DEA Reference: 14/12/16/3/3/1/700

Date: 22 April 2013

Attention: Ms Tebogo Sibanyoni
Department of Environmental Affairs
Private Bag X447
Pretoria
0001

Dear Madam,

APPLICATION FOR ENVIRONMENTAL AUTHORISATION (BASIC ASSESSMENT) IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) (NEMA) AS AMENDED AND THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS 2010 FOR CONSTRUCTION WITHIN RIVERS AND WETLANDS AND CROSSING OF WETLANDS AT THE KUSILE POWER STATION

WETLAND MANAGEMENT PLAN (WMP)

Eskom Holdings submitted a final Basic Assessment Report (BAR) to the Department of Environmental Affairs (DEA) on 28 January 2013. The BAR was in support of the application for Environmental Authorisation (EA) for the following National Environmental Management Act, 1998 (Act 107 of 1998) as amended (NEMA) listed activities at the Kusile Power Station:

- Activity 11 of GN 544 for the:
  - construction of the ash dump dirty dam (ADDD) and settling dams within a wetland;
  - construction of toe drains within a wetland;
  - construction of the ash dump access embankment (with culvert) within a wetland;
  - crossing of the wetlands by a pipeline between the ADDD and station dirty dams;
  - crossing of the wetland by a dirty water pipeline between the Ash Dump and the ADDD; and

  - crossing of wetlands by the fencelines around the Kusile ash dump and the Kusile power station.
- Activity 18 of GN 544 for the:
  - infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert)
  - removal of soil located in a wetland for the construction of the ADDD.

The DEA formally accepted the BAR on 3 March 2013 and an EA was issued on 5 April 2013. One of the conditions of the EA is that Kusile Power Station must submit a Wetland Management Plan (WMP) before commencement of construction activities within wetlands.

Please find herewith a site specific WMP for the above mentioned activities

I trust that you will find this in order.

Please do not hesitate to contact the undersigned if you have any further queries.

Yours faithfully,

....

Deon Esterhuizen
Environmental Assessment Practitioner (EAP)

PROJECT REF: 14/12/16/3/3/1/700

APPLICATION FOR ENVIRONMENTAL AUTHORISATION (BASIC ASSESSMENT) IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) (NEMA) AS AMENDED AND THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS 2010 FOR CONSTRUCTION WITHIN RIVERS AND WETLANDS AND CROSSING OF WETLANDS AT THE KUSILE POWER STATION COMBUSTION WASTE TERRACE

SITE SPECIFIC WETLAND MANAGEMENT PLAN (WMP)

Division Presenting

A&IRM Environmental Division

Document Prepared by

SEBATA INSTITUTE

Date

April 2013

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A MEMBER OF THE SEBATA GROUP OF COMPANIES

Title:	Site Specific Wetland Management Plan for the River Crossings and Wetlands and Construction within Rivers and Wetlands at the Kusile Power Station Combustion Waste Terrace
Authors:	Ndomupei Dhemba
Reviewer	Deon Esterhuizen
Project Name:	Kusile Coal Fired Power Station
DEA Reference No.:	14/12/16/3/3/1/700
ILISO Project No.:	1200055
Date:	April 2013

Approved for Kusile Power Station by:

Stapelberg
....
Leon Stapelberg
Representative of the Applicant

Date: 2013/04/22

Approved for Sebata Institute by:

PP Talmeyer
....
Deon Esterhuizen
Environmental Assessment Practitioner

Date:

EXECUTIVE SUMMARY

Eskom Holdings submitted a final Basic Assessment Report (BAR) to the Department of Environmental Affairs (DEA) on 28 January 2013 for activities 11 and 18 of GN 544 of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) for:

- *construction of the ash dump dirty dam (ADDD) and settling dams within a wetland;*
- *construction of toe drains within a wetland;*
- *construction of the ash dump access embankment (with culvert) within a wetland;*
- *crossing of the wetlands by a pipeline between the ADDD and Station Dirty Dams (SDD);*
- *crossing of the wetland by a dirty water pipeline between the Ash Dump and the ADDD; and*
- *crossing of wetlands by the fencelines around the Kusile ash dump and the Kusile power station.*
- *infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert); and*
- *removal of soil located in a wetland for the construction of the ADDD.*

The DEA formally accepted the BAR on 3 March 2013 and issued a positive Environmental Authorisation (EA) on 5 April 2013. One of the conditions of the EA is that Eskom must submit a site specific Wetlands Management Plan (WMP) that includes mitigation measures for each river/wetland crossing. The scope of this document is therefore to give environmental management specifications, to the Contractor constructing the ADDD, fencelines, the pipeline between the ash dump and the ADDD and the pipeline between the ADDD and the SDD, in fulfilment of the conditions set out in the Environmental Authorisation (EA) issued by the DEA on 5 April 2013.

Potential Impacts

The generic potential impacts that will be experienced for the river and wetland crossing sites are:

- *Loss of Biodiversity;*
- *Erosion and sedimentation; and*
- *Surface Water Pollution.*

Where specific potential impacts were identified, specific mitigation measures were suggested per crossing which can be noted in each river/wetland crossing tables in Section 7.

Long term plans for the ash dump

The 10 year ash dump shown in ***Figure 1-1*** *will be used for the co-disposal of ash and gypsum during year 1 to 4. From year 5 to 10, only gypsum will be disposed of at the ash dump. Kusile is currently applying for a Waste Management Licence for the co-disposal of ash and gypsum at the 10 year ash dump (****DEA Reference: 14/12/3/3/3/51****). The application is currently at the Scoping phase. An Impact Assessment process will be conducted for the 10 year ash dump, including, Specialist Studies and the Environmental Management Programme (EMPr).*

Parallel to the waste management licence application for the 10 year ash dump, Kusile Power Station is currently conducting an Environmental Impact Assessment (EIA) for the 60 year ash dump. A screening process was conducted and five sites were identified for the 60 year ash dump as feasible alternatives (Please refer to ***Figure 10-1****). The final Scoping Report was submitted and approved by the DEA (****DEA Reference: 12/12/20/2412****) on 28 August 2012. An Impact Assessment process will be conducted for the 60 year ash dump, including, Specialist Studies and the Environmental Management Programme (EMPr).*

Conclusions and Recommendations for Mitigation

Where necessary, site specific mitigation measures were included in each detailed information table (please refer to Section 6 for site specific mitigation). It is recommended that for all of the river and wetland crossings the following mitigation measures be implemented as to maintain/contribute to improvement of the aquatic environment at, and downstream, of each crossing site:

General

- *Contractors must refer to the Standard Environmental Specification (SES) attached in* ***Appendix B*** *for the Kusile Project. All the mitigation measures identified in the SES must be applied in addition to the mitigation measures outlined in this WMP. Kusile Power Station applied for relaxations to the SES and some of the conditions of the original 2008 EA.* ***Table 1-1*** *gives a summary of the relaxations that were applied for and approved by the DEA. Please refer to* ***Appendix B*** *for a copy of the SES and the letters of approval for the applications for relaxation of the conditions of the 2008 EA and sections of the SES.*
- *Environmental awareness training must be provided for all contractors and workers, appropriate to the activity and addressing the mitigation measures contained in this WMP.*

- *A maximum impact footprint must be appropriately delineated and sign posted before construction within wetlands commences.*
- *Sensitive areas outside the impact footprint must be clearly demarcated and sign posted as "No Go" areas.*
- *Construction camps shall be located outside the extent of any watercourse and must be recovered and removed shortly after construction has been completed.*
- *All machinery and equipment must be kept in good working order.*

Loss of Biodiversity

- *Existing indigenous vegetation must be retained where possible and only vegetation within the construction servitude must be removed.*
- *Vegetation removal must be done in stages, in order to reduce impact of construction.*
- *Ensure that weeds do not invade, in the short term, disturbed areas by implementing an invasive alien species eradication programme.*
- *Riparian zones should be maintained and rehabilitated.*
- *All areas impacted during construction must be rehabilitated by seeding the area using a cocktail of indigenous grasses.*
- *Off-site mitigation shall be implemented to compensate for the loss of biodiversity. This can be done by identifying a source of water capable of supporting wetlands, as well as a suitable locality, preferably already disturbed so as to avoid altering another ecosystem that can be managed (Please refer to **Section 8**).*

Erosion and Sedimentation

- *All areas susceptible to erosion must be protected to ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas.*
- *The extent of exposed soils at any one time should be limited.*
- *Access into seasonally wet areas and / or turf soils during and immediately after rainy periods must be avoided.*
- *Utilise only light equipment for access and deliveries into areas of unstable soils, in areas where erosion is evident, and at stream and river embankments where possible.*
- *Clearing of vegetation should only be conducted shortly before construction commences.*
- *Preservation of vegetation, where possible, is suggested to avoid soil erosion.*

- *Vegetation clearance for construction should be staggered to guarantee that as little soil as possible is exposed to potential erosion at any given point in time.*
- *Re-planting of areas disturbed by construction should occur immediately after construction activities are completed.*
- *The construction footprint should be minimised to avoid unnecessarily exposing soils to erosion as is standard practice at Kusile (Please refer to* ***Figure 6-1****).*
- *Low level berms and sediment traps should be used in low points. This will contain the extent of erosion and deposition reducing the scale of the impacts to the site itself.*
- *Soils must be protected till plant germination and establishment.*
- *Silt/sediment should be cleared before removing the sediment traps after construction has been completed.*
- *Contours can also be used where necessary to prevent water from flowing away and maximising ingress.*

Surface Water Pollution

- *All hazardous substances or possible pollutants such as hydrocarbons shall be stored offsite or in sealed areas on site to prevent surface water pollution in accordance with SANS Standard.*
- *Stormwater must be diverted into vegetated buffer zones and not directly into surface water concentrated flows.*
- *Contaminated stormwater must be contained and returned into the process circuit.*
- *During construction, the Contractor must ensure that storage, washing and maintenance of equipment and machinery is undertaken outside the extent of any watercourse and only in demarcated areas where runoff and spills are managed in an environmentally sound manner*
- *Litter should be disposed of in appropriate waste disposal bins.*
- *Topsoil must be removed and stockpiled within specified areas and must be outside wetlands.*
- *Spill kits and drip trays shall be made available at point of use.*
- *Sanitation and waste management facilities must be located outside of the extent of a watercourse and must be managed in an environmental sound manner.*
- *Materials must be stored outside the extent of any wetland and transported and prepared/handled in an environmentally sound manner, in compliance with relevant legislation*
- *Discharges into wetlands must be prevented as far as reasonably possible and stockpiles must be protected from erosion.*

- *An emergency plan (i.e. measures for prevention, detection, management and reporting) must be prepared for dealing with accidental spills and leaks in compliance with relevant legislation and regulations.*
- *Clean water and dirty water must be separated. All run-off should be contained in a settling dam before being discharged to a drainage line. No water can be discharged directly into drainage lines.*
- *All contaminated materials will be disposed off at permitted waste disposal facilities.*

Wetland Offset Mitigation

A Wetland Management Strategy (WMS) was developed for Kusile Power Station by Prime Africa Consultants. The study made use of the current delineation and classification study and was based on the Guideline for Wetland Offset developed by SANBI. The WMS addresses the following:

- *An overview of all the wetlands at the Kusile Power Station, including their health status (Present Ecological Status (PES), hydrological function and Ecological Importance and Sensitivity (EIS;*
- *Possible wetland areas, which are suitable for offset consideration at Kusile; and*
- *Potential Rehabilitation areas at Kusile.*

The draft Wetland Management Strategy that was compiled for Kusile identified wetland areas that may be suitable for offsetting wetland loss caused by the construction of the ADDD, the Ash Dump Embankment with Culvert, the pipelines and the fencelines (Please refer to ***Section 8****). In terms of land ownership, the majority of Component 2 is currently owned by Eskom and has the added advantage of having a wetland rehabilitation plan partially in place, making it a prime candidate as an offset. However, a portion of this component is seen as an offset for the 10 Year Co-Disposal Facility by the DWA and would have limited use for other offset credits. Component 3 is comprised largely of the Topigs property, and is not owned by Eskom. This area combined with Component A (incorporating the Wilge River) can be seen as an ideal candidate as an offset area.*

A larger biodiversity offset including the terrestrial grasslands of Component 2, combined with Components 1 and 3 would provide an ideal offset area, which would encompass both terrestrial and wetland-offset targets.

However, this would require Eskom to acquire the Topigs wetland potion and associated terrestrial habitat.

Eskom does not own Components 4 and 5, so wetland rehabilitation would be more difficult and both sites would be unable to mitigate any potential impacts from Kusile on the Wilge River due to their position in the quaternary catchments. While wetland rehabilitation of the wetlands between Kusile and the Wilge has the benefit of mitigating the impacts of the developments on the Wilge, the impact of the developments could be seen as a risk to the success of the rehabilitation and offset initiative. The construction of retention facilities within the wetland is also more likely to be considered mitigation, rather than rehabilitation and offsetting. Components 4 and 5 also have large commercial agricultural activities, which would substantially increase the amount of financial compensation.

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WETLANDS MANAGEMENT PLAN (WMP)

(Ref. No. 14/12/16/3/3/1/700)

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Appendix A: Copy of the Environmental Authorisation for construction within wetlands and the crossing of wetlands at the Kusile Power Station

Appendix B: Kusile Standard Environmental Specifications

Appendix C: Copies of the 2006 Aquatic and Wetlands Specialist Studies and the 2011 Wetlands Delineation Specialist Study Reports

Appendix D: Construction Method Statements

LIST OF ABBREVIATION

ADDD Ash Dump Dirty Dam

BAR Basic Assessment Report

C	Contractor
CECO	Contractor Environmental Control Officer (Dedicated person
CM	Contract Manager (Eskom)
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Environmental Monitoring Committee
EMPr	Environmental Management Programme
GN	Government Notice
IHAS	Invertebrate Habitat Assessment System
PES	Present Ecological Status
PM	Project Manager
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
SANBI	South African National Biodiversity Institute
SASS5	South African Scoring System, Version 5
SES	Standard Environmental Specification
SDD	Station Dirty Dam
WMP	Wetlands Management Plan

WMS	Wetlands Management Strategy
WUL	Water Use Licence

LIST OF UNITS

Ha	hectares
mamsl	metres above mean sea level
%	percentage

1. INTRODUCTION

1.1 BACKGROUND

Eskom Holdings submitted a final Basic Assessment Report (BAR) to the Department of Environmental Affairs (DEA) on 28 January 2013. The BAR was in support of the application for Environmental Authorisation for the following National Environmental Management Act, 1998 (Act 107 of 1998) as amended (NEMA) listed activities at the Kusile Power Station:

- Activity 11 of GN 544 for the:
  - construction of the ash dump dirty dam (ADDD) and settling dams within a wetland;
  - construction of toe drains (Dirty Water Drains) within a wetland;
  - construction of the ash dump access embankment (with culvert) within a wetland;
  - crossing of the wetlands by a pipeline between the ADDD and Station Dirty Dams (SDD);
  - crossing of the wetland by a dirty water pipeline between the Ash Dump and the ADDD; and
  - crossing of wetlands by the fencelines around the Kusile ash dump and the Kusile power station.
- Activity 18 of GN 544 for the:
  - infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert); and
  - removal of soil located in a wetland for the construction of the ADDD.

The DEA formally accepted the BAR on 3 March 2013 and issued a positive Environmental Authorisation (EA) on 5 April 2013 (Please refer to **Appendix A** for a copy of the EA). One of the conditions of the EA is that Eskom must submit a Wetlands Management Plan (WMP) that includes mitigation measures for each river/wetland crossing.

1.2 SCOPE

The scope of this document is to provide wetlands management specifications, to the Contractors constructing the ADDD, fencelines, the pipeline between the ash dump and the ADDD and the pipeline between the ADDD and the SDD, in fulfilment of the conditions set out in the Environmental Authorisation (EA) issued by the Department of Environmental Affairs (DEA) on 5 April 2013.

Contractors must also refer to the Standard Environmental Specification (SES) for the Kusile Project. All the mitigation measures identified in the SES must be applied in addition to the mitigation measures outlined in this WMP. .Kusile Power Station applied for relaxations to the SES and conditions of the original 2008 EA. **Table 1-1** gives a summary of the relaxations that were applied for and approved by the DEA. Please refer to **Appendix B** for a copy of the SES and the letters of approval for the applications for relaxation of the conditions of the 2008 EA and sections of the SES.

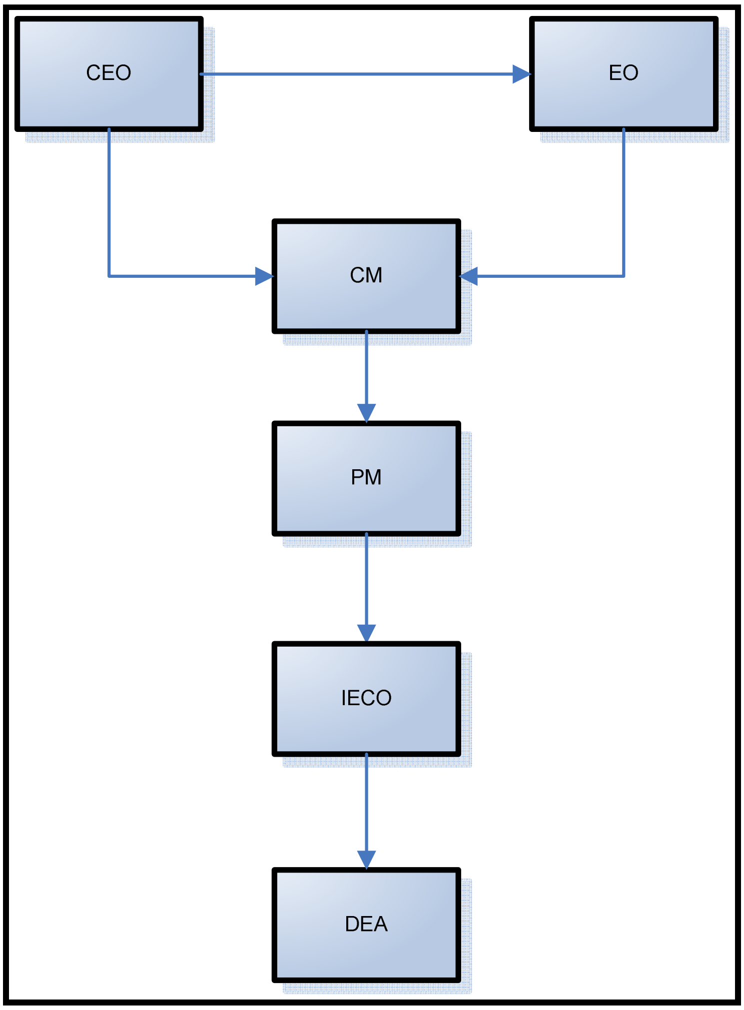
Table 1-1: Consolidated list of construction EMP Amendments letters/ DEA approvals

EMP/SES/RoD section	Specification	DEA approval dates	Comments
SES 622 and 6.3.5.	-Top soil height and - Fencing	07 May 2009	approved
RoD 13.17.2	Exclusion of Occupation health and Safety	15 Jul 2009	OHS excluded on RoD
SES 5.2.2.	Dust level	04 Nov 2010 and 02 Dec 2010	Approved from 0.25 g/ m^2/ day to 1.2 g/ m^2/ day
RoD 6.1.1	Reflective structures	15 July 2009	Permanent structures and non-reflective materials
RoD 3.7.6.	Mercury removal	25 Aug 2010	Condition deferred
RoD 3.10.2	Quarterly monitoring of mortality and fatality rates of chicken	29 Oct 2010	Monitoring to commence a year before operation of the site i.e implementation by Dec 2014

<u>Eskom requires a commitment from the Eskom Project Manager and the Contractor on the following issues:</u>

1) Ensure environmental conditions stipulated in the EA are implemented.
2) To preserve the natural environment by limiting destructive actions on site.

1.3 REPORTING STRUCTURE



Where:

EO: -	Environmental Officer (Can be the Eskom Site Supervisor depending on the size of the project)
C: -	Contractor
CM: -	Contract Manager (Eskom)
CEO: -	Contractor Environmental Officer (Dedicated person)
PM: -	Project Manager (Eskom)
IECO: -	Independent Environment Control Officer who reports to DEA
DEA: -	Department of Environmental Affairs

1.4 RESPONSIBILITY MATRIX

Function	Responsibility
Project Manager (PM) (Eskom)	Overall management of project and WMP implementation.
Site Supervisor/ Contract Manager (CM) (Eskom)	Oversees site works, liaison with Contractor, PM and ECO.
Environmental Officer (EO) – appointed by Eskom	Implementation of WMP.
Contractor (C)	Implementation and compliance with recommendations and conditions of the WMP. Appoints dedicated person (Community Liaison Officer) to work with ECO
Contractor Environmental Officer (CECO)	Implementation of WMP, environmental control of site actions, re-mediation and rehabilitation work.
Independent Environment Control Officer (ECO)	Compliance to WMP, report to DEA ,Auditing
Environmental Advisor (Eskom)	Environmental advice

1.5 STUDY AREA

The river crossings (**Table 1-1** and **Figure 1-1**) are located in the Olifants Water Management Area (WMA 3 (DWA, 2000) and fall within quaternary catchment B20F.

Table 1-2: Summary of the River and Wetland Crossings

Wetland/ River Crossing Number	GN 544 Listed Activity	Description	Quaternary Catchment	GPS location		Elevation (masl)	Farm/Ptn
				South	East		
1	11	Construction of the ash dump dirty dam (ADDD) within a wetland	B20F	25º56'4.61"	28º53'51.75"	1 466	Klipfontein 566 JR, Remainder
2		Construction of settling dams within a wetland	B20F	25º 56'32.92"	28º 54'51.87"	1 488	Klipfontein 566 JR, Portion 10
3		Construction of toe drains within a wetland	B20F	25º 56'36.14"	28º 55'16.64"	1 483	Klipfontein 566 JR, Portion 30
4		Construction of the ash dump access embankment (with culvert) within a wetland	B20F	25º 55'31.89"	28º 54'31.61"	1 464	Klipfontein 566 JR, Remainder
5		Crossing of wetlands by	B20F	25º 55'25.92"	28º 54'7.95"	1 456	Hartbeestfontein

Wetland/	GN 544	Description	Quaternary	GPS location		Elevation	Farm/Ptn
		pipeline between the ADDD and station dirty dam;					537 JR, Remainder
6		Crossing of the wetland by a dirty water pipeline between the ash dump and the ADDD.	B20F	25º 56'8.81"	28º 53'58.26"	1 472	Klipfontein 566 JR, Remainder
7		Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station.	B20F	25º 55'48.71"	28º 55'50.71"	1 512	Klipfontein 566 JR, Portion 58
8		Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station.	B20F	25º 56'42.78"	28º 55'23.01"	1 478	Klipfontein 566 JR, Portion 30
9	**18**	infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert)	B20F	25º 55'31.89"	28º 54'31.61"	1 464	Klipfontein 566 JR, Remainder
10		removal of soil located in a wetland for the construction of the ADDD	B20F	25º56'4.61"	28º53'51.75"	1 466	Klipfontein 566 JR, Remainder

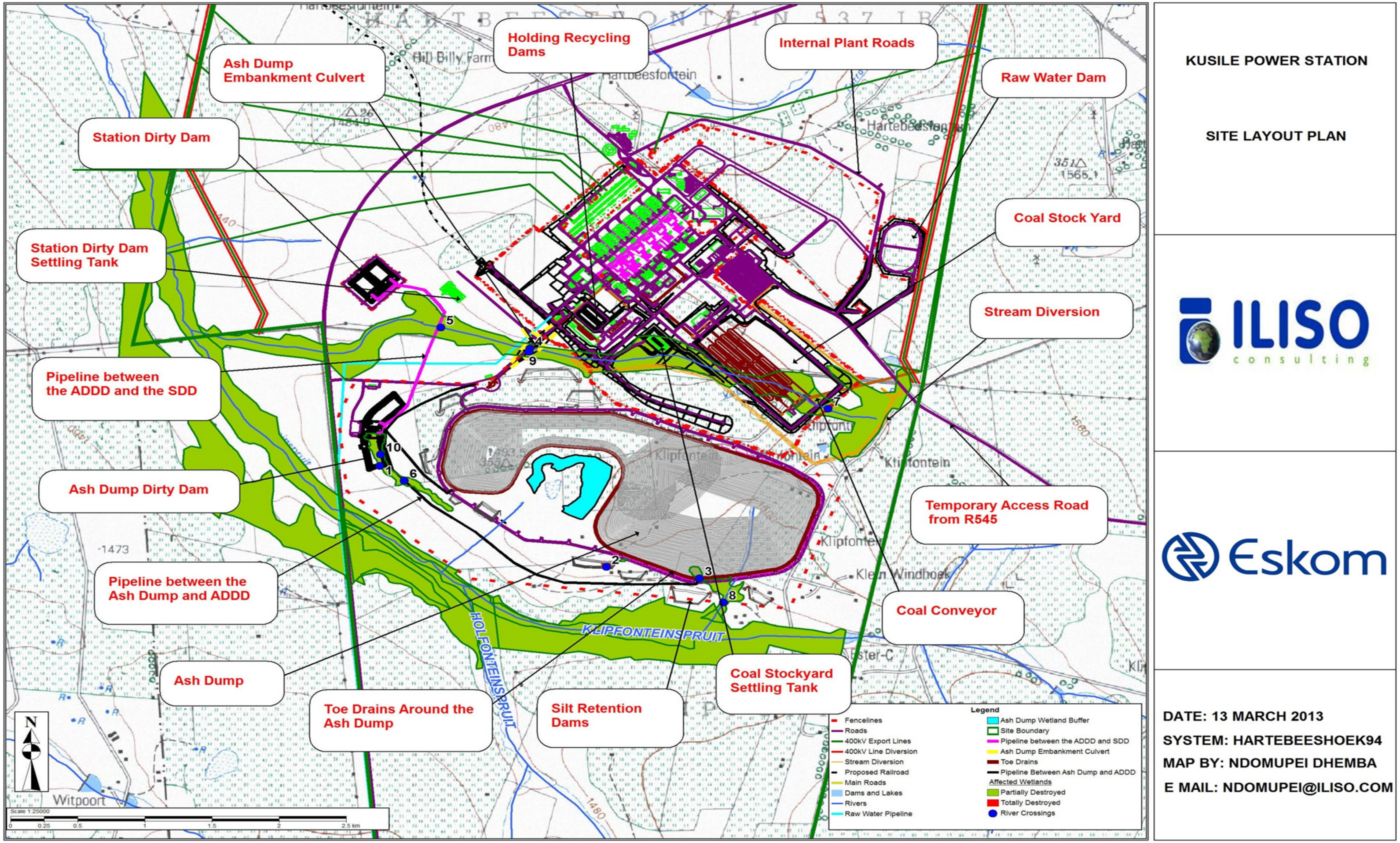


Figure 1-0-1: Kusile Site Layout Plan showing the River and Wetland Crossings being Applied For

1.5.1 Ash Dump Dirty Dams and Settling Tanks

The Toe Drains (Dirty stormwater collection drains) will be provided within the ash dump footprint and around the dump perimeter. These surface channels, together with the sub-surface drains in the base of the ash dump will drain into the ash dump dirty water settling tanks and storage dams. The final designs of these settling tanks and dams have not yet been completed, but it will be lined according to Department of Water Affairs (DWA) approval and will comply with South African legal requirements, in particular Government Notice (GN) 704.

