will soon experience significant water quality concerns. The Saalboomspruit is already showing water quality concerns. The river then flows in a north-easterly direction until it joins the Olifants River upstream of the Loskop Dam. Given the fact that the Olifants River feeds into several water supply storage facilities utilised by local settlements, the impact of deteriorating water quality, which makes the water less fit for use, has significant environmental as well as social and economic implications.

The implementation of the miotigation identified is therefore essential to prevent the deterioration of water quality in the Wilge River.

8.0 PROPOSED MONITORING PLAN

Considering Site H as the preferred site it is proposed that monitoring be undertaken at the sites set out in Table 17.

Table 17: Proposed surface water quality monitoring points

Monitoring points	Location	
	Latitude (S)	Longitude (E)
CSW02	-26.06045	28.86524
CSW03	-26.02776	28.87286
SCH02	-26.08263	28.93350
SCH01	-26.088470	28.941030

It is recommended that sampling be undertaken on a monthly basis, starting at least 6 months prior to construction start-up for the parameters listed below:

- pH;
- Conductivity (mS/m);
- Total Dissolved Solids (TDS)(mg/L);
- Alkalinity as $CaCO_3$ (mg/L);

- Ammonia as N (mg/L);
- Nitrate (NO_3) as N (mg/L)
- Sulphate (SO_4)(mg/L)
- Arsenic (As (µg/L);
- Aluminium (Al) (µg/L);
- Cadmium (Cd)(mg/L);
- Calcium (Ca)(mg/L);
- Chloride (Cl)(mg/L);
- Fluoride (F)(mg/L);
- Iron (Fe)(µg/L);
- Lead (Pb)(µg/L);
- Magnesium (Mg) (mg/L);
- Manganese (Mn) (mg/L);
- Mercury (Hg)(µg/L);
- Potassium (K)(mg/L);
- Sodium (Na)(mg/L); and
- Zinc (Zn) (µg/L).

In light of the fact that certain heavy metals such as cadmium, arsenic, mercury, lead, manganese and zinc are thought to have endocrine disrupting properties at very low concentrations and the users downstream include cattle consuming water from the resource, it is important that these are monitored and that sensitive laboratory techniques, such as ICP-MS, are used.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The Wilge River catchment (and associated tributaries) is a priority and will require water use activities in its catchment to be conducted in a safe and responsible manner so as not to increase the existing impacts on water quality.

Increased surface water monitoring should be instituted to give a better indication of what is happening in the catchment area in relation to surface water contamination as the current sampling is very limited and does not give a clear picture.

The Wilge River has been classified as a Class II river which means that it needs to be protected and maintained in the state that it currently is and improved in areas where it has been severely impacted, such as the unnamed tributary flowing north of the proposed Site H. In terms of surface water quality it is therefore important that best practise is employed when undertaking ash disposal activities.

10.0 REFERENCES

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APPENDIX A

Document Limitation

DOCUMENT LIMITATIONS

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