1.5.2 Silt Retention Dams

Runoff from the fully rehabilitated areas will be managed as clean water and discharged to the stream on either side of the dump after passing through a series of retention/settling dams located around the ash dump perimeter. The runoff from the incremental cleanwater catchments outside of the active footprint, flowing towards the active dump will be intercepted with temporary cut-off drains. These drains will divert the flow around the ash dump footprint, into the clean water system after passing through rention/settling dams.

1.5.3 Ash Dump Embankment Culvert

An access embankment must be constructed between the power station terrace and the planned 10-year Ash/Gypsum Co-Disposal Facility. This structure will provide access for various services (e.g. ash conveyor system, pipelines, access road). The access embankment will be located to the west of the main power station terrace, in the natural wetland in the non-perennial tributary of the Klipfonteinspruit. A culvert will be constructed under the ash dump embankment to accommodate the 1:100 instantaneous flood peak event. The embankment will consist of earth in-filling across the wetland and the culvert will consist of three parallel Armco KA46 culverts to pass all clean stormwater that is collected in the Coal Stockyard (CSY) stream diversion channel under the ash dump embankment. The culvert will have a capacity to pass the design flow of 83.5 m^3/s while flowing partially full.

1.5.4 Pipeline between the ADDD and the Station Dirty Dam

An emergency drain pipeline will be constructed between the ADDD and the Station Dirty Dam, which will cross the low integrity wetland to the South West of the ash dump.

Options to (i) amend the ADDD layout and location; and (ii) of crossing at the ARMCO Culvert and Access Road were considered but none of these alternative proved to be feasible due to elevation constraints between structures. The slope along invert of the 525 mm diameter pipe is, on average, only a minimal 0.6 %. It must be noted that the wetland that will be crossed by the pipeline was crossed already by the project twice before by the D686 access road and RAW pipeline. The pipeline will be above ground level within the wetland

1.5.5 Fenceline

The fencelines to be erected around the ash disposal facility and the power station will be in places within 32 meters of some wetlands. Crossing of the wetlands will be over the authorised diversion trench and the embankment and over a wetland, south east of the ash dump.

1.5.6 Toe Drains (Dirty Water Drain)

A dirty stormwater collection drain comprising a rectangular concrete canal with removable precast lids will be provided around the perimeter of the ash dam footprint and extended across the site during the various stages of development. The concrete dirty storm water channels, which will also receive drainage from the leakage detection drains will report to the ADDD.

1.5.7 Dirty Water Pipeline

A dirty water pipeline will be constructed between the Ash Dump and the ADDD, which will transport dirty water runoff from the Phase 2 footprint of the Ash Dump to the ADDD. The pipeline will be a pre-cast concrete pipe, approximately 3 000 meters long and 2.7 meters in outside diameter. Of the 3 000 meter run, approximately 200 meters will cross through a medium integrity wetland. The dirty water pipeline will be used as a spillage mitigation pipeline and will be above ground level within the wetland

2. CONDITIONS OF THE ENVIRONMENTAL AUTHORISATION

In terms of the Environmental Authorisation that was issued by the DEA, the following conditions will apply.

2.1 SCOPE OF AUTHORISATION

- The construction of a dirty water pipeline between the ash dump and the ash dump dirty dam; silt retention dams; and toe drains within the low integrity wetlands located between the power station and the 10 year ash dump area.
- Authorisation of the activity is subject to the conditions contained in this authorisation, which form part of the environmental authorisation and tare binding on the holder of the authorisation.
- The holder of the authorisation is responsible for ensuring compliance with the conditions contained in this environmental authorisation. This includes any person acting on the holder's behalf, including but not limited to, an agent, servant, contractor, sub-contractor, employee, consultant or person rendering a service to the holder of the authorisation.
- The activities authorised may only be carried out at the property as described above.
- Any changes to, or deviations from, the project description set out in this authorisation must be approved, in writing, by the Department before such changes or deviations may be effected in assessing whether to grant such approval or not, the Department may request such information as it deems necessary to evaluate the significance and impacts of such changes or deviations and it may be necessary for the holder of the authorisation to apply for further authorisation in terms of the regulations.
- This activity must commence within a period of three (3) years from the date of issue of this authorisation. If commencement of the activity does not occur within that period, the authorisation lapses and a new application for environmental authorisation must be made in order for the activity to be undertaken.
- Commencement with one activity listed in terms of this authorisation constitutes commencement of all authorised activities.
- The holder of an environmental authorisation must notify the competent authority of any alienation, transfer and change of ownership rights in the property on which the activity is to take place.

2.2 NOTIFICATION OF AUTHORISATION AND RIGHT TO APPEAL

- The holder of the authorisation must notify every registered interested and affected party, in writing and within 12 (twelve) calendar days of the date of this environmental authorisation, of the decision to authorise the activity.
- The notification referred to must –
  - specify the date on which the authorisation was issued;
  - inform the interested and affected party of the appeal procedure provided for in Chapter 7 of the Environmental Impact Assessment Regulations, 2010;
  - advise the interested and affected party that a copy of the authorisation will be furnished on request; and
  - give the reasons of the competent authority for the decision.
- The holder of the authorisation must publish a notice -
  - informing interested and affected parties of the decision;
  - informing interested and affected parties where the decision can be accessed; and
  - drawing the attention of interested and affected parties to the fact that an appeal may be lodged against this decision in the newspaper(s) contemplated and used in terms of regulation 54(2)(c) and (d) and which newspaper was used for the placing of advertisements as part of the public participation process.

2.3 MANAGEMENT OF THE ACTIVITY

A detailed Wetland Management Plan (WMP) must be submitted to Department for approval prior to commencement of construction activities. The WMP must identify details of the specific impacts expected at every wetland crossing and within wetlands; and prove details of practical implementable rehabilitation measures to mitigate, manage and/or rehabilitate wetlands affected by the following specific activities:

- Construction of the ash dump dirty dam and settling dams within a wetland;
  - Construction of toe drains within a wetland;
  - Construction of the ash dump access embankment (with culvert) within a wetland;
  - Crossing of wetlands by pipeline between the ash dump dirty dam and station dirty dam;
  - Crossing of the wetlands by a dirty water pipeline between the ash dump and the ash dump dirty dam;
  - Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station;

  - o infilling of soil and rock into a wetland for the construction of the ash dump access embankment with culvert);
  - o Removal of soil located in a wetlands for the construction of the ash dump dirty dam and the depositing ash waste material exceeding 5m³ into wetlands for storage purposes using a waste management facility programme plan; and
  - o Measures to protect the high integrity wetlands.
- The WMP must further include, but should not be limited to:
  - o Measures for the protection of all affected wetlands from pollution in particular where construction takes place within the 1:100 year flood line; and
  - o Details of the remaining wetlands and measures to ensure the conservation of these wetlands; either through the Wetland Banking System via Working for Wetlands or a Stewardship Agreement through the Mpumalanga Parks Board. These measures must be for as long as the impact lasts.
- A comprehensive map illustrating the total extent of all lost wetlands referred to above, must accompany the WMP.

2.4 MONITORING

- The current independent Environmental Control Officer (ECO) for the construction of Kusile Power Station in terms of condition 3.13 of EA issued on 17 March 2008 must incorporate this authorisation into his/her responsibilities.
- The existing Environmental Monitoring Committee (EMC) for Kusile Power Station project must also include this project in complying with condition 3.11 of the EA issued for Kusile Power Station on 17 March 2008.

2.5 RECORDING AND REPORTING TO THE DEPARTMENT

- All documentation e.g. audit/monitoring/compliance reports and notifications, required to be submitted to the Department in terms of EA issued for Kusile Power Station on 17 March 2008, shall include the activities approved in this authorisation.

2.6 COMMENCEMENT OF THE ACTIVITY

- The authorised activity shall not commence with twenty (20) days of the date of signature of the authorisation.
- An appeal under section 43 of the National Environmental Management Act (NEMA), Act 107 of 1998 (as amended), does not suspended an environmental authorisation

exemption, or any provisions or conditions attached thereto, or any directive, unless the Minister, MEC or delegated organ of state directs otherwise.

- Should you be notified by the Minister of a suspension of the authorisation pending appeal procedures, you may not commence with the activity until such time that the Minister allows you to commence with such an activity in writing.

2.7 NOTIFICATION TO AUTHORITIES

- Fourteen (14) days written notice must be given to the Department that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include a date on which it is anticipated that the activity will commence, as well as a reference number. This notification period may coincide with the notice of intent to appeal period.

2.8 OPERATION OF THE ACTIVITY

- Fourteen (14) days written notice must be given to the Department that the activity operational phase will commence.

2.9 SITE CLOSURE AND DECOMMISSIONING

- Should the activity ever cease or become redundant, the applicant shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered by any relevant and competent authority at the time.

2.10 SPECIFIC CONDITIONS

- The applicant must provide the department with a detailed long term plan for the expansion of the approved 10 year ash dump to align it with the lifespan of the power station.
- Storm water discharge points must be fitted with the energy dissipaters to slow down the high velocity water discharged into wetlands.
- All hazardous material must be stored away from the wetlands in bunded areas.
- Slit traps must be installed to reduce the sediment loads to avoid sediment loads in river and stream of concern.

2.11 GENERAL

- A copy of this authorisation and the approved EMPr must be kept at the property where the activity will be undertaken. The authorisation and approved EMPr must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent or the holder of the authorisation who works or undertakes work at the property.
- The holder of the authorisation must notify both the Director: Integrated Environmental Authorisations and the Director: Compliance Monitory at the Department, in writing and within 48 (forty eight) hours, if any condition of this authorisation cannot be or is not adhered to. Any notification in terms of this condition must be accompanied by reasons for the non-compliance.
- National government, provincial government, local authorities or committees appointed in terms of the conditions of this authorisation or any other public authority shall not be held responsible for any damages or losses suffered by the applicant or his successor in title in any instance where construction or operation subsequent to construction be temporarily or permanently stopped for reasons of non-compliance by the applicant with the conditions of authorisation as set out in this document or any other subsequent document emanating from these conditions of authorisation.

3. LEGISLATION, DEVELOPMENT STRATEGIES AND GUIDELINES

On compiling this WMP, the following legislation and guidelines/policies were taken into consideration:

- The National Environmental Management Act, 1998 (Act 107 of 1998);
- The National Water Act, 1998 (Act No 36 of 1998);
- The National Forests Act, 1998 (Act No. 84 of 1998);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004);
- The National Fencing Act, 1963 (Act No 31 of 1963 (as amended by Act 108 of 1991); and
- The National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) and its Regulations.

4. AQUATIC ECOLOGY AND WETLAND DELINEATION SPECIALIST STUDIES

Kusile Power Station commissioned extensive aquatic ecological and wetland delineation studies, These studies include the Aquatic and Wetlands Specialist Studies that were undertaken by EcoSun as part of the 2006 Environmental Impact Assessment (EIA), for which Kusile was granted a positive Environmental Authorisation (EA) (**Ref: 12/12/20/807**). Another Wetlands Delineation specialist study conducted by Wetlands Consulting Services was commissioned in April 2011 on request by the Department of Water Affairs (DWA), as part of the Application for a Section 21 (g) Water Use Licence (WUL). Please refer to **Appendix C** for the 2006 Aquatic and Wetlands Specialist Studies and the 2011 Wetlands Delineation specialist study reports.

4.1 AQUATIC SPECIALIST STUDIES (2006)

The overall objective of this study was to provide a broad description of the wetlands and streams associated with the proposed development and included the following specific objectives:

- An assessment of biodiversity patterns & processes associated with wetlands and streams;
- A biotic integrity assessment and associated habitat classification;
- Delineation of aquatic ecosystems, as well as their ecological significance;
- Wetland and biotic status assessment;
- An impacts significance assessment and recommendations to prevent or mitigate identified impacts; and
- A recommendation regarding the project in terms of aquatic and wetland ecosystems, with and without mitigation measures.

The approach included:

- Desktop assessment – obtain relevant information (e.g. satellite imagery, existing literature) verify the likely presence of important ecological attributes – rare and endangered species (R&E), and important habitat types.
- Conduct a desktop delineation of the wetlands associated with the area proposed for the development;
- design a field survey through identifying river reaches and wetland segments most likely to be under threat from impacts that may result from the proposed development

and select survey sites to represent these reaches of likely impact;

- Conduct a field survey to verify desktop delineations and the likely presence of important ecological attributes (e.g. biodiversity patterns and processes);
- Analyses of results and data interpretation involving the following:
  - Classification of aquatic and wetland areas into discernable ecosystem units;
  - Assessment of each unit's ecosystem integrity and services provided.

4.2 WETLAND DELINEATION AND CLASSIFICATION (APRIL 2011)

The main objective of the 2011 Wetlands Delineation and classification study was to establish the extent of the wetlands and assess the potential impacts on these wetlands within the footprint of an ash dump associated with the Kusile Power Station. The scope of work included:

- Confirmation/rejection of the presence of previously identified wetlands on site;
- If present, delineation and mapping of the wetland extent; and establish the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the wetland
- Assess the impacts on the wetland; and
- Identify and describe mitigation measures associated with the proposed activity.

Topographical maps, orthophotos and Google Earth Imagery were used to create base maps of the study area onto which the wetland boundaries could be delineated. A desktop delineation of the wetlands was undertaken by identifying rivers and wetness signatures on the digital base maps. The wetlands were delineated according to the delineation procedures as set out by the DWA. The actual wetland boundaries were delineated using indirect indicators of prolonged saturation (hydrophytes) and wetland soils (hydromorphic soils) with emphasis on the hydromorphic soils. The delineated wetlands were then classified using a hydro-geomorphic classification system.

5. FINDINGS OF THE STUDIES

5.1 AQUATIC ECOLOGICAL ASSESSMENT

Habitat Assessment

Invertebrate Habitat Assessment System, Version 2 (IHAS)

Based on the IHAS scores, habitat availability for aquatic macroinvertebrates was generally poor for the streams on project site (Klipfonteinspruit)).

Aquatic Macroinvertebrates

A total of 40 aquatic macroinvertebrate taxa (10 to 28 taxa per site) were sampled in the study area. The low number of taxa sampled in the Klipfonteinspruit could largely be attributed to limited habitat availability, with an absence of the stones-in-current biotope which provides habitat for the majority of aquatic macro-invertebrate fauna.

South African Scoring System, Version 5 (SASS5)

SASS5 scores recorded in the Klipfonteinspruit were ranged between 38 and 53.

Biotic Integrity based on SASS5 Results

Biotic integrity for the sample area concerned was derived based on the modelled reference conditions for the Highveld region. Based on SASS5 results, biotic integrity in the Klipfonteinspruit was indicated to be Seriously Modified (Class E). This was ascribed mainly to limited habitat availability, rather than water quality impairment.

Ichthyofauna

A total of 121 specimens comprising 4 species were sampled in the study area. These include *Barbus anoplus* (Chubbyhead barb), *Chiloglanis pretoriae* (Shortspine suckermouth), *Pseudocrenilabrus philander* (Southern mouthbrooder) and *Tilapia sparrmanii* (Banded tilapia).

Wetland and Riparian Flora

According to Van Oudtshoorn (1999), approximately 110) grass species occur within the study area. Of these species 78 species were recorded during the study. Of these species 28 species were wetland grass types, 20 species were species associated with both wetlands and veld/grassland areas and 30 species were grass species associated with non-wetland grassland or veld. None of the species identified were classified as Red Data

Book species.

Wetland and Riparian Fauna

Of the 346 bird species known to occur within the study area according to Harrison et al (1997a and b), only 73 species were recorded during the duration of the study. Most of the species recorded were wetland or grassland species with the Grass Owl being the only species found known to be a Red Data List species.

Of the 45 small mammals known to be resident in the region ten were recorded within the study area, of these none of the recorded species are classified as Red Data species.

Twelve amphibian species are known to occur within the study area. Of these species only 4 species were recorded during the study. These species are common in the area and in many other areas in the country and are not listed as Red data species.

Of the 34 reptile species of the area, four were recorded during the study. All of the recorded species are common and no Red Data species were recorded.

Wetland Classification and delineation

The study found that there six different wetland types: channelled valley bottom; hill slope feeding a watercourse; hill slope not feeding a watercourse; non channelled valley bottom; floodplain and depression wetland types on the project site.

Wetland Integrity

The general integrity of the wetlands associated with the site can be regarded as impaired with only two wetland sections of high integrity.

5.2 WETLAND DELINEATION

Two wetland types were identified, a depression or pan with associated seepage wetlands and contact seepage wetlands on the and south western slopes of the site. These identified wetlands occupy 8% of the catchment area of 207 ha, of which 98 ha of the catchment falls within the footprint of the proposed ash dump.

The wetlands to the east of the pan are on deep to moderately deep sandy soils which allow easy infiltration of rainwater into the soil. The infiltrated water will percolate laterally through the soil profile along the aquitard. Most of this water is likely to be lost to evapotranspiration over tome, while some is discharged into adjacent streams.

Wetlands associated with the contact between a diabase sill and Dwyka formation were also detected and delineated outside the footprint of the ash dump. These wetlands were classified as seasonal wetlands. The water emerging within these wetlands is mostly subsurface, but close enough to the surface to influence the vegetation.

The total footprint occupied by the wetlands was estimated to be 17 ha, excluding the valley bottom wetlands, which represent about 8 % of the wetlands catchment.

Present Ecological State (Health)

The DWA wetlands scoring system was applied to determine the Present Ecological Status (PES) and Ecological Importance and Sensitivity (EIS) of the wetlands. The Wet-health tool was used to provide an indication of the departure of the wetlands from an unimpacted state. The tool comprises of three modules namely:

- Hydrology;
- Geomorphology; and
- Vegetation.

Hydrology

There were no obvious indications of changes in the hydrology influencing the two wetland types. Based on site observations the changes in hydrology to both wetland systems were considered to be small and the health category of A (= no discernible modifications, or the modifications are of such a nature that they have no impact on the hydrological integrity) was assigned to the hydrology.

Geomorphology

There were no signs of erosion-deposition, head cuts or other signs of geomorphological changes other than the intentionally excavated section of the contact seepage wetland. The combined system was therefore considered to be unimpacted, with a score of A (= unmodified or natural).

Vegetation

The study found that the state of the vegetation within the catchments and the wetlands themselves suggest that some disturbance had taken place, including cultivation, cattle grazing and trampling in some sections of, particularly the hillslope seepage wetlands on the perimeter of the depression. It was concluded that the extent of the changes were not extensive or intensive and an overall class equating to a PES of B (= very minor change to vegetation composition is evident at the site) was assigned.

Water Quality

There was no way of establishing the water quality except by inference based on land use changes, changes that might have occurred to the water quality contributing to the development and support of the wetlands. Given that a portion of the catchment in which the wetlands are located has been used for cultivation, the specialist found that it was possible that there had been a change in the quality of the water reaching the wetlands. There are however a number of processes that occur within the soil profile that can transform and or remove substances such as nitrogen and phosphates, making it difficult to assess whether the quality of water reaching the wetland has changed. The inferred PES of the water quality was regarded as speculative.

Overall PES

The overall PES of the wetlands was considered to be A for the pan and A/B for the hillside slopes (= largely natural but a slight change in processes is discernible).

Ecological Importance and Sensitivity

The EIS was rated as an A based on the following:

- an assessment of the wetlands taken in isolation from surrounding land uses;
- the lack of biodiversity information which invoked the precautionary principle; and
- the rate of transformation of the land use to open cast coal mining in the Upper Olifants and Wilge catchments in relation to their impact on water flow and wetlands.

This score was however down rated to a C due to the following reasons:

- Kusile Power Station and its associated infrastructure is a strategically important project and had been approved, and has been granted a Water Use Licence (WUL);

- The environmental impacts associated with its positioning have been established and accepted by society; and
- The cost, in terms of time (delays to commissioning the power station), monetary and environmental associated with finding an alternative site.

6. POTENTIAL IMPACTS AND MITIGATION MEASURES

6.1 GENERIC POTENTIAL IMPACTS

The generic potential impacts that will be experienced for the river and wetland crossing sites are:

- Loss of Biodiversity
- Erosion and sedimentation; and
- Surface Water Pollution.

6.2 MITIGATION MEASURES

General

- Environmental awareness training must be provided for all contractors and workers, appropriate to the activity and addressing the mitigation measures contained in this WMP.
- A maximum impact footprint must be appropriately delineated and sign posted before construction within wetlands commences.
- Sensitive areas outside the impact footprint must be clearly demarcated and sign posted as “No Go” areas. Please refer to **Figure 1-1** showing positions of the fencelines around that will protect sensitive areas.
- Construction camps shall be located outside the extent of any watercourse and must be recovered and removed shortly after construction has been completed.
- All Machinery and equipment must be kept in good working order.
- Access roads must be provided during construction. No additional access roads will be required for the construction within wetlands and crossing of wetlands and Rivers at Kusile.

Loss of Biodiversity

- Existing indigenous vegetation must be retained where possible and only vegetation within the construction servitude must be removed.
- Vegetation removal must be done in stages, in order to reduce impact of construction.
- Ensure that weeds do not invade, in the short term, disturbed areas by implementing an invasive alien species eradication programme.
- Riparian zones should be maintained and rehabilitated.
- All areas impacted during construction must be rehabilitated by seeding the area using a cocktail of grasses including:

Table 6-1: Grass species that could be considered for planting on disturbed areas.

Scientific name	Common name	Description	Suitability	Establishment
Eragrostis curvula	Weeping love grass	Robust, densely perennial tufted grass. Establishes easily.	Pasture, disturbed soils, good soil stabilizer	October - December
Eragrostis tef	Tef	Loose annual, sometimes dense tufted grass	Pasture, disturbed soils, good soil stabilizer	September - December
Cynodon dactylon	Couch/Bermuda grass	Short, mat-forming grass	Pasture, disturbed soils, damp soil, excellent soil stabilizer	September - February
Digitaria eriantha	Common finger grass	Perennial tufted grass	Pasture, damp soil	September - February
Panicum maximum	Guinea grass	Leafy perennial tufted grass	Pasture, damp soil	September - February
Chloris gayana	Rhodes grass	Leafy grass which spreads by means of stolons	Pasture, damp soil, good soil stabilizer	October - November, February - March

- Off-set mitigation shall be implemented to compensate for the loss of biodiversity. This can be done by identifying a source of water capable of supporting wetlands, as well as a suitable locality, preferably already disturbed so as to avoid altering another ecosystem that can be managed. Please refer to **Section 8**.

Erosion and Sedimentation

- All areas susceptible to erosion must be protected to ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and Work Areas.
- The extent of exposed soils at any one time should be limited.
- Access into seasonally wet areas and / or turf soils during and immediately after rainy periods must be avoided.
- Utilise only light equipment for access and deliveries into areas of unstable soils, in areas where erosion is evident, and at stream and river embankments where possible.
- Clearing of vegetation should only be conducted shortly before construction commences.
- Preservation of vegetation, where possible, is suggested to avoid soil erosion.
- Vegetation clearance should be staggered to guarantee that as little soil as possible is exposed to potential erosion at any given point in time as is standard practice at Kusile (Please refer to **Figure 6-1**).

Figure 6-1: Evidence that Contractors clear areas in stages

- Re-planting of areas disturbed by construction should occur immediately after construction activities are completed.
- The construction footprint should be minimised to avoid unnecessarily exposing soils to erosion
- Low level berms and sediment traps should be used in low points. This will contain the extent of erosion and deposition reducing the scale of the impacts to the site itself.
- Soils must be protected till plant germination and establishment
- Silt/sediment should be cleared before removing the sediment traps after construction has been completed.
- Contours can also be used where necessary to prevent water from flowing away and maximising ingress.

Surface Water Pollution

- All hazardous substances or possible pollutants such as hydrocarbons shall be stored offsite or in sealed areas on site to prevent surface water pollution in accordance with SANS Standard.

- Stormwater must be diverted into vegetated buffer zones and not directly into surface water concentrated flows must be prevented Contaminated stormwater must be contained and returned into the process circuit.
- During construction, the Contractor must ensure that storage, washing and maintenance of equipment and machinery is undertaken outside the extent of any watercourse and only in demarcated areas where runoff and spills are managed in an environmental sound manner
- Litter should be disposed of in appropriate waste disposal facilities.
- Topsoil must be removed and stockpiled within specified areas and must be outside wetlands.
- Spill kits and drip trays shall be made available at point of use.
- Sanitation and waste management facilities must be located outside of the extent of a watercourse and must be managed in an environmental sound manner.
- Materials must be stored outside the extent of any wetland and transported and prepared/handled in an environmentally sound manner, in compliance with relevant legislation
- Discharges into wetlands must be prevented as far as reasonably possible and stockpiles must be protected from erosion.
- An emergency plan (i.e. measures for prevention, detection, management and reporting) must be prepared for dealing with accidental spills and leaks in compliance with relevant legislation and regulations.
- Clean water and dirty water must be separated. All run-off should be contained in a settling dam before being discharged to a drainage line. No water can be discharged directly into drainage lines.
- All contaminated materials will be disposed off at permitted waste disposal facilities.

7. DETAILED RIVER/WETLAND CROSSING TABLES

Please refer to **Figure 1-1** for the site layout plan showing the locations of the wetland/river crossings. Each wetland/river crossing corresponds to the river crossing marked on the Map e.g. Wetland/River Crossing 1 corresponds to the river crossing marked 1 on the map.

7.1 WETLAND/RIVER CROSSING 1

Wetland/River	A low integrity Wetland, West of the Ash Dump. The affected wetland has a total footprint of 5.74 ha. It is expected that 3.05 ha (53.14 %) of the wetland will be affected by the ADDD before and after mitigation.
Description	Construction of the Ash Dump Dirty Dam (ADDD) within a wetland
Co-ordinates:	25º56’4.61”S, 28º53’51.75”E
Altitude (m.a.s.l):	1 466
Quaternary Catchment	B20F
Water Management Area	Olifants River
PES	A
EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope Seepage
Farm :	Klipfontein 566 JR, Portion 0 (Remainder)
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply.	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Section 6.2 must be applied.	

2. A portion of the wetland will be destroyed as a result of the construction of the ADDD. The rest of the wetland will not be impacted on since the wetland is fed by the pan associated by the ash dump. The pan will be protected by a buffer that has been created around it.
3. The ADDD must be properly lined in terms of the DWA Minimum requirements to ensure that there is no seepage into the groundwater.
4. The ADDD will have adequate capacity to handle a 1:100 year flood/storm event, which will ensure no uncontrolled releases of polluted water into the aquatic environment.

7.2 WETLAND/RIVER CROSSING 2

Wetland/River	A low integrity Wetland, South of the Ash Dump. The affected wetland has a total footprint of 1.58 ha. It is expected that 0.94 ha of the wetland will be affected by the settling dams before mitigation.
Description	Construction of settling dams within a wetland.
Co-ordinates:	25º 56’32.92”S, 28º 54’51.87”E
Altitude (m.a.s.l):	1 488
Quaternary Catchment	B20F
Water Management Area	Olifants River
PES	D.
EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope seepage
Farm :	Klipfontein 566 JR, Portion 10
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply.	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Section 6.2 must be applied. 2. Minimize intersection of wetland, especially on slopes, even slight slopes.	

3. Construction must occur when wetland driest. 4. Restore back-filled trench to same soil texture and compaction as neighbouring soils. 5. Preserve wetland soils - move soil and subsoil only twice – once to get it off the line of the trench, and a second time to replace it. 6. Preserve wetland soils - stockpile topsoil and subsoil to minimize surface area to volume ratio in order to limit exposure to atmosphere. 7. Preserve wetland soils - minimize time between first disturbance and restoration and revegetation.

7.3 WETLAND/RIVER CROSSING 3

Wetland/River	A low integrity Wetland, South East of the Ash Dump. The affected wetland has a total footprint of 5.74 ha,
Description	Construction of toe drains within a wetland
Co-ordinates:	25º 56'32.92"S, 28º 54'51.87"E
Altitude (m.a.s.l):	1 488
Quaternary Catchment	B20F
PES	D
EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope seepage
Water Management Area	Olifants River
Farm :	Klipfontein 566 JR, Portion 10
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply.	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Section 6.2 must be applied. 2. It is expected that a small portion of the wetland will be cut off from the larger Klipfontein	

Wetland system due to crossing of the wetlands by the toe drains. However the impact is considered to be negligible since the size of the wetland to be cut off is negligible compared to the whole Klipfontein wetland.
3. The 10 year ash dump may not be extended to encroach into the Klipfontein wetland system.

7.4 WETLAND/RIVER CROSSING 4

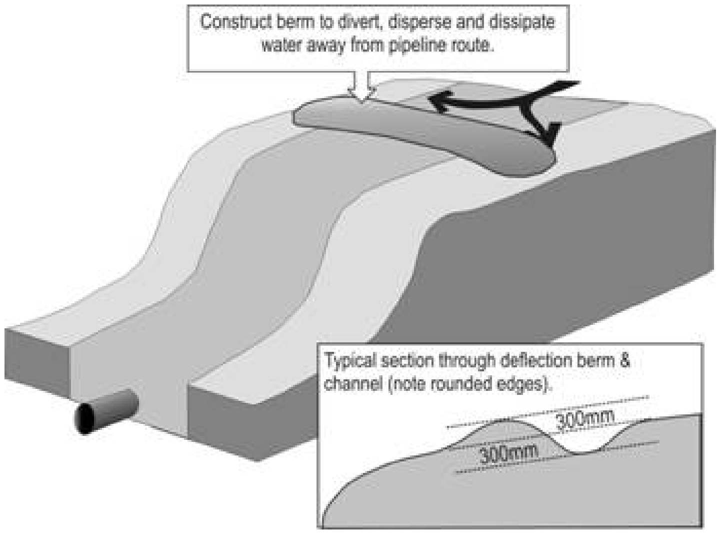
Wetland/River	A low integrity Wetland, North of the Ash Dump. The affected wetland has a total footprint of 53.25 ha. It is expected that 1.83 ha (3.44 %) of the wetland will be affected by the construction of the ash dump embankment culvert.
Description	Construction of the ash dump access embankment (with culvert) within a wetland
Co-ordinates:	25º 55'31.89" S, 28º 54'31.61"E
Altitude (m.a.s.l):	1 464
Quaternary Catchment	B20F
Water Management Area	Olifants River
PES	B
EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope seepage
Farm :	Klipfontein 566 JR, Portion 0 (Remainder)
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D.E**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply.	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Section 6.2 must be applied. 2. Temporary construction phase storm-water channels and silt traps will be provided around the	

Ash Dump Embankment Culvert construction site before construction commences, to divert clean run-off and to manage site storm-water run-off for the control of silt discharge to stream. 3. Because the Ash Dump Embankment Culvert is in the stream course, an upstream diversion. dam must be installed, and any water accumulating behind the dam will be either pumped or gravitated around the construction area, per the contractor's design. 4. The same volume of water from upstream will be released downstream so as not to cause any erosion. Water will be returned to the stream (downstream) through a siltnet.

7.5 WETLAND/RIVER CROSSING 5

Wetland/River	A low integrity Wetland, North West of the Ash Dump. The affected wetland has a total footprint of 53.25 ha. It is expected that 0.24 ha (0.45 %) of the wetland will be affected by the pipeline crossing.
Description	Crossing of wetlands by pipeline between the ADDD and station dirty dam
Co-ordinates:	25 55'25.92"S, 28 54'7.95"E
Altitude (m.a.s.l):	1 456
Quaternary Catchment	B20F
Water Management Area	Olifants River
PES	B
EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope seepage
Farm :	Hartbeestfontein 537 JR, Portion 0 (Remainder)
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply.	
SITE SPECIFIC MITIGATION MEASURES:	

1. Mitigation measures described in Section 6.2 must be applied.
2. No surface water or storm water can be allowed to be concentrated, or to flow down cut or fill slopes or along pipeline routes without erosion protection measures being in place.



Typical application of a deflection berm to avoid erosion of a pipeline route

3. Preferential flow must be prevented from taking place down the pipeline servitude by either:
    - o The placement of trench breakers at 200m intervals down the pipeline route. Each trench breaker consisting of a number of polyethylene bags filled with a 20% bentonite/local soil mix that are packed around the pipeline in the form of a collar. The intention of these trench breakers is to intercept and reduce the probability of preferential flows developing down the pipeline servitude; and/or
    - o The use of valve chambers suitably modified to fulfil a similar function.
    - o The risk of preferential flow paths forming' can also be mitigated by manholes for below grade pipe applicable to the sections outside the wetlands

7.6 WETLAND/RIVER CROSSING 6

Wetland/River	A low integrity Wetland, West of the Ash Dump. The affected wetland has a total footprint of 5.74 ha. It is expected that 0.23 ha (3.31 %) of the wetland will be affected by the pipeline before mitigation and 0.19 ha after mitigation.
Description	Crossing of the wetland by a dirty water pipeline between the ash dump and the ADDD

Co-ordinates:	25 56'8.81"S, 28 53'58.26"E
Altitude (m.a.s.l):	1 472
Quaternary Catchment	B20F
PES	A
EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope seepage
Water Management Area	Olifants River
Farm :	Klipfontein 566 JR, Portion 0 (Remainder)
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply. 2. Please refer to Section 7.5.	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Section 6.2 must be applied. 2. Mitigation measures stated in Section 7.5 apply.	

7.7 WETLAND/RIVER CROSSING 7

Wetland/River	A low integrity Wetland, North East of the Ash Dump. The affected wetland has a total footprint of 143.7 ha. It is expected that 0.04 ha (0.03 %) of the wetland will be affected by the fenceline before and after mitigation.
Description	Crossing of wetlands by the fencelines around the ash dump and the Power Station.
Co-ordinates:	25 55'48.71" S, 28 55'50.71"E
Altitude (m.a.s.l):	1 512

Quaternary Catchment	B20F
PES	D
EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope seepage
Water Management Area	Olifants River
Farm :	Klipfontein 566 JR, Portion 58
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply.	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Section 6.2 must be applied. 2. River crossing 7 is a river diversion (concrete channel) therefore no mitigation measures apply.	

7.8 WETLAND/RIVER CROSSING 8

Wetland/River	A low integrity Wetland, South East of the Ash Dump (same as affected by the toe drains). The affected wetland has a total footprint of 53.25 ha. It is expected that 0.03 ha (0.06 %) of the wetland will be affected by the fenceline before and after mitigation.
Description	Crossing of wetlands by the fence-lines around the ash dump and the Power Station.
Co-ordinates:	25 56'42.78" S, 28 55'23.01"E
Altitude (m.a.s.l):	1 478
Quaternary Catchment	B20F
PES	D

EIS	A but downgraded to C as explained in Section 5.2.
HGM Type	Hillslope seepage
Water Management Area	Olifants River
Farm :	Klipfontein 566 JR, Portion 30
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply. The contractor is referred to the Fencing Act, 1963 (Act No 31 of 1963) (as amended by Act 108 of 1991).	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Section 6.2 must be applied. 2. Steel used in fencing must be stored in demarcated areas, outside wetlands.	

7.9 WETLAND/RIVER CROSSING 9

Wetland/River	A low integrity Wetland, North of the Ash Dump. The affected wetland has a total footprint of 53.25 ha. It is expected that 1.83 ha (3.44 %) of the wetland will be affected by the construction of the ash dump embankment culvert.
Description	Infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert)
Co-ordinates:	25º 55’31.89” S, 28º 54’31.61”E
Altitude (m.a.s.l):	1 464
Quaternary Catchment	B20F
PES	B
EIS	A but downgraded to C as explained in Section 5.2.

HGM Type	Hillslope seepage
Water Management Area	Olifants River
Farm :	Klipfontein 566 JR, Portion 0 (Remainder)
DETAILED CONSTRUCTION METHOD	
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.	
SITE SPECIFIC IMPACTS:	
1. General impacts identified in Section 6.1 apply. 2. Please refer to Section 7.4.	
SITE SPECIFIC MITIGATION MEASURES:	
1. Mitigation measures described in Sections 6.2 and 7.4 must be applied. 2. No foreign material shall be used for infilling.	

7.10 WETLAND/RIVER CROSSING 10

Wetland/River	A low integrity Wetland, West of the Ash Dump. The affected wetland has a total footprint of 5.74 ha. It is expected that 3.05 ha (53.14 %) of the wetland will be affected by the ADDD before and after mitigation.
Description	Removal of soil located in a wetland for the construction of the ADDD
Co-ordinates:	25º56'4.61"S, 28º53'51.75"E
Altitude (m.a.s.l):	1 466
Quaternary Catchment	B20F
PES	A
EIS	A but downgraded to C as explained in Section 5.2.
Hillslope seepage	Hillslope seepage
Water Management Area	Olifants River
Farm :	Klipfontein 566 JR, Portion 0 (Remainder)

DETAILED CONSTRUCTION METHOD
The detailed construction methodology is specified in the attached Method statement in **Appendix D**.
SITE SPECIFIC IMPACTS:
1. General impacts identified in Section 6.1 apply. 2. Please refer to Wetland/River Crossing 1.
SITE SPECIFIC MITIGATION MEASURES:
1. Mitigation measures described in Section 6.2 must be applied. 2. Stockpiles shall be located outside the wetland areas. 3. Please refer to Wetland/River Crossing 1.

8. WETLANDS OFFSET MITIGATION

Prime Africa was appointed by Kusile to compile a Wetland Management Strategy for Kusile Power Station to guide Eskom on the potential offsets that may be required in the future. The WMS addresses the following:

- An overview of all the wetlands at the Kusile Power Station, including their health status (Present Ecological Status (PES), hydrological function and Ecological Importance and Sensitivity (EIS;
- Possible wetland areas, which are suitable for offset consideration at Kusile; and
- Potential Rehabilitation areas at Kusile

8.1 INTRODUCTION

The concept of wetland offset is seen considered to be one of the possible mechanisms for mitigating wetland loss. Wetland offsets fall within a larger group of biodiversity offsets, of which the Business and Biodiversity Offsets Programme define as follows: Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people’s use and cultural values associated with biodiversity (BBOP, 2009).

Offsets are considered to be a relatively straightforward solution to developmental progress, but are a last option when considering the mitigation hierarchy. The hierarchy of steps that need to be followed prior to considering offsets is presented in **Figure 8-1** and is regarded as a prerequisite to offset planning.

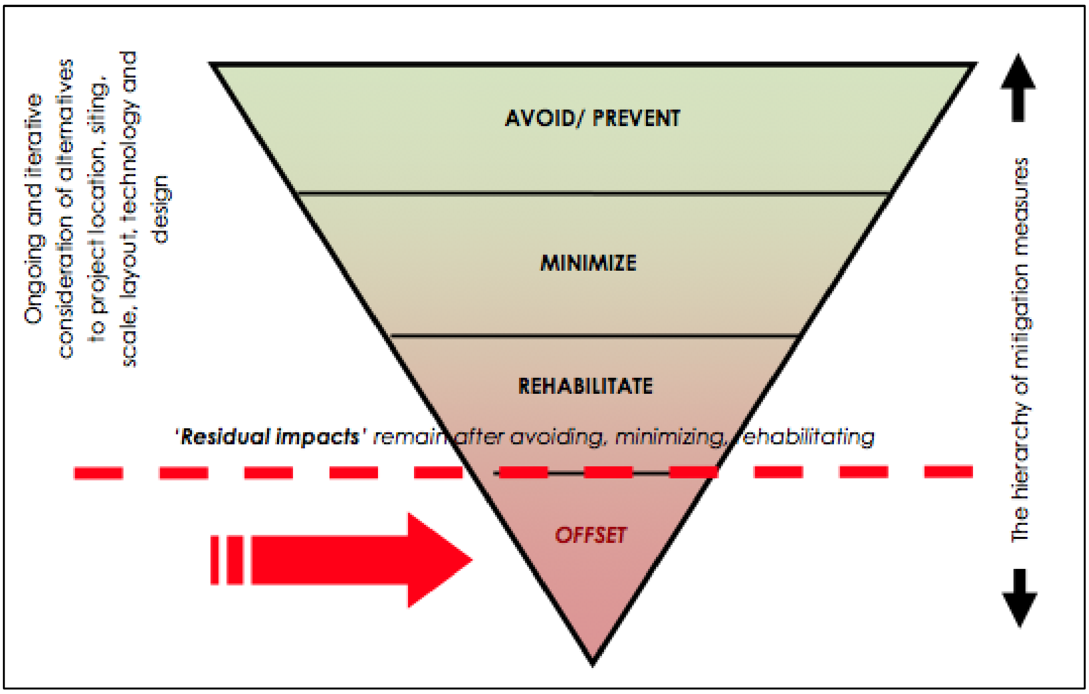


Figure 8-1: The mitigation hierarchy (SANBI 2012)

8.2 Offset Policies

At present two provinces in South Africa, Kwa-Zulu Natal (KZN) (EKZNW, 2009, 2010) and the Western Cape (DEA&DP, 2007) have draft biodiversity offset guidelines and/ or policies. The KZN guideline includes specific provisions for wetland offsets, as a subset of biodiversity offsets.

8.2.1 Legislation Pertaining to Offsets

There are several pieces of legislation in South Africa, which inform wetland offsets. The legislation promotes the conservation and sustainable use of wetland resources; further detail is given in the National Environmental Management Act (Act 107 of 1998), which highlights the need for offsets in the case of unavoidable residual impacts. The NWA also includes relevant provisions relating to the security of obligations, which could be extended to wetland offset activities.

8.2.2 Wetland Banking

Wetland mitigation banks consist of a site, or suite of sites, where wetlands are rehabilitated and/or protected for the purpose of providing wetland offsets for impacts to wetlands within a given service area. In general, wetland mitigation banks sell credits to developers whose obligation for wetland offsets is then transferred to the mitigation bank (SANBI 2012).

While wetland mitigation banking is unlikely to play a part in the early stages of a wetland-offset plan for Kusile, it may at some later stage play an important role in the wider offset strategy.

8.2.3 Cooperation Between SANBI - Working for Wetlands and Eskom

The construction and operation of the Kusile Power Station will have an impact on wetland area and functioning in the B20F quaternary catchment. Eskom is mindful of these impacts and have approached the Working for Wetlands (WfW) Programme to provide guidance and the necessary skills to improve wetland functionality in the catchment.

SANBI, through its Grasslands and WfW Programmes, is exploring ways of addressing unavoidable and residual impacts on biodiversity and ecosystem services, through mechanisms including wetland rehabilitation, wetland offsite mitigation and wetland mitigation banking. The successful development and implementation of these tools could contribute towards the achievement of biodiversity targets across the landscape.

In order to reach a possible Wetland Rehabilitation Target, Kusile Power Station may undertake wetland rehabilitation and agree to investigate possibilities to protect Wetland Mitigation Sites in perpetuity.

The subsequent memorandum of understanding (MOU) between SANBI and ESKOM is currently in the process of being finalised and provides specific roles and responsibilities for each party as follows:

SANBI, as a result of its Grasslands and WfW Programmes has the knowledge and expertise to:

- Advise Eskom Kusile Power Station on a Wetlands Management Strategy that avoids, minimises and mitigates wetlands impacts;

- Manage the rehabilitation and maintenance of wetlands and can thus assist Eskom Kusile Power Station in meeting its possible Wetland Rehabilitation Target to rehabilitate and secure other wetlands;
- Develop and test mechanisms to secure rehabilitated wetlands;
- Develop a Wetland Mitigation Banking Mechanism;
- Identify wetland systems that meet the Minimum Desired Ecological State and can be included in the Wetland Mitigation Bank;
- Has rehabilitated wetlands in various areas of South Africa that could be used as credits in a Wetland Mitigation Bank; and
- Is in a position, in collaboration with MTPA and GDARD, to address protecting Wetland Mitigation Sites or other rehabilitated wetlands, through their declaration as Nature Reserves or Protected Environments.

Eskom Kusile Power Station:

- Is willing to collaborate with SANBI to develop a Wetlands Management Strategy for the Kusile Power Station, rehabilitate, maintain and protect Wetland Mitigation Sites.
- Will pay for the rehabilitation and maintenance and protection of the Wetland Mitigation Sites by making Rehabilitation and Maintenance Costs available, for this purpose.
- Collaborate, based on the outcomes of the Wetlands Management Strategy, with the Water Research Commission to support the science of wetland rehabilitation, as an offset mechanism.
- Investigate, based on the outcomes of the Wetlands Management Strategy, the potential of artificial wetlands at the Eskom Kusile Power Station, as an offset mechanism.

8.3 WETLAND OFFSET

A preliminary calculation of the wetland offsets required for the construction of the ADDD, the Armco culvert and the river crossings was conducted.

8.4 FINDINGS

The construction of the infrastructure around Kusile (Ash Dump Access Embankment with Armco culvert, the ADDD, the pipelines and fencelines will result in the loss of small amount of wetland area.

8.4.1 Preliminary Offset Calculation

The wetlands impacted by the construction of the ADDD, the ash dump embankment culvert, fencelines and pipelines and their calculated hectare equivalents are given in the **Table 8-1**.

Table 8-1: Wetlands impacted by the construction of infrastructure. The PES and the hectare equivalents required for the offset are also given. The wetland number corresponds with the impacts shown in Figure 1-1.

Wetland/ River Crossing Number	Comment	Description	Total Area Affected (ha)	Portion affected by Facility after Mitigation	% Affected	HGM Type	PES	Hectare Equivalents
1	Wetland will be partially destroyed	Construction of the ash dump dirty dam (ADDD) within a wetland	5,74	3,05	53,14	Hillslope Seepage	A	2.59
2	Wetland will not be destroyed	Construction of settling dams within a wetland	1.58	0	0.00	Hillslope Seepage	D	
3	Wetland will be partially destroyed	Construction of toe drains within a wetland	5,74	Included in ADDD		Hillslope Seepage	D	
4	Wetland will be partially destroyed	Construction of the ash dump access embankment (with culvert) within a wetland	53.25	1.83	3.44	Hillslope Seepage	B	0,27
5	Wetland will be partially destroyed	Crossing of wetlands by pipeline between the ADDD and station dirty dam;	53.25	0.24	0.45	Hillslope Seepage	B	0,2

Wetland/ River Crossing Number	Comment	Description	Total Area Affected (ha)	Portion affected by Facility after Mitigation	% Affected	HGM Type	PES	Hectare Equivalents
6	Wetland will be partially destroyed	Crossing of the wetland by a dirty water pipeline between the ash dump	5.74	0.19	3.31	Hillslope Seepage	A	0,19
7	Wetland will be partially destroyed	Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station.	143.7	0.04	0.03	Hillslope Seepage	D	0
8	Wetland will be partially destroyed	Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station.	53.25	0.03	0.06	Hillslope Seepage	D	0
9	Wetland will be partially destroyed	Infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert)	53.25	1.83	3.44	Hillslope Seepage	B	0,52
10	Wetland will be partially destroyed	Removal of soil located in a wetland for the construction of the ADDD	5.74	3.05	53.14	Hillslope Seepage	A	0,44
TOTAL				**10.26**				**4.21**

The total area for the possible offset requirements is approximately 4.21 ha. The PES requirements for the offsets vary from an A to a D category.

8.4.2 Potential Wetland Rehabilitation Areas

The identification of wetland rehabilitation areas around Kusile relied on a landscape approach of the B20F quaternary catchment, which includes sensitive and threatened habitats, species and vegetation units, comprising riparian zones, wetlands and terrestrial grasslands. It took cognisance of the fact that both riparian zones and wetlands exist within a matrix of other landscape units and are not divorced from them, often relying on the integrity, intactness and functionality of these units for their own functionality and status. **Figure 8-2** outlines five (5) major components within the B20F quaternary catchment that will be discussed as 5 parts to an overall strategy for wetland management.

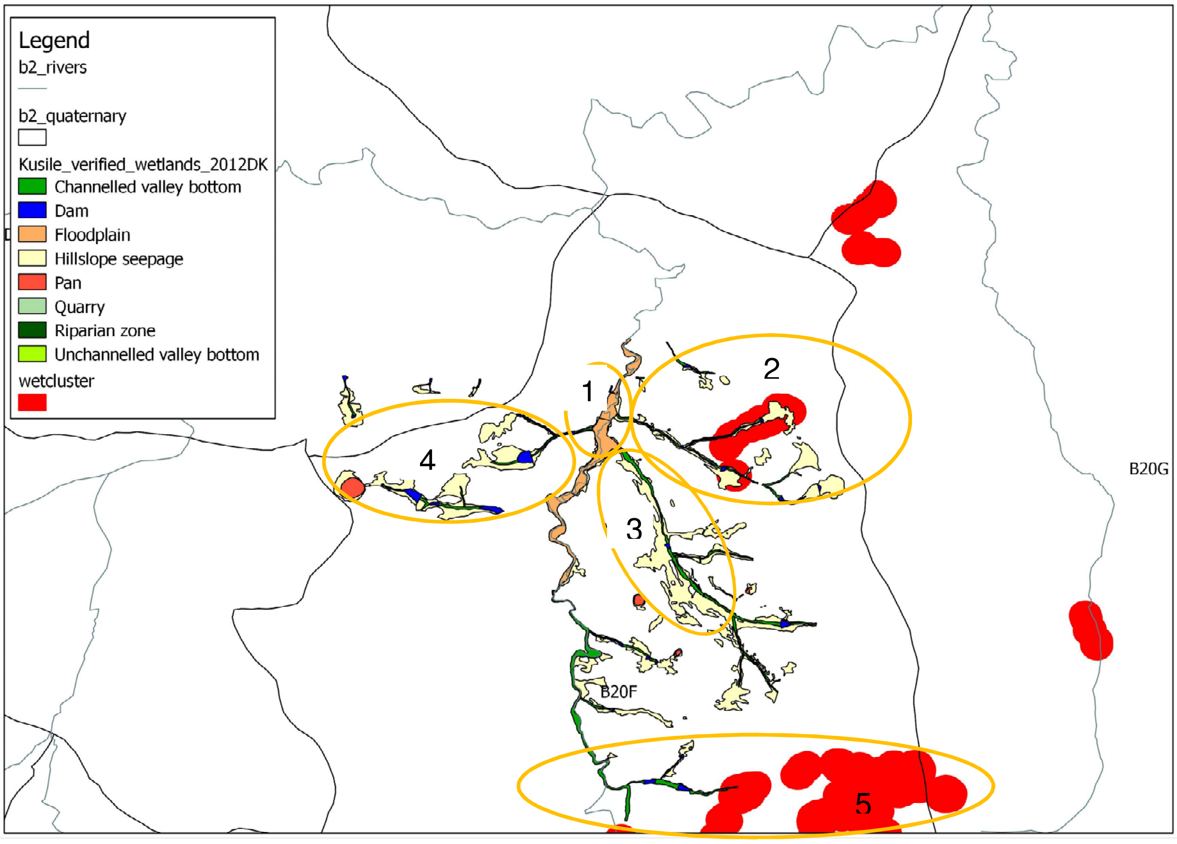


Figure 8-2: Landscape overview of the B20F quaternary catchment indicating 5 major components (1 to 5) to a proposed overall wetland management strategy

8.4.3 Wetland Areas Identified for Rehabilitation

Component 1 is the Wilge River noted and assessed as Sub-Quaternary (SQ) B20F-01150 (SQ = sub-quaternary). This portion of the Wilge River has only 43% natural landcover within 500m of the channel (National Landcover Data). The Wilge River also gives rise to large areas of floodplain wetlands. The SQ has recently been assessed for ecostatus (PES = C) and Ecological Importance (EI) and Sensitivity (ES) (both are Moderate), (Louw *et al.* in press). The main impacts in this area are agricultural lands, abstraction and alien vegetation invasion.

Component 2 is dominated by hillslope seepage and channelled valley-bottom wetlands. These wetlands feed into the main Wilge River, so any management of this component that improves functionality will also positively affect the Wilge River. Most of these wetlands are recognised as an important wetland cluster (wetcluster, Nel *et al.*, 2011) with sightings of both Blue Cranes and Secretary Birds. The majority of the wetlands are in a C or D category, with a significant proportion in D. Since the main impacts include elevated storm water with consequent erosion, agricultural activities, high trampling pressure (mostly cattle) and dams there is a high potential for rehabilitation of wetlands (and uplands) with a high probability of achieving significant improvement in PES.

Component 3 is dominated by hillslope seepage wetlands with some channelled valley-bottom wetlands and a small portion of floodplain wetlands at the confluence with the Wilge River. The majority of these are category C wetlands with some A and D. These wetlands will be directly impacted by activities at Kusile. They therefore form an extensive "buffer" between Kusile and the Wilge River and it is proposed to use this to the advantage of both protecting downstream habitats from elevated flows or sediments and improving the PES of a portion of downstream wetlands.

Component 4 is dominated by hillslope seepage wetlands with some channelled valley-bottom wetlands and a pan. Approximately 50% of the wetlands in this area are category D wetlands, with some C and a large proportion of B wetlands. The main impacts are as a result of agriculture and increased wetness due to irrigation runoff / seepage.

Component 5 comprises several wetland clusters noted for national importance (wetcluster, Nel *et al.*, 2011). Most of cluster 5 would appear to fall within the New Largo footprint. If the wetlands in this area are not mined by New Largo, they will likely be targeted by New Largo for offsets and will not be available to Kusile. While further investigation of the area is required, it is unlikely that it would be available for rehabilitation.

8.4.4 Possible Management Interventions

A proposed strategy for overall wetland management of the B20F quaternary within a landscape context is outlined below, and is intended to serve as sufficient wetland offset requirements. The steps indicated below are not intended to be prescriptive at this stage, nor are they exhaustive but will provide a conceptual framework that will require more detailed planning and development. In all cases rehabilitation is intended to improve the overall PES of wetlands, especially where category C and D wetlands occur:

1) Rehabilitation of the Wilge River and associated floodplain wetlands (component 1). The PES can be improved and a category B may be achievable if alien plants are removed and agricultural encroachment is curtailed by moving lands out of floodplain wetlands. If land is owned or purchased, terrestrial rehabilitation of grasslands is also possible which will enhance overall ecosystem resilience. The rehabilitation potential of the Wilge River is high.
2) Rehabilitation of wetlands outlined in component 2, especially those associated with the NFEPA wetland cluster and those already impacted by activities associated with Kusile. The area lends itself to the development of a nature reserve within which both terrestrial and wetland habitats are rehabilitated, with the added possibility of incorporating local communities into the reserve management / ownership. Rehabilitation potential is high and would involve *inter alia* reducing cattle or replacing with natural grazers, reducing dams (in both number and size i.e. reduce dam wall height), removing artificial levees, developing effective storm water runoff management and removing alien woody species (particularly Bluegums and Poplars). The main drainage line of area 2 is also heavily impacted by Kusile in terms of turbidity, though this is not yet reflected in the aquatic ecology as much as for the Klipfonteinspruit. However, additional interventions to deal with altered flows and turbidity (e.g. small retention dams or upgrade of existing dams) might also be considered for the upper reaches of this drainage line
3) Some of the wetlands in component 3 will be lost and it is proposed that a portion of wetlands closest to the ash dump be “sacrificed” to protect downstream habitats. This

would entail utilising an upstream portion of the wetlands to mitigate impacts by installing a series of small retention dams that would trap sediments, improve water quality and disperse runoff. The area required for the retention dams, as well as the capacity of the retention dams, will need to be determined through detailed hydrological modelling. The result would be some portion of upstream wetlands essentially becoming artificial in nature, but retaining desired ecological functions and at the same time protecting and improving downstream ecostatus. The majority of wetlands in the area however are to undergo rehabilitation. A significant portion of the wetlands in component 3 is associated with agricultural activities where irrigation and artificial runoff is high (and polluted), and disturbance activities promote alien weed infestation ensuring an efficient refuge of alien weeds that encroach into the wetlands. Rehabilitation of terrestrial grasslands in this area, while not an activity directly associated with wetlands, will effectively enhance the ecostatus of wetlands within a grassland matrix by reducing the source of alien plant species, erosion and elevated runoff. Wetlands in this area also have the potential for the development of a conservation area, and could easily be joined to component 2. Specific rehabilitation activities could include the removal of the existing breached dam wall near the Wilge River and restoration of the floodplain, the removal of alien plant species and the restoration of upland grasslands (which are also a threatened vegetation unit type).

4) Rehabilitation of wetlands outlined in component 4 will be more difficult to achieve since the major impact is related to agricultural encroachment and irrigation and would more than likely require the purchase of land.
5) This may not be a viable option but would entail investigating the possibility of improving wetland ecostatus of several NFEPA wetland clusters outlined in component 5.

Each of the steps outlined above will significantly improve wetland condition, functionality and integrity within component areas. Should several of the steps become operational it would significantly improve overall wetland (and riparian and terrestrial) ecostatus of the B20F quaternary.

A preliminary assessment of the five potentially available areas was conducted and approximately 1 788 ha in total of wetland area was found (please refer to **Table 8-2**). Although this area seems large and more than adequate to cover the hectare equivalents for each of the site alternatives, each of the five rehabilitation areas has certain drawbacks and limitations, so it is likely that a combination of areas would be required to develop a suitable offset programme.

Table 8-2: Hydro-geomorphic type and extent of wetlands in the five areas preliminarily identified as potential offsets

Rehabilitation Area	Channelled Valley Bottom	Floodplain	Hillslope Seepage	Pan	Dam	TOTAL
1	3,87	119,69	18,60	0	2,04	**144,20**
2	57,66	0	397,67	0	10,14	**465,47**
3	78,43	0	373,85	10,57	3,98	**466,84**
4	41,19	0	430,79	49,12	52,81	**573,91**
5	68,54	0	57,45	0	12,42	**138,41**
TOTAL	**249,69**	**119,69**	**1 278,36**	**59,69**	**81,40**	**1 788,8**

The vast majority of wetlands fall within the PES C category, however considerable amounts fall within the B category and the D categories (Please refer to **Table 8-3**). The success of a rehabilitation plan would depend on the acquisition of the adjacent properties and the rehabilitation potential of such areas.

Table 8-3: Present Ecological State (PES) categories for each of the five potential rehabilitation areas

Rehabilitation Area	PES B	PES C	PES D	PES E	TOTAL
1	1,81	132,39	7,09	0	141,29
2	62,82	292,20	99,88	0	454,91
3	15,66	385,15	39,17	0	439,98
4	114,61	194,93	210,73	0,82	521,09
5	0	96,64	25,70	0	122,34
TOTAL	**194,91**	**1 101,30**	**382,58**	**0,82**	**1 679,60**

9. REHABILITATION PLAN

Rehabilitation aims at returning the land/environment in a given area to some degree of its former state after a particular process has resulted in its damage. Rehabilitation in this case will be aimed at restoring the disturbed riparian vegetation and wetlands to a situation that is as close to its natural situation as is possible.

The objectives of the rehabilitation plan include:

- Rehabilitation of all areas disturbed by the construction within wetlands and crossing of rivers and wetlands;
- Rehabilitate any erosion that occurred as a result of the construction work; and
- Removal of alien invasive species that occur in the disturbed area.

The method statements for each component were developed to address the rehabilitation of the wetlands affected by construction (Please refer to **Appendix D** for the method statements).

9.1 REHABILITATION PHASE

Where possible the rehabilitation of construction servitudes will be done concurrently with the construction activities. Other rehabilitation activities will be conducted immediately after construction.

9.2 REHABILITATION ACTIVITIES

On completion of construction, the Contactor must ensure that all disturbed areas are re-vegetated in consultation with an indigenous plant expert, and only indigenous sedges, shrubs, and grasses shall be used to restore biodiversity. (Refer to **Table 6-1** for a list of grass species that could be considered for planting on disturbed areas). Rehabilitation of disturbed riparian and in-stream habitat shall commence immediately after construction by re-establishing marginal vegetation in the diversion canal. This shall be overseen by an Aquatic Scientist

The vegetation of the surrounding catchment shall also be managed to prevent erosion and siltation of watercourses. A systematic, long-term rehabilitation programme shall be implemented immediately after construction, to restore natural streams to environmentally acceptable and sustainable conditions. This programme shall be directed by an Aquatic Scientist, and shall include, but not be limited to:

- Rehabilitation of disturbed and degraded riparian areas to restore and upgrade the riparian habitat integrity to sustain a bio-diverse riparian ecosystem.
- Depending on the wetland type and damage incurred, rehabilitation could include (not limited to) the following:
  - Ripping and scarifying the disturbed area to alleviate soil compaction;
  - Landscaping of the area to approximate the natural landscape profile to avoid any preferential flow paths across the site that could lead to erosion;
  - Seeding of the disturbed area with an appropriate seed mix;
  - Implementation of a monitoring plan to ensure successful establishment of vegetation and to prevent invasion by alien species.

An annual assessment of habitat to monitor the sustainability of management measures and compliance with conditions 5.1 to 5.6.2 of Annexure II of the Water Licence dated 10 September 2008 (Ref: 27/22//B620/101/8) must be conducted.

10. LONG TERM PLANS FOR THE ASH DUMP

The 10 year ash dump shown in **Figure 1-1** will be used for the co-disposal of ash and gypsum during year 1 to 4. From year 5 to 10, only gypsum will be disposed of at the ash dump. Kusile is currently applying for a Waste Management Licence for the co-disposal of ash and gypsum at the 10 year ash dump (**DEA Reference: 14/12/3/3/3/51**). The application is currently at the Scoping phase. An Impact Assessment process will be conducted for the 10 year ash dump, including, Specialist Studies and the Environmental Management Programme (EMPr).

Parallel to the waste management licence application for the 10 year ash dump, Kusile Power Station is currently conducting an Environmental Impact Assessment (EIA) for the 60 year ash dump. A screening process was conducted and five sites were identified for the 60 year ash dump as feasible alternatives (Please refer to **Figure 10-1**). The final Scoping Report was submitted and approved by the DEA (**DEA Reference: 12/12/20/2412**) on 28 August 2012. An Impact Assessment process will be conducted for the 60 year ash dump, including, Specialist Studies and the Environmental Management Programme (EMPr).

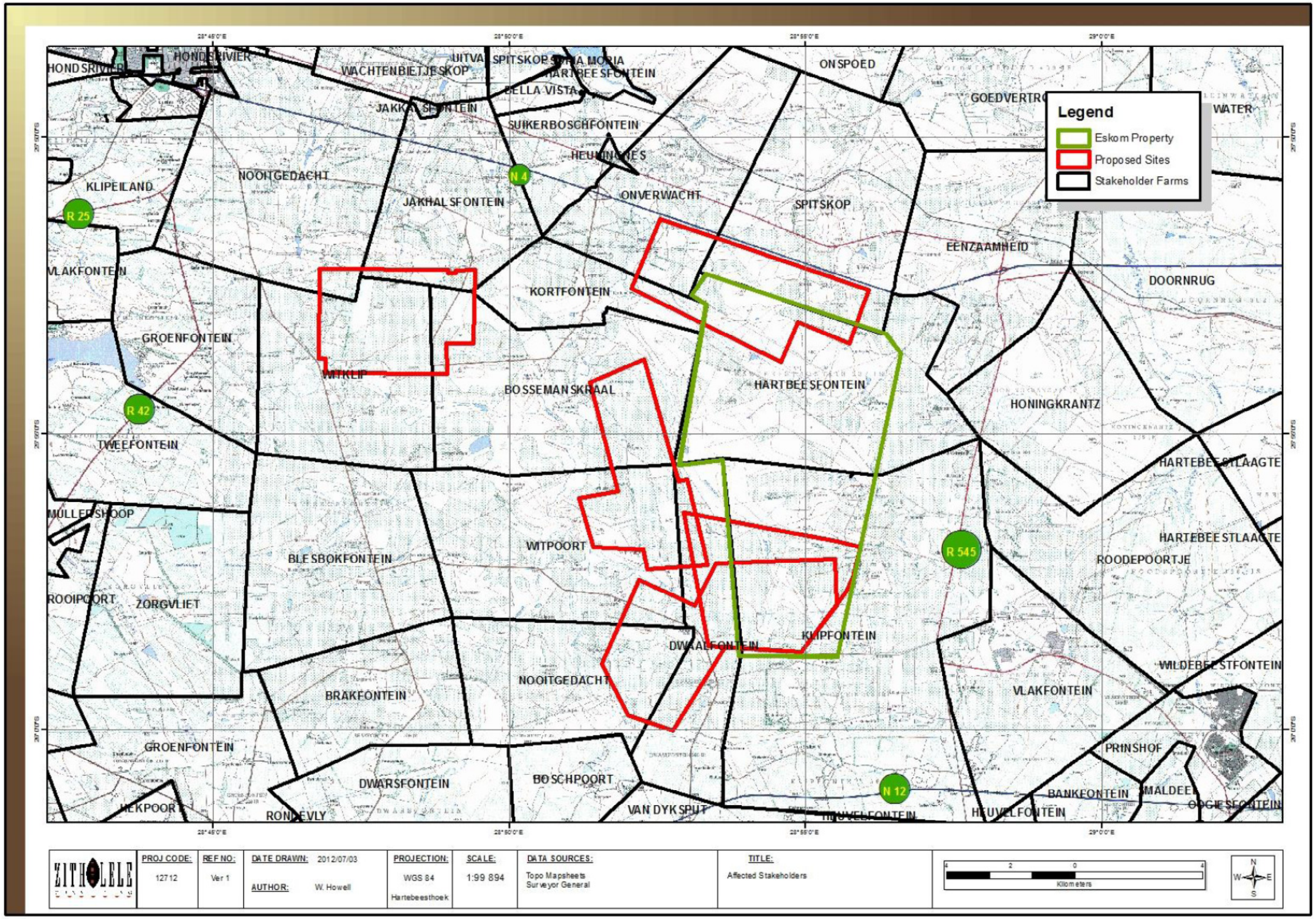


Figure 10-1: Feasible alternatives for the 60-year ash dump

11. CONCLUSION AND RECOMMENDATIONS

Since most of the impacts on the wetland areas result from erosion and sedimentation thus affecting the water quality, it is recommended that access into seasonally wet areas and / or turf soils during and immediately after rainy periods must be avoided.

The generic potential impacts that will be experienced for the river and wetland crossing sites are:

- Loss of Biodiversity
- Erosion and sedimentation; and
- Surface Water Pollution.

Mitigation measures for the identified generic potential impacts were also identified. Where necessary, site specific mitigation measures were included in each detailed information table (please see **Section 7** for site specific mitigation). It is recommended that for all of the river and wetland crossings the generic mitigation measures be implemented as to maintain/contribute to improvement of the aquatic environment at, and downstream, of each crossing site.

The draft Wetland Management Strategy that was compiled for Kusile identified wetland areas that may be suitable for offsetting wetland loss caused by the construction of the ADDD, the Ash Dump Embankment with Culvert, the pipelines and the fencelines (Please see **Section 8**). In terms of land ownership, the majority of Component 2 is currently owned by Eskom and has the added advantage of having a wetland rehabilitation plan partially in place, making it a prime candidate as an offset. However, a portion of this component is seen as an offset for the 10 Year Co-Disposal Facility by the DWA and would have limited use for other offset credits. Component 3 is comprised largely of the Topigs property, and is not owned by Eskom. This area combined with Component 1 (incorporating the Wilge River) can be seen as an ideal candidate as an offset area.

A larger biodiversity offset including the terrestrial grasslands of Component 2, combined with Components 1 and 3 would provide an ideal offset area, which would encompass both terrestrial and wetland-offset targets.

However, this would require Eskom to acquire the Topigs wetland potion and associated terrestrial habitat.

Eskom does not own Components 4 and 5, so wetland rehabilitation would be more difficult and both sites would be unable to mitigate any potential impacts from Kusile on the Wilge River due to their position in the quaternary catchments. While wetland rehabilitation of the wetlands between Kusile and the Wilge has the benefit of mitigating the impacts of the developments on the Wilge, the impact of the developments could be seen as a risk to the success of the rehabilitation and offset initiative. The construction of retention facilities within the wetland is also more likely to be considered mitigation, rather than rehabilitation and offsetting. Components 4 and 5 also have large commercial agricultural activities, which would substantially increase the amount of financial compensation.

Appendix A

Copy of the Environmental Authorisation for construction within wetlands and the crossing of wetlands at the Kusile Power Station

TRANSMISSION VERIFICATION REPORT

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NEAS Reference: DEA/EIA/0001461/2012
DEA Reference: 14/12/16/3/3/1/700
Enquiries: Tebogo Sibanyoni
Telephone: 012-310-3328 **Fax:** 012-320-7539 **E-mail:** tsibanyoni@environment.gov.za

Mr Abram Masango
Eskom Holdings SOC Limited- Kusile Power Station
Suite 46 Postnet
HIGHVELD
1035

Fax no: 086 664 5078

PER FACSIMILE / MAIL

Dear Mr Masango

APPLICATION FOR ENVIRONMENTAL AUTHORISATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998: GN R. 543 AND 544: PROPOSED CONSTRUCTION OF DIRTY WATER PIPELINE BETWEEN THE ASH DUMP AND THE ASH DUMP DIRTY DAM; SILT RETENTION DAM AND TOE DRAINS WITHIN WETLANDS AT KUSILE POWER STATION IN EMALAHLENI MUNICIPALITY, MPUMALANGA PROVINCE

With reference to the above application, please be advised that the Department has decided to grant authorisation. The environmental authorisation (EA) and reasons for the decision are attached herewith.

In terms of regulation 10(2) of the Environmental Impact Assessment Regulations, 2010 (the Regulations), you are instructed to notify all registered interested and affected parties, in writing and within 12 (twelve) days of the date of the EA, of the Department's decision in respect of your application as well as the provisions regarding the submission of appeals that are contained in the Regulations.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X 447· PRETORIA · 0001· Fedsure Building · 315 Pretorius Street · PRETORIA
Tel (+ 27 12) 310 3911 · Fax (+ 2712) 322 2682

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Your attention is drawn to Chapter 7 of the Regulations, which prescribes the appeal procedure to be followed. This procedure is summarised in the attached document. Kindly include a copy of this document with the letter of notification to interested and affected parties.

Should the applicant or any other party wish to appeal any aspect of the decision a notice of intention to appeal must be lodged by all prospective appellants with the Minister, within 20 days of the date of the EA, by means of one of the following methods:

By facsimile:	012 320 4431;
By post:	Private Bag X447, Pretoria, 0001; or
By hand:	2nd Floor, Fedsure Building, North Tower, Cnr. Lilian Ngoyi (Van der Walt) and Pretorius Streets, Pretoria.

If the applicant wishes to lodge an appeal, it must also serve a copy of the notice of intention to appeal on all registered interested and affected parties as well as a notice indicating where, and for what period, the appeal submission will be available for inspection, should you intend to submit an appeal.

Please include the Department *(Attention: Director: Integrated Environmental Authorisations)* in the list of interested and affected parties, notified through your notification letter to interested and affected parties, for record purposes.

Appeals must be submitted in writing to:

Mr Z Hassam, Director: Appeals and Legal Review, of this Department at the above mentioned addresses or fax number. Mr Hassam can also be contacted at:

Tel: 012 310 3271
Email: AppealsDirectorate@environment.gov.za

The authorised activity/ies shall not commence within twenty (20) days of the date of signature of the authorisation. Further, please note that the Minister may, on receipt of appeals against the authorisation or conditions thereof suspend the authorisation pending the outcome of the appeals procedure.

Yours sincerely

Gordon

Mr Mark Gordon
Chief Director: Integrated Environmental Authorisations
Department of Environmental Affairs
Date: 05/04/2013

CC:	Mr Deon Esterhuizen	Sebata Institute	Tel: 012-685-0900	Fax: 012-665-1886
	Mr G Batchelor	Mpumalanga Provincial Department	Tel: 013-759-4099	Fax: 013-766-4614
	Ms Yolanda Pulanesegami	Emalahleni Municipality	Tel: 013-665-6065	Fax: 013-655-6041
	Mr S Malaza	Compliance Monitoring (DEA)	Tel: 012-310-3397	Fax: 012-320-5744

APPEALS PROCEDURE IN TERMS OF CHAPTER 7 OF THE NEMA EIA REGULATIONS, 2010 (THE REGULATIONS) AS PER GN R. 543 OF 2010 TO BE FOLLOWED BY THE APPLICANT AND INTERESTED AND AFFECTED PARTIES UPON RECEIPT OF NOTIFICATION OF AN ENVIRONMENTAL AUTHORISATION (EA)

APPLICANT	INTERESTED AND AFFECTED PARTIES (IAPs)
1. Receive EA from the relevant Competent Authority (the Department of Environmental Affairs [DEA]).	1. Receive EA from Applicant/Consultant.
2. Within 12 days of date of the EA notify all IAPs of the EA and draw their attention to their right to appeal against the EA in terms of Chapter 7 of the Regulations.	2. N/A.
3. If you want to appeal against the EA, submit a notice of intention to appeal within 20 days of the date of the EA with the Minister of Water and Environmental Affairs (the Minister).	3. If you want to appeal against the EA, submit a notice of intention to appeal within 20 days of the date of the EA. with the Minister of Water and Environmental Affairs (the Minister).
4. After having submitted your notice of intention to appeal to the Minister, provide each registered IAP with a copy of the notice of intention to appeal within 10 days of lodging the notice.	4. After having submitted your notice of intention to appeal to the Minister, provide the applicant with a copy of the notice of intention to appeal within 10 days of lodging the notice.
5. The Applicant must also serve on each IAP: • a notice indicating where and for what period the appeal submission will be available for inspection.	5. Appellant must also serve on the Applicant within 10 days of lodging the notice, • a notice indicating where and for what period the appeal submission will be available for inspection by the applicant.
6. The appeal must be submitted in writing to the Minister within 30 days after the lapsing of the period of 20 days provided for the lodging of the notice of intention to appeal.	6. The appeal must be submitted to the Minister within 30 days after the lapsing of the period of 20 days provided for the lodging of the notice of intention to appeal.
7. Any IAP who received a notice of intention to appeal may submit a responding statement to that appeal to the Minister within 30 days from the date that the appeal submission was lodged with the Minister.	7. An Applicant who received notice of intention to may submit a responding statement to the appeal to the Minister within 30 days from the date that the appeal submission was lodged with the Minister.

NOTES:

1. **An appeal against a decision must be lodged with:-**
   a) the Minister of Water and Environmental Affairs if the decision was issued by the Director- General of the Department of Environmental Affairs (or another official) acting in his/ her capacity as the delegated Competent Authority;
   b) the Minister of Justice and Constitutional Development if the applicant is the Department of Water Affairs and the decision was issued by the Director- General of the Department of Environmental Affairs (or another official) acting in his/ her capacity as the delegated Competent Authority;

2. **An appeal lodged with:-**
   a) the Minister of Water and Environmental Affairs must be submitted to the Department of Environmental Affairs;
   b) the Minister of Justice and Constitutional Development must be submitted to the Department of Environmental Affairs;

3. **An appeal must be:-**
   a) submitted in writing;
   b) accompanied by:
   - a statement setting out the grounds of appeal;
   - supporting documentation which is referred to in the appeal; and
   - a statement that the appellant has complied with regulation 62 (2) or (3) together with copies of the notices referred to in regulation 62.

Pardon

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Environmental Authorisation

In terms of regulation 36 of the Environmental Impact Assessment Regulations, 2010

Construction of a dirty water pipeline between the ash dump and the ash dump dirty dam; silt retention dams; and toe drains within wetlands at Kusile Power Station

Emalahleni Municipality

Authorisation register number:	*14/12/16/3/3/1/700*
NEAS reference number:	*DEA/EIA/1461/2012*
Last amended:	*First issue*
Holder of authorisation:	*Eskom Holdings SOC Limited*
Location of activity:	*Mpumalanga Province, Emalahleni Municipality*

This authorisation does not negate the holder of the authorisation's responsibility to comply with any other statutory requirements that may be applicable to the undertaking of the activity.

Decision

The Department is satisfied, on the basis of information available to it and subject to compliance with the conditions of this environmental authorisation, that the applicant should be authorised to undertake the activities specified below.

Non-compliance with a condition of this authorisation may result in criminal prosecution or other actions provided for in the National Environmental Management Act, 1998 and the EIA regulations.

Details regarding the basis on which the Department reached this decision are set out in Annexure 1.

Activities authorised

By virtue of the powers conferred on it by the National Environmental Management Act, 1998 (Act 107 of 1998) and the Environmental Impact Assessment Regulations, 2010 the Department hereby authorises –

ESKOM HOLDINGS SOC LIMITED

with the following contact details –

Mr Abram Masango
Eskom Holding SOC Limited
Suite 46, Posnet
HIGHVELD
1035

Tel: (013) 759 4099
Fax: (086) 664 5078
Cell: (082) 888 9276
E-mail: MasangA@eskom.co.za

to undertake the following activities (hereafter referred to as "the activities") indicated in Listing Notices 1 (GN R.544):

Listed activities	**Activity/Project description**
<u>*GN R. 544 Item 11*</u>: *The construction of:* *(ii) channels;* *(iv) dams;* *where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.*	- Construction of the ash dump dirty dam and settling dams within a wetland; - Construction of toe drains within a wetland; - Construction of the ash dump access embankment (with culvert) within a wetland; - Crossing of wetlands by pipeline between the ash dump dirty dam and station dirty dam; - Crossing of the wetland by a dirty water pipeline between the ash dump and the ash dump dirty dam; and - Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station
<u>*GN R. 544 Item 18*</u>: *The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, pebbles or rock from (i) a watercourse.*	- Infilling of soil and rock into a wetland for the construction of the ash dump access embankment with culvert) - Removal of soil located in a wetland for the construction of the ash dump dirty dam and the depositing ash waste material exceeding $5m^3$ into wetland for storage purposes using a waste management facility.

as described in the Basic Assessment Report (BAR) dated 30 January 2013 at:

coordinates 25 ° 56.175' south and 28° 54.992' east,

- for the construction of a dirty water pipeline between the ash dump and the ash dump dirty dam; silt retention dams; and toe drains within wetlands on farm Hartbeestfontein 537 JR and farm Klipfontein 566 JR at Kusile Power Station in Emalahleni Municipality, Mpumalanga Province, hereafter referred to as "the property".

<u>The infrastructure associated with this facility includes:</u>

- Construction of the ash dump dirty dam and settling dams within a wetland;
- Construction of toe drains within a wetland;
- Construction of the ash dump access embankment (with culvert) within a wetland;
- Crossing of wetlands by pipeline between the ash dump dirty dam and station dirty dam;
- Crossing of the wetland by a dirty water pipeline between the ash dump and the ash dump dirty dam;
- Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station;
- Infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert); and
- Removal of soil located in a wetland for the construction of the ash dump dirty dam and the depositing ash waste material exceeding $5m^3$ into wetland for storage purposes using a waste management facility.

Conditions of this Environmental Authorisation

Scope of authorisation

1. The construction of a dirty water pipeline between the ash dump and the ash dump dirty dam; silt retention dams; and toe drains within the low integrity wetlands located between the power station and the 10 year ash dump area.
2. Authorisation of the activity is subject to the conditions contained in this authorisation, which form part of the environmental authorisation and are binding on the holder of the authorisation.
3. The holder of the authorisation is responsible for ensuring compliance with the conditions contained in this environmental authorisation. This includes any person acting on the holder's behalf, including but not limited to, an agent, servant, contractor, sub-contractor, employee, consultant or person rendering a service to the holder of the authorisation.
4. The activities authorised may only be carried out at the property as described above.
5. Any changes to, or deviations from, the project description set out in this authorisation must be approved, in writing, by the Department before such changes or deviations may be effected. In assessing whether to grant such approval or not, the Department may request such information as

it deems necessary to evaluate the significance and impacts of such changes or deviations and it may be necessary for the holder of the authorisation to apply for further authorisation in terms of the regulations.

6. This activity must commence within a period of three (3) years from the date of issue of this authorisation. If commencement of the activity does not occur within that period, the authorisation lapses and a new application for environmental authorisation must be made in order for the activity to be undertaken.
7. Commencement with one activity listed in terms of this authorisation constitutes commencement of all authorised activities.
8. The holder of an environmental authorisation must notify the competent authority of any alienation, transfer and change of ownership rights in the property on which the activity is to take place.

Notification of authorisation and right to appeal

9. The holder of the authorisation must notify every registered interested and affected party, in writing and within 12 (twelve) calendar days of the date of this environmental authorisation, of the decision to authorise the activity.
10. The notification referred to must –
    - 10.1. specify the date on which the authorisation was issued;
    - 10.2. inform the interested and affected party of the appeal procedure provided for in Chapter 7 of the Environmental Impact Assessment Regulations, 2010;
    - 10.3. advise the interested and affected party that a copy of the authorisation will be furnished on request; and
    - 10.4. give the reasons of the competent authority for the decision.
11. The holder of the authorisation must publish a notice –
    - 11.1. informing interested and affected parties of the decision;
    - 11.2. informing interested and affected parties where the decision can be accessed; and
    - 11.3. drawing the attention of interested and affected parties to the fact that an appeal may be lodged against this decision in the newspaper(s) contemplated and used in terms of regulation 54(2)(c) and (d) and which newspaper was used for the placing of advertisements as part of the public participation process.

Management of the activity

12. A detailed Wetland Management Plan (WMP) must be submitted to Department for approval prior to commencement of construction activities. The WMP must identify details of the specific impacts expected at every wetland crossing and within wetlands; and provide details of practical implementable rehabilitation measures to mitigate, manage and/or rehabilitate wetlands affected by the following specific activities:
    12.1. Construction of the ash dump dirty dam and settling dams within a wetland;
    12.2. Construction of toe drains within a wetland;
    12.3. Construction of the ash dump access embankment (with culvert) within a wetland;
    12.4. Crossing of wetlands by pipeline between the ash dump dirty dam and station dirty dam;
    12.5. Crossing of the wetlands by a dirty water pipeline between the ash dump and the ash dump dirty dam;
    12.6. Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station;
    12.7. Infilling of soil and rock into a wetlands for the construction of the ash dump access embankment with culvert);
    12.8. Removal of soil located in a wetlands for the construction of the ash dump dirty dam and the depositing ash waste material exceeding 5m³ into wetlands for storage purposes using a waste management facility programme plan; and
    12.9. Measures to protect the high integrity wetlands.
13. The WMP must further include, but should not be limited to:
    13.1. Measures for the protection of all affected wetlands from pollution in particular where construction takes place within the 1:100 year flood line; and
    13.2. Details of the remaining wetlands and measures to ensure the conservation of these wetlands; either through the Wetland Banking System via Working for Wetlands or a Stewardship Agreement through the Mpumalanga Parks Board. These measures must be for as long as the impact lasts.
14. A comprehensive map illustrating the total extent of all lost wetlands referred to above, must accompany the WMP.

Monitoring

15. The current independent Environmental Control Officer (ECO) for the construction of Kusile Power Station in terms of condition 3.13 of EA issued on 17 March 2008 must incorporate this authorisation into his/her responsibilities.
16. The existing Environmental Monitoring Committee (EMC) for Kusile Power Station project must also include this project in complying with condition 3.11 of the EA issued for Kusile Power Station on 17 March 2008.

Recording and reporting to the Department

17. All documentation e.g. audit/monitoring/compliance reports and notifications, required to be submitted to the Department in terms of EA issued for Kusile Power Station on 17 March 2008, shall include the activities approved in this authorisation.

Commencement of the activity

18. The authorised activity shall not commence within twenty (20) days of the date of signature of the authorisation.
19. An appeal under section 43 of the National Environmental Management Act (NEMA), Act 107 of 1998 (as amended), does not suspend an environmental authorisation or exemption, or any provisions or conditions attached thereto, or any directive, unless the Minister, MEC or delegated organ of state directs otherwise.
20. Should you be notified by the Minister of a suspension of the authorisation pending appeal procedures, you may not commence with the activity until such time that the Minister allows you to commence with such an activity in writing.

Notification to authorities

21. Fourteen (14) days written notice must be given to the Department that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include a date on which it is anticipated that the activity will commence, as well as ~~a reference~~ number. This notification period may coincide with the notice of intent to appeal period.

Operation of the activity

22. Fourteen (14) days written notice must be given to the Department that the activity operational phase will commence.

Site closure and decommissioning

23. Should the activity ever cease or become redundant, the applicant shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered by any relevant and competent authority at that time.

Specific conditions

24. The applicant must provide the department with a detailed long term plan for the expansion of the approved 10 year ash dump to align it with the lifespan of the power station.
25. Storm water discharge points must be fitted with the energy dissipaters to slow down the high velocity water discharged into wetlands.
26. All hazardous material must be stored away from the wetlands in bunded areas.
27. Silt traps must be installed to reduce the sediment loads to avoid sediment loads in river and stream of concern.

General

28. A copy of this authorisation and the approved EMPr must be kept at the property where the activity/ will be undertaken. The authorisation and approved EMPr must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertakes work at the property.
29. The holder of the authorisation must notify both the *Director: Integrated Environmental Authorisations* and the *Director: Compliance Monitoring* at the Department, in writing and within 48 (forty eight) hours, if any condition of this authorisation cannot be or is not adhered to. Any notification in terms of this condition must be accompanied by reasons for the non-compliance.
30. National government, provincial government, local authorities or committees appointed in terms of the conditions of this authorisation or any other public authority shall not be held responsible for

any damages or losses suffered by the applicant or his successor in title in any instance where construction or operation subsequent to construction be temporarily or permanently stopped for reasons of non-compliance by the applicant with the conditions of authorisation as set out in this document or any other subsequent document emanating from these conditions of authorisation.

Date of environmental authorisation: 05 April 2013

Gordon

Mr Mark Gordon
Chief Director: Integrated Environmental Authorisations
Department of Environmental Affairs

Annexure 1: Reasons for Decision

1. Information considered in making the decision

In reaching its decision, the Department took, *inter alia*, the following into consideration -

a) The information contained in the BAR dated 30 January 2013;
b) The information contained in the existing environmental authorisation dated 17 March 2007 for Kusile Power Station;
c) The previous specialised studies undertaken for the entire Kusile Power Station in 2006 and confirmation letters from the specialist confirming the present ecological status of the affected area;
d) Comments from the Directorate Biodiversity and Conservation Planning of this Department;
e) Mitigation measures proposed in the final BAR and the EMPr;
f) Information contained in the site visit report conducted on 17 January 2013; and
g) The objectives and requirements of relevant legislation, policies and guidelines, including section 2 of the National Environmental Management Act, 1998 (Act 107 of 1998).

2. Key factors considered in making the decision

All information presented to the Department was taken into account in the Department's consideration of the application. A summary of the issues which, in the Department's view, were of the most significance is set out below.

a) The initial authorisation dated 17 March 2008 for the construction of the Kusile Power Station;
b) The specialist studies confirming the present ecological status of the affected areas;
c) The significance of potential impacts on wetlands;
d) The need and desirability of the proposed activities;
e) The water use license application for the proposed activities;
f) Inputs made by the Directorate Biodiversity and Conservation Planning;
g) The mitigation measures stipulated in the final BAR and the EMPr; and
h) Public participation process conducted.

3. Findings

After consideration of the information and factors listed above, the Department made the following findings -

a) The initial authorisation dated 17 March 2008 partially approved the proposed activities.
b) The specialist studies confirmed that the present ecological status remains unchanged.
c) The impacts on wetlands will be high; however, it is the low integrity wetlands that are affected.
d) The proposed activities are highly essential and interconnected to the entire development of the power station for the normal day to day operation hence their need.
e) The Water Use License application covers the proposed activities in that it approved the diversion and altering of the flow in a watercourse (wetlands) for disposal of ash/gypsum.
f) According to the Biodiversity Management Directorate, some impacts around the affected wetlands (such as crossings) can be mitigated and where infilling of wetlands with soil and rock or removal of soil in wetlands will occur, compensation is necessary.
g) The impacts on the wetlands will be significant, however mitigation measures are proposed and specific conditions are included in the EA to minimise and manage the impacts.
h) No objections against the proposed activities were received from the public.

In view of the above, the Department is satisfied that, subject to compliance with the conditions contained in the environmental authorisation, the proposed activity will not conflict with the general objectives of integrated environmental management laid down in Chapter 5 of the National Environmental Management Act, 1998 and that any potentially detrimental environmental impacts resulting from the proposed activity can be mitigated to acceptable levels. The application is accordingly granted.

Appendix B

Kusile Standard Environmental Specifications and DEA's letters of approval for application for relaxation of some of the requirements of the SES and 2006 EA

PROJECT BRAVO POWER STATION

STANDARD ENVIRONMENTAL SPECIFICATION

CONTENTS

1 SCOPE AND INTERPRETATIONS

1.1 GENERAL

This section covers the requirements for controlling the impact of construction activities on the environment. Environmental management is concerned not only with the results of the Contractor's operations to carry out the Works but also, and most importantly, with the manner in which his operations are carried out. It is thus a requirement that the Contractor shall comply with the environmental requirements on an ongoing basis.

The Contractor shall take full responsibility for protecting the natural environment and eliminating or minimising the negative impacts of construction on the environment during construction. The Contractor shall prevent or limit the occurrence of accidents which may cause damage to the environment, prevent or limit the consequences of such accidents and shall return the environment to a state as close as possible to its condition prior to any such accident occurring. Nothing specified herein shall relieve the Contractor of any obligations or responsibilities in this regard.

The requirements of this Specification apply to all areas under the Contractor's control, including but not limited to the Working Area, all borrow pits, the construction camp and offices, all access/ haul routes and all labour accommodation areas.

1.2 ENVIRONMENTAL POLICY

The Contractor shall prepare and implement an Environmental Protection Policy, in line with various statutory regulations and this Specification. The Policy shall be submitted to the Engineer within 28 days after the Commencement Date. Upon the Engineer's approval, the Contractor shall immediately implement the policy and any amendments, and keep it in operation for the full duration of the Contract. The policy shall be communicated to all personnel and copies of the policy shall be prominently displayed at all places of work.

The Contractor shall keep the policy updated in accordance with his Quality Management Procedures and make amendments as required by the Engineer and the circumstances prevailing at the time. Upon such revision, the Contractor shall immediately supply the Engineer with two copies of an updated Environmental Policy, which shall clearly indicate the revisions undertaken.

1.3 INTERPRETATIONS

1.3.1 Supporting specifications

This Specification must be read in concert with the International Federation of Consulting Engineers Conditions of Contract for Construction (FIDIC CCC). In particular, the Contractor's attention is draw to the following sections of the FIDIC CCC, which are considered to form part of the environmental controls:

i) Subclause 3.2: Delegation by the Engineer (for the appointment of the Environmental Control Officer);
ii) Subclause 4.14: Avoidance of Interference;
iii) Subclause 4.15: Access Route;
iv) Subclause 4.18: Protection of the Environment;
v) Subclause 4.23: Contractor's Operations on Site;
vi) Subclause 4.24: Fossils;
vii) Subclause 6.6: Facilities for Staff and Labour;
viii) Subclause 6.9: Contractor's Personnel;

ix) Subclause 6.11: Disorderly Conduct;
x) Subclause 8.8: Suspension of Work;
xi) Subclause 11.11: Clearance of Site;

1.3.2 Application

In the event of any difference or discrepancy between the provisions of the other specifications forming part of the Tender Document and the provisions of this Specification, where such difference or discrepancy has environmental implications, the latter shall prevail.

2 DEFINITIONS

For the purposes of this Specification, the following definitions shall apply:

Borrow area means any areas within designated boundaries, approved for the purpose of obtaining borrow material.

Borrow material means any material, be it gravel, sand or soil obtained from designated areas for use as bedding material or fill. It does not include rock or stone or any material obtained from commercial sources.

Borrow pit means the excavated pit in a borrow area.

Botanical specialist, for the purposes of this Specification, means a specialist suitably qualified to deal with the type of vegetation occurring in the affected environment. This should be the specialist who undertook the botanical investigation as part of the Environmental Impact Assessment (EIA), or where he/ she is unavailable, a suitable replacement identified by the Engineer.

Clearing means the clearing and removal of vegetation, whether partially or in whole, including trees and shrubs, as specified.

Contaminated water means water contaminated by the Contractor's activities, e.g. concrete water as well as runoff from equipment, construction camps, ablution facilities and personnel wash areas.

Demolish means the demolition and complete removal and disposal of buildings, sheds, poles, concrete and any other objects and structures.

Environment means the surroundings within which humans exist and that are made up of:

i) The land, water and atmosphere of the earth;
ii) Micro-organisms, plant and animal life;
iii) Any part or combination of i) and ii) and the interrelationships among and between them; and
iv) The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being (*i.e.* the social environment).

Establishment period means the period that commences from the time of actual planting or revegetation until at least six months after planting.

Flood plain means the area encompassed by the 1:100 year flood line.

Grubbing means the removal and disposal of roots and stumps of trees and vegetation already cleared.

Hazardous substance means a substance governed by the Hazardous Substances Act as well as the Hazardous Chemical and Substances Regulations. In addition, any other substance that, in the reasonable opinion of the Engineer, can have a deleterious effect on the environment will be regarded as a potentially hazardous substance.

Heritage resource, as per the provisions of the National Heritage Resources Act (No 25 of 1999), means those heritage resources that are of cultural significance or other special value for present and future generations, and which are accordingly considered part of the national estate. In this regard, the national estate includes those items identified in terms of Section 2 of the Act.

Heritage specialist, for the purposes of this Specification, means a specialist suitably qualified to deal with the type of heritage resource discovered. For example where the resource is an archaeological artefact or site, the heritage specialist would be an archaeologist and where it is a fossil the specialist would be a palaeontologist.

Invasive alien vegetation means vegetation which either does not naturally occur in the country and/or region or which under certain conditions proliferates and becomes problematic since it outgrows other plants and may represent a significant maintenance cost.

Maintenance period means the period after the establishment period up to and until the end of the defects liability period, during which the contractor shall be responsible to maintain the vegetation, and shall be one growing season.

Method Statement means a written submission by the Contractor to the Engineer in response to this Specification or a request by the Engineer, setting out the equipment, plant, materials, labour and method the Contractor proposes using to carry out an activity identified by this Specification or the Engineer when requesting the Method Statement, in such detail that the Engineer is able to assess whether the Contractor's proposal is in accordance with this Specification and/ or will produce results in accordance with this Specification.

The Method Statement shall cover applicable details with regard to:

- i) Construction procedures;
- ii) Plant, materials and equipment to be used;
- iii) Transporting the equipment to and from site;
- iv) How the plant/ material/ equipment will be moved while on site;
- v) How and where the plant/ material/ equipment will be stored;
- vi) The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
- vii) Timing and location of activities;
- viii) Compliance/ non-compliance with this Specification; and
- ix) Any other information deemed necessary by the Engineer.

Natural vegetation means all existing species, indigenous or otherwise, of trees, shrubs, groundcover, grasses and all other plants found growing on the site.

Oil Separator means a trap that separates oil from the water and prevents oil from being carried from the Works into watercourses and water bodies.

Pollution Incident means any incident that may or has caused damage to or the contamination of the natural environment.

Reasonable means, unless the context indicates otherwise, reasonable in the opinion of the Engineer after he has consulted with a person, not an employee of the Employer, suitably experienced in environmental management practices.

Settlement Ponds means ponds that retain water from the Works laden with sediment, suspended solids or other matter for a sufficient period for the sediment/ suspended solids/ matter to settle.

Sensitive area means any area that is denoted as sensitive by this Specification or Engineer due to its particular attributes, which could include the presence of rare or endangered vegetation, the presence of heritage resources (*e.g.* archaeological artefact or graves), the presence of a unique natural feature, the presence of a watercourse or water body, the presence of steep slopes (in excess of 1:4) *etc*.

Slope means the inclination of a surface expressed as one unit of rise or fall for so many horizontal units.

Solid waste means all solid waste, including construction debris, chemical waste, excess cement/ concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Spoil means excavated material which is unsuitable for use as material in the Works or is material which is surplus to the requirements of the Works.

Topsoil means a varying depth (up to 300 mm) of the soil profile irrespective of the fertility appearance, structure, agricultural potential, fertility and composition of the soil.

Watercourse means any river, stream and natural drainage channel whether carrying water or not.

Water body means body containing any form of water and includes dams and wetlands, whether ephemeral or permanent. In this regard, wetland means any area that is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the area is covered by shallow water. Specifically, an area is classified as a “wetland” if it meets at least one of the following criteria:

i) The area predominantly supports hydrophytes, at least periodically;
ii) The substrate(soil) is predominantly undrained hydric soil; and/ or
iii) The substrate is non-soil, and is saturated with water or covered by shallow water at some time during the growing season.

Works means the Works to be executed in terms of the Contract and in accordance with this Specification.

Working Area means the land and any other place on, under, over, in or through which the Works are to be executed or carried out, and any other land or place made available by the Employer in connection with the Works. The Working Area shall include the site office, construction camp, stockpile and laydown areas, batching areas, all access routes and any additional areas to which the Engineer permits access.

3 GENERAL REQUIREMENTS

3.1 GENERAL AND LEGAL OBLIGATIONS

All construction activities shall observe and obey any relevant environmental legislation and in so doing shall be undertaken in a manner that will minimise impacts on the surrounding environment, the public and adjoining landowners. The Contractor shall absolve the Employer of any and all risk or liability in terms of compliance with all relevant statutory obligations.

The Contractor shall construct and/ or implement all the necessary environmental protection measures in each area before any production work will be allowed to proceed. The Engineer may suspend the Works at any time in terms the Conditions of Contract should the Contractor, in the Engineer's opinion, fail to implement, operate or maintain any of the environmental protection measures adequately.

3.2 ENVIRONMENTAL MONITORING

A suitably qualified senior staff member employed full time on site by the Contractor shall be responsible for environmental monitoring and control. This position shall be designated as the Environmental Officer (EO). The EO shall be a person with adequate environmental knowledge to understand and implement these Specifications, as determined by the Engineer. As a minimum requirement the EO should poses a tertiary qualification in a relevant field and two years of experience in environmental monitoring and control. The duties of the EO will include:

i) Liaison with the Environmental Control Officer (ECO);
ii) Monitoring of all of the Contractor's activities for compliance with the various environmental requirements contained in this Specification;
iii) Monitoring of compliance with other relevant environmental legislation;
iv) Development of requisite environmental Method Statements;
v) Instituting remedial action in the event of non-compliance;
vi) Implementation and management of environmental protection measures;
vii) Keeping a register of public complaints and recording and addressing any public comments or issues;
viii) Routine recording and reporting of environmental activities on a daily basis;
ix) Recording and reporting of environmental incidents; and
x) Environmental induction and presentation of the Environmental Awareness Training courses to the Contractor's staff.

The Contractor's attention is draw to the fact that, as a result of the statutory authorisation process in terms of the Environment Conservation Act (No 73 of 1989), an Environmental Control Officer (ECO) will be appointed by the Employer to monitoring compliance by the Contractor and his staff with the environmental requirements of this Specification. As per the provisions of Subclause 14.2 of the FIDIC CCC, the Engineer will delegate many of his functions in terms of this Specification to the ECO.

3.3 SITE MEETINGS

Compliance with this Specification will be an item on the agenda of the monthly site meetings.

3.4 ENVIRONMENTAL INDUCTION

The Contractor shall ensure that all of his employees, and those of his Sub-Contractor's, attend Environmental Awareness Training course/s. The Environmental Awareness Training course/s shall be structured to ensure that attendees:

i) Acquire a basic understanding of the key environmental features within the Working Area and its immediate environs;
ii) Become familiar with the environmental controls contained within this Specification; and

iii) Receive pertinent, written instructions regarding compliance with the relevant environmental management requirements (*viz.* environmental “do’s” and “don’ts”); and
iv) Are made aware of any other environmental matters as deemed necessary by the Engineer.

The initial Environmental Awareness Training course shall be held within 14 days from the Commencement Date, and subsequent courses shall be arranged for new employees coming onto site after the initial training course. Provision shall also be made for refresher courses to be undertaken on a quarterly basis during the course of the Contract.

The Contractor shall provide a suitable venue with facilities and ensure that the specified employees attend the Environmental Awareness Training course/s. The course/s shall be held in the morning during normal working hours. No more than 20 people shall attend each course and the Contractor shall allow for sufficient sessions to train all personnel. The Contractor shall provide proof of attendance by all of his employees in the form of a signed attendance register for each session.

The Contractor shall erect and maintain information posters for the information of his employees, depicting actions to be taken to ensure compliance with aspects of this Specification.

3.5 ENVIRONMENTAL METHOD STATEMENTS

Unless indicated otherwise by the Engineer, the Contractor shall provide the following Method Statements no less that 14 days prior to the programmed Commencement Date of the subject Works or activity:

i) Logistics for the Environmental Awareness Training course/s, including the date, time and location of the course/s, the course content and provision for refresher courses;
ii) Location and layout of the construction camp in the form of a plan showing the location of key infrastructure and services, including but not limited to offices, overnight vehicle parking areas, stores, the workshop, stockpile and laydown areas, hazardous storage areas (including fuels), the batching plant/s, designated access routes, equipment cleaning areas and the placement of any staff accommodation, cooking and ablution facilities. This Method Statement shall include the Materials Safety Data Sheets (MSDS’s) for all fuels, lubricants, paints, solvents and other chemicals to be used or stored on site
iii) Location and structure of the fuel storage area, including the type and volume of storage container and the design and capacity of the bund, and procedures for the filling and dispensing of fuel both at the fuel storage area and on Site;
iv) Location, layout and preparation of concrete batching facilities including the methods employed for the mixing of concrete and the management of runoff water from such areas. An indication shall be given of how concrete spoil will be minimised and cleared;
v) Solid waste (refuse) control and removal of waste from the Site, including the number, type and location of rubbish bins, the manner and frequency with which the waste will be removed from site and a description of the identified disposal site;
vi) Contaminated water management system, including an indication of the source and volume of contaminated water and how this would be disposed of;
vii) Method for dealing with runoff, including a stormwater management plan, mechanisms for the control of erosion and sedimentation, location and layout of settlement ponds (including the treatment of sludge), approach to the treatment and control of all contaminated return water to watercourses and approach to water quality monitoring;

viii) Drainage and stormwater planning showing procedures for the control of erosion due to stormwater on Site;

ix) Details of water abstraction, including the site of abstraction, the envisaged volume of water to be pumped and what methods would be implemented to prevent spillage/ pollution during the refuelling and operation of the abstraction pumps. The Contractor shall be responsible for obtaining the requisite permissions/ authorisations to enable abstraction and copies of these permissions/ authorisations shall be attached to the Method Statement;

x) Extent of areas to be cleared within the Working Area (including the construction camps, batching plants, access roads *etc.*), the method of clearing and the preparation for this clearing so as to ensure minimisation of exposed areas;

xi) Method of undertaking earthworks, including topsoil handling and erosion, dust and noise controls;

xii) Use of herbicides, pesticides and other poisonous substances, including means of storage;

xiii) Dust control, including methods to prevent dust generation and method to reduce dust where its generation is unavoidable;

xiv) Emergency procedures for spillages of hazardous substances, fire and serious accidents;

xv) Motivation and method for undertaking any construction related activities within a "no-go" area, including requisite emergency procedures. Unless a clearly motivated and proposed methodology exhibiting an obvious focus on environmentally sensitive construction practice is provided, no activity will be permitted within the defined "no-go" areas.

The Contractor shall not commence the activity until the Method Statement has been approved and, except in the case of emergency activities, shall allow a period of two weeks for approval of the Method Statement by the Engineer. Such approval shall not unreasonably be delayed or withheld.

The Engineer may require changes to a Method Statement if the proposal does not comply with this Specification or if, in the reasonable opinion of the Engineer, the proposal may result in, or carries a greater than reasonable risk of, damage to the environment in excess of that permitted by this Specification.

Approved Method Statements shall be readily available on the site and shall be communicated to all relevant personnel. Where necessary the requisite training shall be give to the personnel to facilitate compliance with the approved Method Statement. The Contractor shall carry out the Works strictly in accordance with the approved Method Statement. Approval of the Method Statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the Contract.

3.6 INTERFACE WITH LANDOWNERS AND LOCAL COMMUNITIES

The Contractor shall respect the property and rights of landowners and communities at all times and shall treat all such persons with courtesy. Disruption to the communities and landowners abutting the Working Area shall be minimised. The removal of tenants and squatters currently occupying the affected properties will be undertaken by the Employer, and no communities shall be displaced by the Contractor after the Commencement Date. The Contractor shall, however, make provision for delays in his construction programme associated with the removal of the tenants/ squatters.

The Contractor shall take every effort to ensure that private property abutting the Working Area is not damaged as a result of his activities, and that access for landowners and communities residing within the area is maintained. The Contractor shall absolve the Employer of any and all risk and liability in this regard.

The Fencing Act (Act 63 of 1963) regulates matters relating to fences between properties. In terms of this legislation, it is a criminal offence to dismantle fences without the landowner's permission or to leave gates open. Accordingly, in the execution of the Works the Contractor shall:

i) Install gates (standard or game gates) on all fence crossings, subject to the requirements of the landowner, as approved by the Engineer. Provide all gates with a Contractor's lock. No work shall commence prior to the erection of the requisite gates;
ii) Use the gates provided to gain access to all parts of the defined Working Area;
iii) Ensure that all gates properties are kept locked at all times;
iv) Not drop or dismantle any fence or gate without the Engineer's permission.

Where existing fences have to be dismantled and re-erected, they shall be erected to the same design as the original, but with such modifications as may be required by the Engineer.

The Contractor shall maintain a "complaints register" that records all complaints raised by landowners, communities or the general public about construction activities. The register shall be regularly updated and shall be used to record the name of the complainant, his or her domicile and contact details, the nature of the complaint and any action taken to rectify the problem. The Contractors shall ensure that any complaints are appropriately addressed, and the complaints registered shall merely serve as a record of the complaint and its remediation. All complaints, as well as the remedial actions taken, shall be brought to the attention of the Engineer, who shall be the sole arbiter regarding the adequacy of such actions.

3.7 SAFETY OF THE PUBLIC

The Contractor shall recognise that the Site is situated close to inhabited areas and shall therefore take all reasonable measures to ensure the safety of people in the surrounding area. Where the public could be exposed to danger by any of the Works or Site activities, the Contractor shall as appropriate provide suitable flagmen, barriers and/ or warning signs in English, Afrikaans and relevant indigenous languages, all to the approval of the Engineer.

All unattended open excavations shall be adequately demarcated (fencing shall consist of a minimum of three strands of wire wrapped with danger tape). Adequate protective measures must be implemented to prevent unauthorised access to the Working Area and access/ haul routes. No firearms shall be permitted on Site without the prior approval of the Engineer.

3.8 PROTECTION OF NATURAL FEATURES AND HERITAGE RESOURCES

The Contractor shall not deface, paint, damage or mark any natural features (e.g. rock formations) situated in or around the Site for survey or other purposes unless agreed beforehand with the Engineer. Any features affected by the Contractor in contravention of this clause shall be restored/ rehabilitated to the satisfaction of the Engineer.

The infrastructure associated with the Project Bravo Power Station have either been sited to avoid known sites of heritage significance, or the requisite permits for the demolition/ disruption of these sites has been obtained by the Employer. The Contractor shall, however, make provision for accidental discovery of further heritage resources. The Contractor shall take reasonable precautions to prevent any person from removing or damaging any heritage resources (including but not limited to fossils, coins, articles of value or antiquity, graves and structures and other remains of archaeological interest) discovered on the Site, immediately upon discovery thereof and before removal. The Contractor shall inform the Engineer immediately of such a discovery and carry out the Engineer's instructions for dealing therewith. In the event that Works within the vicinity of the discovery are suspended, the area shall be cordoned off until such time as the Engineer authorises resumption of the Works in writing. The Engineer will take all necessary actions to ensure that delays are minimised.

Upon notification by the Contractor, the Engineer will contact the South African Heritage Resources Agency (SAHRA) and will arrange for the excavation to be examined by an appropriate heritage specialist as soon as practicable. Acting upon the advice of SAHRA and the heritage specialist, the Engineer will advise the Contractor of the requisite actions. A Provisional Sum has been included in the Schedule of Quantities for the appointment of a heritage specialist, together with any assistance required, to identify heritage resources and for the appropriate treatment of such resources. This sum will be under the control of the Engineer.

3.9 PROTECTION OF WATERCOURSES, WATER BODIES AND WETLANDS

The Contractor shall ensure that all watercourses and water bodies (including but not necessarily limited to those areas identified in the specialist ecological assessment undertaken by Ecosun, and any subsequent studies) are protected from contamination or degradation as a result of his activities. All watercourses and water bodies shall be protected from direct or indirect spills of pollutants such as solid waste, sewage, cement, oils, fuels, chemicals, aggregate tailings, wash and contaminated water or organic material resulting from the Contractor's activities. In the event of a spill, prompt action shall be taken to clear the polluted or affected areas, and the Engineer shall be notified immediately.

The Contractor shall not work within the flood plain or any watercourses or waterbodies without the written approval of the Engineer as required for the execution of the work. The Contractor shall not permit his employees to make use of any natural watercourse or waterbody for the purposes of swimming, personal washing and the washing of machinery or clothes.

When working in or near any watercourses, the Contractor shall be cognisant of the following environmental controls and considerations:

- i) When planning work in or near watercourses the Contractor shall take into account possible river levels during the period of construction;
- ii) The Contractor shall program the execution of the Works such that Construction within flowing water is minimized. All diversions shall be in place, water diverted away from the Working Area and the area sandbagged prior to excavations commencing;
- iii) Construction equipment shall not ford any watercourse or operate from within the river channel unless it is essential to the execution of the Works. All works within flowing water shall be subject to prior authorisation from the Engineer;
- iv) When working in flowing water, the Contractor shall ensure that downstream sedimentation is controlled by installing and maintaining the necessary temporary sedimentation barriers, e.g. geotextile silt curtains or sedimentation weirs constructed out of suitably secured straw bales. Sedimentation barriers shall be a maximum of 25 m downstream of the construction activities;
- v) During the execution of the Works, the Contractor shall take appropriate measures to prevent pollution and contamination of the riverine environment e.g. including ensuring that construction equipment is well maintained, using drip trays, provision of bins, monitoring etc;
- vi) Where earthwork is being undertaken in close proximity to any watercourse, slopes shall be stabilised using sandbags or geotextile fabric to prevent sand and rock from entering the channel; and

vii) Appropriate rehabilitation and revegetation measures for the riverbanks shall be implemented timeously. In this regard, the banks should be appropriately and incrementally stabilized as soon as construction allows.

No excavation or construction shall be permitted within any wetland area, unless exceptional circumstances require that such excavation or construction cannot be avoided, in which regard the Engineer shall be the sole arbiter of whether or not such excavation or construction in a wetland area can or cannot be avoided. Where, in the opinion of the Engineer, excavation or construction within a wetland area cannot be avoided in the execution of the Works, the extent of any disturbances shall be kept to an absolute minimum. The various soil layers shall be removed and stockpiled separately. Following the completion of the construction activities, the soil layers shall be returned in the reverse order to which they were removed.

Where possible, the Contractor shall ensure that no construction equipment traverses any seasonal or permanent wetland. Where seasonally wet areas must be traversed, the Contractor shall obtain the prior approval of the Engineer and shall ensure that this only occurs during the dry season.

3.10 PROTECTION OF FLORA AND FAUNA

Except to the extent necessary for the execution of the Works, flora shall not be removed, damaged or disturbed nor shall any vegetation be planted without authorisation. At the commencement of the Contract, the Engineer will identify to the Contractor indigenous flora or any rare or endangered flora that shall be preserved. The Contractor shall thereafter demarcate such and undertake all necessary measures to ensure the protection of such flora.

In areas where needless destruction of vegetation has occurred, the Contractor shall, at his own expense, reinstate those areas to the standard specified by the Engineer. In this regard, the Engineer will arrange for the disturbed area to be examined by an appropriate botanical specialist. Acting upon the advice of the botanical specialist, the Engineer will advise the Contractor of the requisite actions. A Provisional Sum has been included in the Schedule of Quantities for the appointment of a botanical specialist, together with any assistance required, to identify sensitive vegetation and for the relocation of such vegetation. This sum will be under the control of the Engineer.

The Contractor shall protect fauna living within the Site and shall ensure that trapping, poisoning, shooting and/ or other hunting of animals is strictly prohibited, including the collection of the carcass of any domestic or wild animal. The Contractor shall ensure that no domestic pets or livestock are permitted on Site, and the keeping of pets by the Site staff shall be strictly prohibited. The requisite measures shall be put in place to ensure that domestic and native animals belonging to surrounding landowners are kept away and are safe from the unprotected Works.

The Contractor shall ensure that the Working Area is kept clean, tidy and free of rubbish that would attract animal pest species, and that no feeding of animals occurs. The Contractor's employees shall be prohibited from collecting firewood from the surrounding areas, and this shall be supplied by the Contractor from a legitimate supplier.

3.11 PREVENTION AND CONTROL OF FIRES

The Contractor shall take adequate precautions to ensure that the fire hazard on and near the Site is reduced to a minimum. Fires may only be lit at sites specifically prepared for the purpose and approved by the Engineer. The Contractor shall ensure that there is basic fire-fighting equipment available on Site at all times, and any fires that occur shall be reported to the Engineer immediately.

Smoking shall not be permitted in those areas where it is a fire hazard. Such areas shall include the workshop and fuel storage areas, any areas where the vegetation or other material is such as to make likely the rapid spread of an initial flame and any other areas not designated as smoking areas. All eating areas shall include provision for a smoking area.

The Contractor shall not be permitted to use burning as a disposal method.

3.12 EMERGENCY PROCEDURES

Telephone numbers of emergency services, including the local fire fighting service, shall be posted conspicuously in the Contractor's office near the telephone.

The Contractor shall develop emergency procedures that will enable rapid and effective response to all types of environmental emergencies. The Contractor’s procedures for the following emergencies shall include:

3.12.1 Fire

The Contractor shall advise the relevant authority and affected landowners of a fire as soon as one starts and shall not wait until he can no longer control it. The Contractor shall ensure that his employees are aware of the procedure to be followed in the event of a fire.

3.12.2 Accidental leaks and spillages

The Contractor shall ensure that his employees are aware of the emergency procedure(s) to be followed for dealing with spills and leaks, which shall include notifying the Engineer and the relevant authorities. The Contractor shall ensure that the necessary materials and equipment for dealing with spills and leaks is available on Site at all times. Treatment and remediation of the spill areas shall be undertaken to the reasonable satisfaction of the Engineer.

In the event of a spill, the source of the spillage shall be isolated, and the spillage contained. The area shall be cordoned off and secured. The Contractor shall maintain spill kits on site at all times and shall ensure that there is always an adequate supply of absorbent material available in the spill kits to absorb/ breakdown and, where possible, be designed to encapsulate minor spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of spillage.

3.13 TEMPORARY SITE CLOSURE

If the site is closed for a period exceeding one week, the Contractor, in consultation with the Engineer, shall carry out a checklist procedure, which should as a minimum address the following:

<u>Hazardous substances storage</u>

- i) Outlet secure/ locked;
- ii) Bund empty (where applicable);
- iii) Fire extinguishers serviced and accessible;
- iv) Secure area from accidental damage e.g. vehicle collision;
- v) Emergency and contact details displayed; and
- vi) Adequate ventilation.

<u>Safety</u>

- i) Fencing and barriers in place as per the Occupational Health and Safety Act (No 85 of 1993);
- ii) Emergency and Management contact details displayed;

iii) Security personnel have been briefed and have the facilities to contact or be contacted by relevant management and emergency personnel;
iv) Night hazards such as reflectors, lighting, traffic signage etc have been checked;
v) Fire hazards identified and the local authority notified of any potential threats e.g. large brush stockpiles, fuels etc;
vi) Stockpile appropriately secured; and
vii) Structures vulnerable to high winds secure.

Erosion
i) Wind and dust mitigation in place;
ii) Slopes and stockpiles at stable angle; and
iii) Revegetated areas watering schedules and supply secured.

Water contamination and pollution
i) Cement and materials stores secured;
ii) Toilets empty and secured;
iii) Refuse bins empty and secured;
iv) Drip trays empty and secure (where possible); and
v) Structures vulnerable to high winds secure.

4 PLANT AND MATERIALS

4.1 PLANT AND MATERIALS HANDLING, USE AND STORAGE

The Contractor shall ensure that any delivery drivers are informed of all procedures and restrictions (including "no go" areas) required to comply with this Specification. The Contractor shall ensure that these delivery drivers are supervised during off loading, by someone with an adequate understanding of the requirements of this Specification.

Plant and materials shall be appropriately secured to ensure safe passage between destinations. Loads that pose a risk of dust generation or spillage during transit, including but not limited to sand, stone chip, fine vegetation, refuse, paper and cement, shall have appropriate cover. The Contractor shall be responsible for any clean-up resulting from the failure by his employees or suppliers to secure transported plant and materials properly.

All manufactured and/ or imported plant and material shall be stored within the Contractor's camp. All stockpiling and laydown areas outside of the construction camp shall be subject to the Engineer's approval, which will not be unreasonably withheld.

4.2 HAZARDOUS SUBSTANCES

4.2.1 General

The storage and disposal of hazardous chemical substances (as defined in the Regulations for Hazardous Chemical Substances) and their waste, is regulated through other legislation, which should be complied with *i.e.* the Occupational Health and Safety Act. All hydrocarbons, including petrol, diesel, engine oil, hydraulic oil, shutter oil and curing compound, pose a risk of causing water and soil contamination and accordingly shall be regarded as potential hazardous substances from an environmental perspective. Specific requirements in this regard are outlined below.

4.2.2 Fuel (petrol and diesel)

Fuel may be stored on site in an area approved by the Engineer. The fuel storage area shall be located in a portion of the construction camp where it is unlikely to pose a significant risk in terms of water pollution or traffic safety. The Contractor shall ensure that diesel is stored in appropriate storage tanks or in bowsers. The tanks/ bowsers shall be situated on a smooth impermeable surface (concrete) with a permanent bund. The impermeable lining shall extend to the crest of the bund and the volume inside the bund shall be 130% of the total capacity of all the storage tanks/ bowsers (110% statutory requirement plus an allowance for rainfall). The floor of the bund shall be sloped, draining to an oil separator. Provision shall be made for refuelling at the fuel storage area, by protecting the soil with an impermeable layer, appropriate for the type of traffic.

If fuel is dispensed from 200 ℓ drums, only empty externally clean drums may be stored on the bare ground. All empty externally dirty drums shall be stored on an area where the ground has been protected. The proper dispensing equipment shall be used, and the drum shall not be tipped in order to dispense fuel. The dispensing mechanism of the fuel/ oil storage drum shall be stored in a waterproof container when not in use.

The Contractor shall prevent unauthorised access into the fuel storage area. No smoking shall be allowed within the vicinity of the fuel storage area. The Contractor shall ensure that there is adequate fire-fighting equipment at the fuel stores.

Where reasonably practical, equipment shall be refuelled at the fuel storage area or at the workshop as applicable. If it is not reasonably practical then the surface under the refuelling area shall be protected against pollution to the reasonable satisfaction of the Engineer prior to any refuelling activities. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and, where possible, be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill. This material must be approved by the Engineer prior to any refuelling or maintenance activities.

4.2.3 Oils and curing compound

The Contractor shall ensure that engine oil, hydraulic oil, shutter oil, lubricants and curing compound containers that are in use are stored within a bunded area consisting of a smooth impermeable base (concrete or 250 μm plastic) with an earth bund. The fuel bund may be used for this purpose as long as the capacity of the bund remains 130% of all of the fuel storage tanks/ bowsers it contains. The unopened storage containers shall be inspected regularly to ensure that no leakage occurs. When oil/ curing compound is dispensed, the proper dispensing equipment shall be used, and the storage container shall not be tipped in order to dispense the oil/ curing compound. The dispensing mechanism of the oil/ curing compound storage container shall be stored in a waterproof container when not in use.

Oil/ curing compound shall be used in moderation and shall be applied under controlled conditions using appropriate equipment. The Contractor shall take all reasonable precautions to prevent accidental and incidental spillage during the application of these compounds.

In the event of an oil/ curing compound spill, the source of the spillage shall be isolated, and the spillage contained. The Contractor shall clean up the spill, either by removing the contaminated soil or by the application of absorbent material in the event of a larger spill. Treatment and remediation of the spill area shall be undertaken to the reasonable satisfaction of the Engineer.

4.2.4 Paints, solvents and other chemicals

The Contractor shall ensure that the use of oil based paints, chemical additives, cleaners and other chemicals is strictly controlled, and that no contamination of the environment, particularly of watercourses and water bodies, occurs as a result of there use.

4.2.5 Herbicides and pesticides

Where the use of herbicides, pesticides and other poisonous substances has been specified or approved by the Engineer, they shall be stored, handled and applied with due regard to their potential harmful effects and in adherence with the approved Method Statement. The Contractor shall strictly adhered to the manufacturer's specifications regarding applications rates, storage and safety precautions. Herbicides shall not be used within 50 m of any watercourse.

Unused chemicals shall not be disposed of on site, but shall be disposed of at a waste site licensed for such disposal.

5 EQUIPMENT

5.1 GENERAL

The Contractor shall be cognisance of the requirements of this Specification in the selection and operation of his equipment, to ensure than environmental degradation is kept to a minimum. To this end, the Contractor shall ensure that his equipment operators are made aware of the environmental requirements and any other reasonable controls.

In sensitive areas, wheeled equipment shall be used in preference to tracked equipment. Reasonable speeds, as specified, shall be maintained at all times, but particularly were construction activities are taking place near to populated areas.

5.2 WORKSHOP, EQUIPMENT MAINTENANCE AND STORAGE

All vehicles and equipment shall be kept in good working order. Leaking equipment shall be repaired immediately or removed from Site. Where practical, all maintenance of equipment and vehicles on Site shall be performed in the workshop. The workshop shall have a smooth impermeable (concrete) floor. The floor shall be bunded and sloped towards an oil separator to contain any spillages.

If it is necessary to do maintenance outside of the workshop area, the Contractor shall obtain the approval of the Engineer prior to commencing activities. The Contractor shall ensure that in his workshop and at other equipment maintenance facilities, including those areas where, after obtaining the Engineer's approval, the Contractor carries out emergency equipment maintenance, there is no contamination of the soil or vegetation.

When servicing equipment on Site, portable drip trays shall be used to collect the waste oil and other lubricants. Drip trays shall also be provided in construction areas for stationary equipment (such as compressors) and for "parked" equipment (such as excavators, loaders and cranes). Drip trays shall be inspected and emptied daily. Drip trays shall be closely monitored during rain events to ensure that they do not overflow. Where practical, the Contractor shall ensure that equipment is covered so that rainwater is excluded from the drip trays. Oil from the drip trays shall be stored in externally clean drums in a bunded area as required for fuel storage. These shall be removed on a regular basis to an oil-recycling centre.

The washing of equipment shall be restricted to urgent or preventative maintenance requirements only. Vehicle cleaning shall be undertaken in designated wash bays, which have an impermeable floor and are bunded to contain runoff and direct it into a sump. Oil and diesel shall be skimmed off the sump water on a monthly basis and recycled or disposed of at an appropriately licensed recycling or waste disposal site.

5.3 BATCHING PLANTS

The siting of batching plants shall take cognisance of the requirements of this Specification and shall be subject to the Engineer's approval. The Contractor's attention is specifically drawn to the requirements related to hazardous substances, dust and noise control, site demarcation, site clearing and refuse and waste control. The Contractor shall be responsible for obtaining the Engineers approval prior to the siting and establishment of any batching plants.

No batching activities shall occur directly on unprotected ground. Batching plants shall be located on a smooth impermeable surface (concrete or 250 µm plastic covered with 5 cm of sand). All wastewater resulting from batching of concrete shall be disposed of via the contaminated water management system and shall not be discharged into the environment. To this end, either the batching area shall be bunded and sloped towards a sump or diversion berms shall be installed to direct all contaminated water to a storage area. Contaminated water storage areas shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented

Empty cement bags shall be stored in weatherproof containers to prevent wind blown cement dust and water contamination. Empty cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose. Unused cement bags shall be stored so as not to be affected by rain or runoff events. The Contractor shall ensure that sand, aggregate, cement or additives used during the mixing process are contained and covered to prevent contamination of the surrounding environment.

The Contractor shall take all reasonable measures to prevent the spillage of cement/ concrete during batching and construction operations. During pouring, the soil surface shall be protected using plastic and all visible remains of concrete shall be physically removed on completion of the cement/ concrete pour and appropriately disposed of. All spoiled and excess aggregate/ cement/ concrete shall be removed and disposed of via the solid waste management system.

Where “readymix” concrete or cement is used, the Contractor shall ensure that the delivery vehicles do not wash their chutes directly onto the ground, but that the chutes are washed off into a hole dug into the stockpiled subsoil from the foundation excavations. This contaminated subsoil shall be used as backfill for the foundations excavations, and covered with topsoil as part of the landscaping and rehabilitation process (Clause 8). Any spillage resulting from the “readymix” delivery shall be immediately cleared and disposed of via the solid waste management system.

5.4 PUMPING

Where dewatering is required, pumps shall be placed over a drip tray in order to contain fuel spills and leaks. The Contractor shall take all reasonable precautions to prevent spillage during the refuelling of these pumps. The Contractor shall ensure that none of the water pumped during any dewatering activities, is released into the environment without the Engineer's approval.

5.5 DUST AND EMISSIONS

5.5.1 Dust control programme

A dust control programme shall be implemented by the Contractor to maintain a safe working environment, minimise nuisance for surrounding residential areas, prevent damage to the natural vegetation of the area and protect topsoil. The Contractor's shall take all reasonable and appropriate measures to minimise the generation of dust because of his activities, and his dust control programme shall, as a minimum, address the following:

i) Schedule of spraying water on dust prone portions of the Working Area, particularly gravel access roads, paying due attention to the control of runoff. High traffic sections shall either be paved or treated via the application of suitable dust suppressing agents;
ii) Speed limits for vehicles on unpaved roads and minimisation of haul distances;
iii) Measures to ensure that material loads are properly covered during transportation;
iv) Schedule for wheel cleaning and measures to clean up public roads that may be soiled by construction vehicles;
v) Minimisation of the area disturbed at any one time and protection of exposed soil against wind erosion, e.g. dampening with water, covering with straw or applying suitable dust suppressing agents;
vi) Location and treatment of material stockpiles taking into consideration prevailing wind directions and location of sensitive receptors; and
vii) Reporting mechanism and action plan in case of excessive wind and dust conditions.

An appropriate number of water tankers shall be permanently available for the control of dust generation, and the Contractor shall ensure that the sprays do not generate excess run off. There shall be sufficient water tankers of adequate capacity to enable the dampening of all working areas and access/ haul roads at least four times daily. During high wind conditions, the Contractor shall comply with the Engineer’s instructions regarding additional dust-damping measures.

5.5.2 Dust measurement

The Contractor shall provide, maintain and calibrate fall out dust collectors for the measurement of dust fallout. The directional dust collector devices shall consist of four removable dust collectors placed at right angles mounted at a height of 2 metres above ground.

Dust measurement will only be required at those portions of the Working Area were working is actively occurring. As a minimum, two dust collectors shall be positioned at each of the active borrow areas and four dust collectors shall be positioned on the perimeter of the site for each of the various structures. The exact number and location of individual collectors shall be established in consultation with the Engineer. The Engineer may from time-to-time instruct the Contractor to carry out testing of dust levels at additional locations.

The Contractor shall arrange for the collection of dust from the dust collectors on a weekly basis (or more frequently if required by the Engineer) and calculate the dust fallout according to the following formula:

$$\text{Fallout} = M \div (A \times d)$$

Where M = mass of dust sample, A = area of opening of dust collector and d = number of days over which sample was collected

Should fallout exceed 0.25 g/ m^2/ day then the Contractor shall cease with the operations that are causing the dust until such time as remedial measures have been put in place to ensure that dust levels are within the specified limit.

The Contractor shall keep records of all dust level measurements for the duration of the Contract. These records shall be submitted each month to the Engineer.

5.5.3 Vehicle emissions

All vehicles and equipment shall be kept in good working order and serviced regularly. Vehicles noticeably emitting excessive fumes will not be permitted to continue working on site.

5.6 NOISE

5.6.1 Noise control

The Contractor's attention is drawn to the requirements of the Noise Induced Hearing Loss Regulations No 307 of the Occupational Health and Safety Act of 1993. Appropriate directional and intensity settings are to be maintained on all hooters and sirens, and the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other plant to reduce noise levels associated with his activities. The Contractor shall restrict any of his operations that may result in undue noise disturbance to those communities and dwellings abutting the Site to the hours of 06h00 to 18h00 on weekdays and Saturdays or as otherwise as agreed with the Engineer.

No amplified music shall be allowed on Site. The use of radios, tape recorders, compact disc players, television sets etc shall not be permitted unless the volume is kept sufficiently low as to avoid any intrusion on members of the public within range. The Contractor shall not use sound amplification equipment on site other than in emergencies.

The Contractor shall ensure that environmental awareness and training for all employees includes the need to minimise noise. The Contractor shall provide suitable ear protectors to all of his staff and others entering areas with high noise levels. Zones of risk shall be clearly identified with warning signs.

5.6.2 Noise measurement

The Contractor shall be responsible for monitoring noise levels as detailed in this specification. Noise monitoring equipment shall meet the IEC Publication 651 standard for a Class 1 integrating sound level meter. The meter shall be recalibrated at yearly intervals by an acoustics laboratory approved by the Engineer. A set of sound measuring equipment shall be made available for use by the Engineer as required.

No fixed monitoring stations are proposed for noise measurements, and an *ad hoc* approach is recommended, depending on which activities are in progress and their respective locations on the site in relation to sensitive receptors. At least 14 days prior to the onset of construction activities various noise level readings shall be recorded throughout the Working Area to serve as controls. During construction, noise levels shall be measured at weekly intervals (or more frequently if so required by the Engineer) at the closest sensitive receptor to the Site locations agreed with the Engineer. These locations shall include the closest sensitive receptor to the; (1) construction camp, (2) batching plants; (3) active borrow areas, (4) active construction areas (particularly during the execution of noise generating activities like blasting), (5) stockpiling and laydown areas, (6) access routes and (7) additional areas identified by the Engineer

Noise recordings shall reflect typical ambient noise levels during construction and accordingly noise levels shall be recorded during normal construction operations and <u>not</u> during periods of reduced activity (*e.g.* lunch break, Sundays, site closure). The Contractor shall keep records of all noise level measurements for the duration of the Contract. These records shall be submitted each month to the Engineer, or on the request of the Engineer.

Noise levels measured at the aforementioned locations shall not exceed the ambient sound level measured continuously at the same measuring point by 7 dBA or more. Where noise levels exceed this standard, the Contractor shall comply with the Engineer's instructions in this regard. Such instructions may include the cessation of the operations causing the unacceptable noise level until remedial measures have been put in place.

5.7 LIGHTING

The Contractor shall ensure that any lighting installed on the site for his activities does not interfere with road traffic or cause a reasonably avoidable disturbance to indigenous fauna, surrounding communities or other users of the area.

6 SITE ESTABLISHMENT

6.1 SITE LAYOUT

The Contractor shall inform the Engineer of the intended actions and programme for site establishment and of the proposed location of the construction camp/s and provide him with a plan showing the layout of the construction camp, including the positions of all buildings, stockpile and laydown areas, vehicle wash and service areas, fuel storage areas, batching areas and other infrastructure. The Construction camp shall occupy as small an area as possible, and no site establishment shall be allowed within 100 m of any watercourse or water body unless otherwise approved by the Engineer. The site layout shall be planned to facilitate ready access for deliveries, facilitate future works and to curtail any disturbance or security implications for neighbours. The final site layout shall be subject to the Engineer's approval, which shall not be unreasonably withheld.

6.2 SITE DEMARCATION

6.2.1 General

The Contractor shall maintain in good order all demarcation fencing and barriers for the duration of construction activities, or as otherwise instructed by the Engineer.

6.2.2 Construction camp

The Contractor shall erect fencing around the construction camp and batching plants in accordance with this Specification and the Engineer's instructions. The material and erection shall be in accordance with the provisions of this Section, but the material need not necessarily be new. Where used materials are offered, they shall nevertheless be in a good condition and approved in advance by the Engineer. When no longer required, the fencing and gates shall be dismantled and removed.

Temporary fencing shall be 1.8 m in height and comprise the following:

- i) Metal or wooden standards at 20 m centres, with three wooden droppers spaced evenly between the standards;
- ii) Four equally spaced strands of double strand high tensile wire, with the lowest strand being at a height of 500 mm above natural ground level and the highest being at 1.8 m;
- iii) Diamond mesh or bonnix type fencing, of 1.8 m in height, secured to the wire strands and posts; and
- iv) Gates to suit the width of access as required.

6.2.3 "No go" areas

Unless otherwise agreed to by the Engineer, the Contractor shall ensure that all activities are restricted to within the defined Working Area. The areas outside of the defined Working Area as well as any other areas identified by the Engineer or in this Specification shall be regarded as "no go" areas. Insofar as he has the authority, the Contractor shall ensure that no unauthorised entry, stockpiling, dumping or storage of equipment, plant or materials shall be allowed within the "no go" areas.

Unless demarcated with other fencing, the boundary of the Working Area shall be demarcated using "no go" fencing consisting of wooden posts at 3 m centres. The top 300 mm of each wooden post shall be painted with white paint and each post shall be long enough so that at least 1.5 m protrudes above the ground once it has been installed.

The Engineer may also identify patches of natural vegetation or any other natural, sensitive or special features inside the Working Area as "no go" areas. These areas shall be demarcated using "no go fencing consisting of wooden posts at 2 m centres. The top 300 mm of each wooden post shall be painted with white paint and each post shall be long enough so that at least 1.5 m protrudes above the ground once it has been installed.

Once construction within an area has been completed and the area has been rehabilitated, it shall be considered a "no go" area.

6.3 SITE CLEARING

6.3.1 Demolition and removal of existing structures

Clearing shall consist of the removal of all vegetation, crops, rubbish, fences and all other material prohibiting the execution of the Works, including the disposal of all resultant materials, subject to the requirements of this Specification and the Engineer. Any existing structures located within the Working Area, including but not limited to buildings, dams, graves and services, shall only be damaged or demolished and removed with the prior approval of the Engineer.

6.3.2 Identification and management of sensitive vegetation

6.3.2.1 General

At the commencement of the Contract, the Engineer will identify to the Contractor the areas of natural vegetation that may be disturbed during the execution of the Works as well as the areas of natural vegetation or any rare or endangered flora that shall be preserved. The latter areas shall be designated as "no-go" areas and treated as per the requirements of Subclause 6.2.3.

Prior to the onset of construction activities within any areas occupied by natural vegetation, a search and rescue operation shall be undertaken by the Contractor, in consultation with the Engineer, to collect rare and endangered plants identified for transplanting or use in the revegetation of affected area. Search and rescue operations will occur under the direction of the botanical specialist appointed by the Employer and accordance with the requirements outlined in Subclause 6.3.2.2.

6.3.2.2 Search and rescue

When plant material is rescued, the Contractor shall accept full responsibility for maintaining the plants in good condition. The plants shall either be transplanted to the location(s) indicated by the Engineer or shall be fully maintained in an on-site nursery until they are utilised for revegetation. Maintenance of stored plants shall include regular watering, and any plant losses due to lack of maintenance, including diseases developed during the construction period and the Defects Notification Period, shall be replaced at the Contractor's expense.

Each plant shall be handled and packed in the approved manner for that species or variety, and all necessary precautions shall be taken to ensure that plants arrive at the on-site nursery or transplant location(s) in a condition for successful growth. Vehicles used for transporting plants shall be equipped with covers to protect plants from windburn. Containers shall be in a good condition.

6.3.2.3 On-site nursery

On-site nursery facilities shall be erected for the holding and maintenance of rescued plant material and the propagation of appropriate species for revegetation. The location of the nursery shall be to the approval of the Engineer. The Contractor shall provide adequate labour, shade, water and all things necessary to sustain the plants in the nursery.

A record of stock relevant to the Project that is held in the nursery shall be provided to the Engineer on a monthly basis.

6.3.3 Clearing of vegetation

The object of vegetation clearing is to trim, cut or clear the minimum number of trees and vegetation necessary for the safe construction and operation of the power station. No clearing of trees or vegetation shall occur prior to the Contractor obtaining written permission from the Engineer, who shall designate in detail the exact areas to be cleared and the time at which it shall be done.

The Contractor shall ensure that the clearance of vegetation is strictly restricted to that required to facilitate the execution of the Works. Any natural vegetation, particularly trees, within or immediately adjacent to the Working Area, which do not require removal, shall be fully protected against damage. Vegetation clearance shall be restricted to the construction camp, approved access roads, approved stockpiling and laydown areas, batching plant sites and portions of the Working Area where vegetation interferes with construction activities.

Site clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. The detail of vegetation clearing shall be subject to the Principal Agent’s approval. All cleared vegetation shall either be mulched and mixed into the topsoil stockpiles or disposed of at an approved disposal site. The disposal of vegetation by burying or burning is prohibited without the requisite permit from the local authority.

Should fauna be encountered during site clearance, activities shall cease until such fauna have been safely relocated.

6.3.4 Stockpiling, removal and disposal of vegetation and trees

All cleared vegetation shall be mulched and mixed into the topsoil stockpiles, used as brush-packing (depending on the type of vegetation) or disposed of at an approved disposal site. The disposal of vegetation by burying shall be strictly prohibited.

Trees shall be cut into manageable logs (no more than 400 mm) and, where appropriate, distributed to local communities for use as firewood. Failing this, logs shall be disposed of at an appropriate landfill site. Under no circumstances shall members of the public be allowed to collect logs from the Working Area.

6.3.5 Stripping and stockpiling of topsoil

The Contractor shall strip the topsoil, which includes the top 300 mm of soil (or to the depth of the bedrock where the soil is shallower than 300 mm) and root material of cleared vegetation, for subsequent use during rehabilitation and revegetation. Topsoil shall be stripped from all areas of the Working Area where topsoil will be impacted by construction activities, including areas for temporary facilities, as directed by the Engineer. If the Contractor fails to conserve topsoil as instructed, he shall obtain suitable substitute material from other sources, approved by the Engineer, without any additional payment.

Topsoil collected from different areas shall be stockpiled separately and replaced in the same areas from which it was taken. Furthermore, topsoil shall be stockpiled separately from subsoil.

Where possible, stockpiles shall be located on previously disturbed areas or in areas were they pose the minimum risk of causing further environmental degradation. Topsoil and subsoil stockpiles shall not exceed 2 m in height and shall be so placed as to occupy the minimum width compatible with the natural angle of repose of the material, and measures shall be taken to prevent the material from being spread over too wide a surface. Where required, appropriate precautions shall be taken to prevent the erosion and limit the compaction of the stockpiles. The Contractor shall ensure that all stockpiles do not cause the damming of water or run off, or are themselves washed away. If the stockpiles start to erode significantly or cause dust problems, they shall be covered with Hessian.

Where practical, topsoil shall not be left for longer than six months before being used for rehabilitation. If stored for longer than six months, the topsoil shall be analysed and, if necessary, upgraded before placement.

6.3.6 Erosion and sedimentation control

The Contractor shall take all reasonable measures to limit erosion and sedimentation due to the construction activities and shall include in the design of the site works measures to prevent such occurrences. The Works shall be phased, and development staged so that stripped areas are kept to a minimum. The Contractor shall ensure that the stabilisation of cleared areas is actively managed in order to prevent and control erosion.

Surface stormwater shall not be allowed to be concentrated and to flow down cut or fill slopes, access roads or other areas prone to erosion without erosion protection measures being in place. Accordingly, the necessary temporary and permanent drainage works shall be installed as soon as possible. For access roads on sloping terrain, water diversion berms shall be installed immediately after the road is opened and shall be 4 m in width with a minimum compacted height of 350 mm and outlets of 2 m in length. The spacing of the water diversion berms shall be inversely proportional to the slope of the access road, ranging from a spacing of 60 m for a 2% slope to 10 m where the slope is greater than 15%.

Erosion shall not be allowed to develop on a large scale before repairs are effected and all erosion damage shall be repaired as soon as it has been detected. In this regard, any runnels or erosion channels that develop during the construction shall immediately be backfilled and compacted and the areas restored to a proper stable condition.

The landscaping and rehabilitation of disturbed areas shall occur as soon as practically possible following the cessation of the work in a specific area. In this regard, the Contractor's Works Programme shall clearly indicate that the rehabilitation will immediately be executed, per phase, upon the completion of the works within a specific area. Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised area shall be repaired and maintained to the satisfaction of the Engineer.

6.3.6.1 Alien invasive vegetation

The Contract shall remove all alien invasive vegetation from the Working Area for the duration of the construction and maintenance period. In general, clearance of alien invasive vegetation shall be undertaken by hand, using chainsaws and hand held implements, with vegetation being cut off at ground level, and not uprooted. To prevent re-growth, cut stumps of resprouting alien invasive species, such as gums (*Eucalyptus* species), Port Jackson (*Acacia saligna*), Golden wattle (*Acacia pycnantha*) and Australian myrtle (*Leptospermum laevigatum*), shall be treated with *Chopper* herbicide, at the application rate specified by the manufacturers. The Contractor shall ensure that the person applying the herbicide is certified to do so and shall provide the Engineer with proof of such certification.

Topsoil that is contaminated with seeds of alien invasive species shall not be used for rehabilitation purposes.

6.4 TEMPORARY SERVICES AND FACILITIES

6.4.1 Site structures

All site structures shall be of a temporary nature and shall be removed at the end of the contract. All site establishment components (as well as equipment) shall be located within previously disturbed areas where possible, and shall be positioned to limit visual intrusion on neighbours and to limit the extent of the area disturbed. The type and colour of roofing and cladding materials of the Contractor's temporary structures shall be selected to reduce reflection.

6.4.2 Accommodation of site staff

With the exception of the night watchmen, none of the Contractors staff shall be accommodated on Site overnight. The Contractor shall make adequate provision for his staff to be accommodated in nearby towns.

6.4.3 Services

Temporary services, including pipelines, power lines and telephone lines, shall be located in a manner which will cause the least disturbance to the environment. In particular, care shall be taken to ensure that the route alignment for temporary services avoids identified sensitive areas. Where possible, the Contractor shall ensure that service infrastructure is accommodated within the same trench.

6.4.4 Stockpiling and stockpile areas

Plant and materials shall be stored within the demarcated construction camp or batching areas. Where this is not feasible, the Engineer will identify additional sites for stockpiling within the Working Area. Where possible, stockpiled materials shall be stored off the ground on scaffolding and care shall be taken to minimise disturbance to the vegetation and topsoil. Where this is not possible, the stockpile areas shall be treated as specified under Subclause 6.3.

Soil, sand and gravel stockpiles shall be convex in shape, shall be no higher than 2 m and shall be located so as to cause minimal disturbance. Stockpiles shall be so placed as to occupy the minimum width compatible with the natural angle of repose of the material, and measures shall be taken to prevent the material from being spread over too wide a surface. The Contractor shall ensure that all stockpiles do not cause the damming of water or run off, or are themselves washed away.

The Contractor shall ensure that material is not stockpiled within 50 m of any watercourse. Stockpiles shall be placed so that watercourses are not obstructed or polluted and shall not obstruct any stormwater or drainage paths.

6.4.5 Access roads

Only designated access roads shall be used to access the Working Area. If required, the Engineer will, together with the Contractor, negotiate access to construction camp and Working Area with the affected landowners. The access agreement will be reduced to writing. Where private roads are utilised, the Contractor shall record the condition of the road prior to its use. The Contractor shall maintain the designated access roads during the course of the Contract. Maintenance includes ensuring the provision of adequate drainage and dust control. Damage to the existing access roads because of construction activities shall be repaired to the satisfaction of the Engineer, using material similar to that used in the original construction of the infrastructure.

Where new access roads are required, these shall be subject to prior approval by the Engineer and shall be planned and constructed to ensure that as small an area as possible is disturbed (maximum width of 5 m, with splays where appropriate and required), that they avoid all “no-go” areas and, as far as possible, that they follow the natural contours. As required, access roads shall be watered to control dust nuisance to the local communities as well as possible hazards resulting from the dust. Watering shall occur on instruction of the Engineer and shall be undertaken using a water tanker at an application rate of 1.5 ℓ/m^2.

All temporary access roads shall be rehabilitated to their original (i.e. pre-construction) condition at the end of the Contract, including ripping the disturbed area parallel with the contours to a depth of 300 mm and spreading back of previously stripped topsoil. Temporary access roads across cultivated land shall be ripped to a depth of 600 mm.

All vehicle turning-areas shall be located within the Working Area and shall be subject to the prior approval of the Engineer. The Contractor shall ensure that horse and trailer vehicles transporting plant and materials only turn within the designated turning-areas, and not within cultivated lands or areas of natural vegetation.

Mud and sand deposited onto public roads by construction activities shall be cleared on a daily basis.

6.4.6 Ablution facilities

The contractor shall provide adequate ablution facilities for his staff in the construction camp. Mobile chemical toilets shall be provided at all other locations within the Working Area, as directed by the Engineer. Acts of excretion and urination are strictly prohibited other than at the facilities provided. The ratio of the available toilets to the site staff at any particular location should not exceed 1: 15 and toilet paper shall be provided in all toilets at all times.

The Contractor shall not install pit latrines or septic tanks for the ablution facilities at the Construction Camp. Where mobile chemical toilets are utilised, the Contractor shall ensure the following:

i) Toilets shall be located within 100 m from any point of work but no closer than 50 m to any watercourse or water body;
ii) Toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause;
iii) Toilets situated close to the site boundaries or within sight of residential areas shall be hidden behind screens or other cover as approved by the Engineer;

iv) No spillage shall occur when the toilets are cleaned or emptied and the contents shall be properly stored and removed from Site;
v) Discharge of waste from toilets into the environment and burial of waste is strictly prohibited;
vi) Toilets shall be provided with an external closing mechanism to prevent toilet paper from being blown out; and
vii) Toilets shall be emptied before long weekends and builders' holidays, and shall be locked after working hours.

6.4.7 Eating areas

The Contractor shall designate eating areas for his staff at all location within the Working Area where work is taking place. These eating areas shall be clearly demarcated and shall be provided with bins with lids. The Contractor shall ensure his employees do not consume meals anywhere other than at these eating areas and that noise is limited. All eating areas shall include provision for a smoking area.

Any cooking on Site shall be done on well-maintained gas cookers with fire extinguishers present. No cooking shall be permitted to occur on open fires.

6.4.8 Water use

Water is a scarce resource in South Africa and water shall be conserved wherever possible. The Contractor shall minimise the use of water and shall immediately attend to any wastage.

Subject to the prior approval of the Engineer, water for construction purposes may be abstracted from either watercourses/ water bodies or agricultural sources in the surrounding area. Abstraction of water from a watercourse or water body will require a permit from the Department of Water Affairs and Forestry, and abstraction from an agricultural source will require the owner's permission. The Contractor shall be responsible for obtaining the necessary authority and landowner approvals prior to undertaking such abstraction. The Contractor shall absolve the Employer of any and all legal obligation and risk in this regard.

Where water is abstracted from a watercourse, the Contractor shall abstract the water either from a naturally occurring scour hole located upstream or downstream of the river crossings or from a temporary sump, as directed by the Engineer. During water abstraction, the Contractor shall ensure the following:

i) The vehicle abstracting water does not enter or cross the river and does not operate from within the river;
ii) No damage occurs to the river bed or banks and that the abstraction of water does not entail stream diversion activities;
iii) All reasonable measures to limit pollution or sedimentation of the downstream watercourse are implemented e.g. construction equipment is well maintained, use of drip trays, provision of bins, monitoring of personnel and activities.

The quantity of all water abstracted from any watercourses/ water bodies or agricultural sources shall be measured by way of water meters or other devices approved by the Engineer. The total quantity of water abstracted shall be recorded on a daily basis and reported to the Engineer each week in writing.

6.4.9 Solid waste management

The management of solid waste on site shall be strictly controlled and monitored. The quantities of waste generated on site shall be minimised. Littering shall be avoided.

The Contractor shall provide sufficient weatherproof and scavenger-proof bins on Site to store the solid waste produced on a daily basis. Solid, non-hazardous waste shall be disposed of in the bins provided and no on-site burying, dumping or burning of any waste materials, vegetation, litter or refuse shall occur. Bins shall not be allowed to become overfull and shall be emptied a minimum of twice weekly. The waste may be temporarily stored on the Site in a central waste area that is weatherproof and scavenger-proof, and which the Engineer has approved.

All solid waste shall be disposed of off-site at an approved landfill site. The Contractor shall supply the Engineer with a certificate of disposal.

6.4.10 Contaminated water management

6.4.10.1 General

Pollution could result from the release, accidental or otherwise, of contaminated runoff from construction camps and batching areas, discharge of contaminated water, chemicals, paints, solvents, oils, fuels, sewage, runoff from stockpiles, solid waste, litter, etc. Accordingly, the Contractor shall establish a contaminated water management system to address the prevention of pollution as well as suitable methods for the disposal of contaminated water. In this regard:

i) Appropriate pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into watercourses or water bodies shall be designed and implemented;
ii) Runoff from the cement/ concrete batching areas shall be strictly controlled, and contaminated water shall be collected, stored and either treated or disposed of off-site, at a location approved by the Engineer. The approval of the Engineer shall be required prior to the release of treated runoff from batching areas into any watercourse;
iii) Runoff from vehicle wash bays, workshops and diesel/ fuel tank areas shall pass through oil traps. The oil sludge thus collected shall be disposed of at an approved waste disposal site, *i.e.* licensed for such material;
iv) All spillage of oil onto concrete surfaces shall be controlled by the use of an approved absorbent material;
v) Water collected during the dewatering activities shall be pumped to settlement ponds complying with the requirements of Subclause 6.4.10.2.

Natural stormwater runoff not contaminated by construction operations and clean water can be discharged directly to watercourses and water bodies, subject to the Engineer’s approval. Water that has been contaminated with suspended solids, like soils and silt, may be released into watercourses or water bodies only once all suspended solids have been removed from the water by settling out these solids in settlement ponds. The release of settled water back into the environment shall be subject to the Engineers approval.

The Contractor shall notify the Engineer immediately of any pollution incidents on Site. Verbal reports must be followed up by a written report, which shall be submitted within 24 hours of the incident.

6.4.10.2 Settlement ponds

The Contractor shall construct, operate and maintain settlement ponds at key locations within the Working Area, including at washing areas, batching areas, vehicle washing areas, areas were dewatering is occurring and any other areas where a significant volume of contaminate water is discharged from the Works. The size, location, layout and operation of the settlement ponds shall be to the satisfaction of the Engineer.

The Contractor shall ensure that settlement ponds are located outside of the floodplain and riparian vegetation zones of watercourses and that the area is rehabilitated pursuant to the cessation of the operation of the pond. Each settlement pond shall have sufficient capacity for their purpose and shall be fitted with suitable oil traps. Settlement ponds shall be constructed using suitable materials and shall be made watertight using a liner approved by the Engineer. They shall be sub-divided to enable alternative sections to be cleaned while other sections are in operation. Plant and materials used in the construction of the settlement ponds shall themselves not cause pollution or effluent of an unacceptable quality.

All natural ground water and stormwater must be prevented from flowing into the ponds, and must be diverted around the settlement ponds to ensure that accumulated sludge is not washed into natural watercourses by stormwater.

If the Engineer is not satisfied that the provisions for the settlement ponds are adequate, he may order the Contractor to carry out such additional work as is necessary in order to comply with this Specification without any additional payment.

6.4.10.3 Water quality monitoring

(a) Point source

All effluent emanating from settlement ponds, batching plants, washing areas and any other areas of effluent and water discharge shall be sampled and tested as indicated in Table 1 at point of source. Quality of water at monitoring points shall comply with the criteria given in Table 1. Monitoring points for effluents shall be determined in agreement with the Engineer when the locations of specific areas and treatment works have been established in terms of the Contractor's Method Statements. Monitoring of point source effluent disposal into the watercourse/ water body will be the final effluent at the point of discharge into the watercourse/ water body.

Table 1: *Required effluent standards/ water quality guidelines for effluent from the sedimentation ponds, batching plants, washing areas or any other areas of effluent and water discharge to be returned to the environment.*

Variable	Required Effluent Standard
COD	Not to exceed 75 mg/ℓ
Conductivity	Not to be increased by more than 75 mS/m above influent, and shall not exceed 250 mS/m
Fecal coliforms	No *E. coli* (0/100 ml)
Free & saline ammonia (as N)	Not to exceed 10.0 mg/ℓ
Nitrate (as $N0_3$)	Not to exceed 25.0 mg/ℓ
Nitrite	Not to exceed 1.0 mg/ℓ
pH	Between 5,5 and 9,5

Variable	Required Effluent Standard
Phosphate (as PO_4)	Not to exceed 5.0 mg/ℓ
Residual Chlorine (as Cl)	Not to exceed 0.1 mg/ℓ
Soap, oil, grease	Not to exceed 2.5 mg/ℓ
Suspended solids	Not to exceed 250 mg/ℓ
Temperature	Water discharged into a watercourse shall not raise the water temperature at a point 500 m downstream of the point of discharge by more than 2°C above the temperature of the water 500 m upstream of the point of discharge.

(b) Diffuse source

Diffuse source monitoring shall be undertaken whenever there is a disturbance to any watercourse or water body as a result of construction activities within or adjacent to said watercourse/ water body. Sampling and monitoring shall take place 50 m upstream and 50 m downstream of the area where disturbance to the river has occurred and at 4 points equidistant across the river at each location. Sampling shall occur on a daily basis and the following variables shall be measured:

i) Temperature;
ii) Conductivity;
iii) Dissolved Oxygen;
iv) pH;
v) Suspended Solids; and
vi) Hydrocarbons.

Based on a comparison of the sampling variables, the quality of the water in the watercourse downstream of the activities in the watercourse shall be no worse than the quality of the water upstream of the activities.

(c) Sampling protocol

The Contractor shall ensure that persons taking water samples are correctly trained and standard sampling techniques are followed. Depending on the variable being measured, water quality monitoring shall either be undertaken *in situ* using approved handle-held instruments or at a SANS accredited laboratory in terms of SANS 10259.

6.5 ACCESS TO SITE

The Contractor shall ensure that access to the Site and associated infrastructure and equipment is off-limits to the public at all times during construction.

6.6 ACCOMMODATION OF TRAFFIC

The Contractor shall ensure vehicle traffic safety at all times and shall implement safety measures to this end. The Contractor shall control the movement of all his vehicles and equipment including that of his suppliers so that they remain on designated routes, are distributed so as not to cause an undue concentration of traffic, are routed and operated in a manner that minimises disruption to other users and that all relevant laws are complied with. On gravel or earth roads on the Site and within 500 m of the Site, the vehicles of the Contractor and his suppliers shall not exceed a speed of 40 km/hr.

7 SURFACE EXCAVATIONS AND BLASTING

7.1 SITE PREPARATION

The Contractor shall ensure that the measures specified for site clearing (Subclause 6.3), specifically as they relate to the identification and management of sensitive vegetation, clearing of vegetation and the stripping and stockpiling of topsoil, are implemented prior to the onset of earthworks.

7.2 DUST AND NOISE

The Contractor shall ensure that the dust and noise control measures specified in Subclauses 5.5 and 5.6 of this Specification are implemented during excavation and blasting operations.

7.3 EXTENT OF DISTURBANCE

All earthworks shall be undertaken in such a manner so as to minimise the extent of any impacts caused by such activities, particularly with regards to loss of natural vegetation, erosion and dust/ noise generation. No equipment associated with earthworks shall be allowed outside of the Site and defined access routes unless expressly permitted by the Engineer. Cuts into sloping terrain shall be minimised to eliminate the potential erosion risks associated with such operations.

7.4 STABILISATION

The Contractor shall ensure that the slopes of all excavations are stable. The most effective stabilisation mechanism is the retention of existing vegetation, where possible. Accordingly, clearing of any area shall be programmed to occur immediately prior to the onset of construction activities within the subject area. Moreover, disturbed areas shall be revegetated, as per the landscaping and rehabilitation provisions outlined in Clause 9, as soon as is reasonably possible.

Excavation at all the sites shall be carried out in such a way that slopes are not made dangerously steep. In general excavated slopes should be no steeper than 1:3 (approx 18 degrees), but where this is unavoidable appropriate measures shall be undertaken to stabilise the slopes. No materials, equipment or other load shall be placed so close to any excavation that the stability of the sides of the excavation is endangered.

7.5 BLASTING

The Contractor shall take appropriate precautions to minimise damage to the surrounding environment, including persons, private property and terrestrial and aquatic flora and fauna. The Contractor shall accept responsibility for all injury or damage occasioned by any blasting operations and shall make good such damage to the satisfaction of the Engineer. The following environmental considerations shall be applicable to blasting operations:

i) Topsoil shall be stripped and stockpiled before the commencement of drilling for the setting of charges.
ii) Precautions to minimise damage to the surrounding environment shall include measures to reduce the deposition of flyrock. Flyrock greater than 150 mm in diameter that falls beyond the cleared Working Area, shall be collected and removed.
iii) Each separate blast shall be designed to break out rock with the minimum explosive force. In this regard, blasting work shall be monitored using a tri-axial particle velocity meter, and the amount of explosives that may be detonated shall not result in a ground vibration with a peak particle velocity in excess of 20 mm/sec to limit

damage to the fragile root systems of plants adjacent to the areas where blasting may take place.

iv) For multiple charges, time-delay detonators shall be used to reduce the overall detonation to a series of single explosions separated by a minimum 25 milliseconds (1/1000 seconds) delay.

v) Prior to blasting, the Contractor shall notify the relevant occupants of surrounding land and address any concerns.

vi) The Contractor shall notify emergency services, in writing, a minimum of 24 hours prior to any blasting activities commencing on Site.

vii) Adequate warning must be issued to all personnel on site prior to blasting activities taking place. All legally required signals are to be clearly indicated. The Engineer shall be issued daily updates of the days intended blasting activities.

7.6 TRENCHING

Trenching shall be undertaken in accordance with the engineering specifications with the following environmental amplifications, where applicable:

viii) Soil shall be excavated and immediately used for refilling trenches i.e. soil from the first trench section shall be excavated and stockpiled, thereafter soil from the second excavated trench length shall be used to backfill the trench behind it once the infrastructure has been laid. The last trench shall be filled using the soil stockpiled from the first trench.

ix) Trench lengths shall be kept as short as practically possible before backfilling and compacting. No trench shall exceed 1 000 m in length without the prior approval of the Engineer

x) Trenches shall be re-filled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion.

7.7 TREATMENT OF SPOIL

For the purpose of this Contract the designated spoil sites shall consist of the borrow pits located at the designated borrow areas or any additional site(s) identified by the Engineer. Surplus or unsuitable material obtained from any excavations as well as rubble not required elsewhere in the Works shall be spoiled at designated spoil sites. In operating the spoil sites, the Contractor shall ensure that:

i) Topsoil that would have been buried as a result of the spoiling of material is moved to one side and either replaced over the spoil site on completion or used for rehabilitation elsewhere on the site.

ii) The spoil disposed of in the spoil sites is free of contamination, including explosive residues and detonators.

iii) The spoil sites are shaped to blend with the local topography as far as is practicable and do not have slopes with a gradient exceeding 1:3.

iv) Drainage is provided to control ground water exit gradients within the spoil dumps such that migration of fines is kept to a minimum.

v) Surface water runoff is appropriate channelled through or around the spoil sites to prevent erosion damage resulting from stormwater runoff. In this regard, perimeter drainage channels shall be provided, and lined with rock or other suitable material to prevent scour, so that runoff will be collected and conducted past the spoil dumps.

vi) The surface of the spoil dump is rehabilitated as per the landscaping and rehabilitation provisions outlined in Clause 9.

8 BORROW MATERIALS

8.1 USE OF ALTERNATIVE BORROW AREAS

Borrow materials shall only be obtained from the designated borrow areas shown on the Drawings. These sites are either on property owned by the Employer or have been approved in terms of the Minerals and Petroleum Resources Development Act (No 28 of 2002).

Should the Contractor wish to utilise alternative material sources, this shall be subject to the written approval of the Engineer and the Department of Minerals and Energy. The Contractor shall, at his own expense, institute the requisite negotiations with the landowner as well as compile and submit the requisite application to the Department of Minerals and Energy, and comply with any and all of it's requirements. The Contractor shall absolve the Employer of any and all legal obligation and risk in this regard.

Where the Contractor proposes the use of an alternative material source/s, they shall take due cognisance of the time required to obtain the required licences and permission from the relevant authorities and owners of the land for such use.

8.2 SITE DEMARCATION

As required by the Engineer, access to borrow areas shall be controlled via the erection of temporary fencing around each borrow area. Temporary fencing shall comprise the following:

- vii) Fencing shall be 1.4 m in height high with 4 equally spaced strands of double strand high tensile wire;
- viii) Bitumen coated Y-section iron standards installed at 20 m centres to at least 300 mm below ground level and fixed to each wire strand;
- ix) Three droppers evenly spaced between standards and separately fixed to each wire strand;
- x) Timber straining posts of nominal section 100 mm diameter with diagonal struts, as required, installed at 300 m centres and a changes of direction or gradient and embedded at least 500 mm below ground level in concrete foundations at least 400 mm x 400 mm in section; and
- xi) Gates to suit width of access as required.

8.3 BORROW AREA INFRASTRUCTURE

The only permanent infrastructure permitted at the borrow areas shall be a crushing and screening plant (if required) and a night watchman's hut. Written permission shall be required from the Engineer prior to bringing any additional permanent infrastructure onto the site. Where the additional infrastructure conflicts with the requirements of any Department of Minerals and Energy's approval, the Contractor shall be responsible for obtaining the necessary authorisation from the Department of Minerals and Energy.

8.4 DUST AND NOISE

Borrow material shall be excavated in a manner that will minimise any detrimental environmental impacts. The Contractor shall ensure that the dust and noise control measures specified in Subclauses 5.5 and 5.6 of this Specification are implemented during borrow operations.

8.5 ACCESS ROUTES

Only designated access routes shall be used to access the borrow areas. Where alternative access routes are identified, these shall be subject to prior approval by the Engineer. The

Contractor shall, at his own expense, institute the requisite negotiations with the landowners as well as comply with the requisite statutory requirements. The Contractor shall absolve the Employer of any and all legal obligation and risk in this regard.

The Contractors attention is drawn to the requirements of Subclause 6.4.5. The Contractor shall minimize any disturbance to the environment during the construction and operation of any access routes. If so required by the Engineer, the Contractor shall fence access roads.

The Contractor shall ensure that access routes are maintained in a satisfactory condition and that appropriate steps, as detailed in this Specification, are taken to prevent air pollution and erosion. The Contractor staff, including those of his Subcontractors, shall not be permitted to use any road or track other than the established access routes.

8.6 BORROW OPERATIONS

Borrow material shall be excavated in a manner that will minimise any detrimental environmental impacts. The removal of material from the borrow areas shall be undertaken as a phased strip mining operation as follows:

i) The Contractor shall remove all large trees from the borrow areas, as directed by the Engineer.
ii) The borrow pit operations shall be undertaken in a phased manner. Blocks of 0.25 ha shall be mined, with each block being cleared, mined to depletion, topsoiled and rehabilitated prior to the next block being exposed. Directly after completion of mining of each block, the topsoil shall be smoothed over the mined area and the Contractor shall ensure that no further activities occur in that particular block.
iii) The Contractor shall remove and stockpile the upper 300 mm of topmaterial. The handling and stockpiling of topsoil shall comply with the requirements of Subclause 6.3.5.
iv) Following vegetation clearing and topsoil stockpiling operations, the mined material shall be ripped, crusher/ screened and temporarily stockpiled and/or directly loaded via an excavator into awaiting trucks. The side slopes of the excavation shall not exceed a slope of 1:3 and shall have rounded tops. The slopes shall be finished off in such a way that sharp angles are not formed and that flowing curves are formed to blend with the surrounding landscape.
v) The Contractor shall ensure that fauna is not disturbed or destroyed during the clearing and mining operations. Any animal life encountered shall be relocated safely to beyond the border of the borrow pit site.
vi) Any watercourse shall be protected during the borrow operations.
vii) Working hours shall be limited to between 06h00 and 18h00, Monday to Saturday with no operations on Sundays or public holidays unless approved by the Engineer.
viii) The Contractor shall take steps to minimize the visual intrusion of mining activities on adjacent landowners by screening the properties with appropriately located stockpiles.

8.7 FINISHING AND REHABILITATION

During the course of borrow operations, the Contractor shall plan his operations in such a way that the amount of work that will be necessary for the finishing off of borrow areas is reduced as far as possible. Indiscriminate excavation without due regard for the desired final shape of the borrow pit will not be permitted, and shall be rectified at the Contractor's expense.

Prior to the onset of rehabilitation activities, the Contractor shall ensure that the remains of site infrastructure (if any) are demolished, removed from site and appropriately disposed of. Where directed by the Engineer, access roads shall be obliterated by breaking the surface crust and erecting earth embankments to prevent erosion.

On completion of operations in a borrow area, the Contractor shall reinstate the entire area, including access routes, so that it blends with the surrounding area and is suitable for the re-establishment of vegetation. For this purpose the borrow area shall be shaped to even contours with no slopes steeper than 1: 3, except where agreed to by the Engineer. The shaping and finishing off of the borrow areas shall be done in such a manner that the borrow pit will drain properly. All material in and around the borrow area, whether spoil, excess stockpiled material, oversize material left in the borrow pit, material resulting from clearing and grubbing operations or excess overburden shall be used or disposed of as directed by the Engineer. Material not capable of supporting vegetation shall be buried and used in shaping the borrow area and be subsequently covered with at least 500 mm soft material. All available soft material shall be spread evenly to the thickness directed and where sufficient material is not available for this purpose to cover the entire area, the remaining portions shall be scarified along the contours so that undue erosion is avoided.

Borrow areas shall be topsoiled and revegetated as per the landscaping and rehabilitation provisions outlined in Clause 9. All revegetated areas shall be considered "no go" areas and the Contractor shall ensure that none of his staff or equipment enters these areas.

Fencing around the borrow areas shall be left in position to enclose the damaged area on which the natural vegetation can be expected to re-establish itself and to enclose any area which is dangerous to livestock, as directed by the Engineer.

9 LANDSCAPING AND REHABILITATION

9.1 SCOPE

All areas disturbed as a result of the construction activities, irrespective of whether they occur within the defined Working Area or not, shall be subject to the landscaping and rehabilitation requirements outlined in this Specification. This includes, but is not limited to, Construction Camps, all stockpiling and laydown areas, the batching plants, all temporary access routes and all other areas from which topsoil has been stripped.

The type and number of plant and tree species to be planted at various locations throughout the Working Area will be guided by a landscaping plan developed by others, and not included here. For the purposes of this Specification, the landscaping and rehabilitation of disturbed areas shall entail the clearing, shaping, trimming and scarification of the area, as well as the replacement of the stockpiled topsoil. For areas where plant material has been rescued and stored in the on-site nursery, landscaping and rehabilitation shall also include the replanting of the rescued plants.

9.2 TIMING OF LANDSCAPING AND REHABILITATION

Vegetation is the most effective control against surface erosion. Accordingly, taking cognisance of the fact that the optimal timing for revegetation is during the summer rainfall period (September to March), the Contractor shall programme for the landscaping and rehabilitation of disturbed areas to occur as soon as practically possible following the cessation of the work in a specific area. In this regard, the Contractor's Works Programme shall clearly indicate how rehabilitation will executed, per phase, upon the completion of the works within a specific area. The period between the cessation of activities associated with the construction a particular infrastructural component and the and the onset of landscaping and rehabilitation for the area affected by these activities shall not exceed 1 month (28 days).

9.3 DEMOLITION AND REMOVAL OF STRUCTURES

Prior to landscaping and rehabilitation, the Contractor shall demolish and remove from Site everything not forming part of the Permanent Works. This includes, but is not limited to, temporary services and facilities (including foundations), temporary fences, temporary access routes, protective works, equipment, materials (nut, bolts, washers, wire, wood, bricks, cement *etc.*) and settlement ponds. All material generated from the demolition and removal of structures from site shall be appropriately disposed off.

9.4 SHAPING

All slopes which do not form part of the Permanent Works shall be graded so that no slope exceeds a maximum gradient of 1:3 or as otherwise directed by the Engineer. Contour drains shall be provided to control erosion where required by the Engineer.

Excavation and fills for Temporary Works and spoil dumps shall be formed in such a manner that the final profile shall appear as a natural extension to the adjacent, undisturbed ground profiles.

9.5 TRIMMING

Trimming shall consist of bringing the existing or previously shaped ground to a smoothly flowing surface with the final levels generally following the original surface as directed by the Engineer. Both mechanical and hand trimming shall be undertaken.

Trimming of any areas requiring grass shall be done in such a way that, after cultivation and application of any Topsoil, the finished surface of the area shall be approximately 25mm below the top of adjacent kerbing, channelling or pavement.

9.6 SCARIFYING

Prior to the application of topsoil, the ground surface shall be scarified by hand, plough or a mechanical ripper to a depth of approximately 150 mm to breakdown soil clods.

9.7 RIPPING

Compacted soil that has become too hard to scarify, shall be ripped with a mechanical ripper to a depth of 250 mm. No section of ground shall remain undisturbed after ripping.

9.8 TOPSOILING

Before placing topsoil, the Contractor shall remove all visible weeds from the placement area and from the topsoil. The previously stockpiled topsoil (Subclause 6.3.5) shall generally be spread evenly over the prepared surface to a depth of 150 mm on flat ground or to a minimum of 75 mm on slopes. Topsoil placement shall occur concurrently with construction or as soon as construction in a given area has ceased.

Topsoil shall be placed in the same soil zone from which it was stripped. However, if there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other soil zones of similar quality, subject to the approval of the Engineer.

9.9 RE-PLANTING

As part of the landscaping and rehabilitation programme, the Contractor may be required to re-plant rescued plants stored in the on-site nursery, either at their sites of origin or at a location identified by the Engineer. The transplanting of stored small trees (1 to 1½ m in height) and stored small shrubs (less than 1 m in height) shall entail the following

i) Trees and shrubs shall only be transplanted between the months of April and September;
ii) Trees shall be planted in holes of 1 m x 1 m x 1 m and shrubs shall be transplanted in holes of 600 mm x 600 mm x 600 mm;
iii) Trees and shrubs shall be planted so that their stems or trunks are at the same depth as in their original location. The orientation of the transplanted plants must be the same as in their original location (i.e. the north-facing side of the plant must remain north-facing after it has been planted); and
iv) Transplanted plants shall be watered once directly after transplanting (the planting hole shall be filled with water) and thereafter as required for establishment.

The transplanting of succulents and bulbous plants shall entail the following:

i) Succulents and evergreen bulbous plants may be transplanted at any time of the year. Deciduous bulbous plants shall be transplanted when they are leafless;
ii) Bulbous plants shall be planted in similar soil conditions and to the same depth as they were before removal; and
iii) Transplanted bulbs shall be watered once directly after transplanting to settle the soil.

In all cases, the soil around the roots of the plants being planted shall not be disturbed. Topsoil and subsoil from the hole shall be stored nearby to be replaced to the same depth intervals from which it was originally removed. Plants shall be carefully planted into holes.

9.10 ESTABLISHMENT AND MAINTENANCE OF REVEGETATED AREAS

9.10.1 Establishing of vegetation

The establishment of vegetation on landscaped and rehabilitated areas shall include maintaining the surface to the required slopes and levels without erosion or sedimentation, watering, weeding and any other procedure consistent with good horticultural practice necessary to ensure normal, vigorous and healthy growth of the plant material on site.

Notwithstanding the fact that the method of landscaping and rehabilitation may be specified or agreed to by the Engineer, the Contractor shall be solely responsible for rescuing, storing, establishing and maintaining the replanted material.

9.10.2 Maintenance of vegetation

The Contractor's liability with regard to the maintenance of the vegetation shall commence when the vegetation has been planted over the whole of the area subject to revegetation, and shall be not less than one year.

9.10.3 Watering and weeding

All landscaped and rehabilitated areas shall be adequately watered to ensure proper growth until the vegetation has become established and thereafter as required to sustain growth. The amount and frequency of watering shall be agreed with the Engineer.

The landscaped and rehabilitated areas shall be kept free of weeds. Weeds shall be controlled by means of pulling, or any other approved means.

9.10.4 Traffic on landscaped and rehabilitated areas

The Contractor shall not undertake the landscaping and rehabilitation of any areas until all operations that may require construction material and equipment to pass over those areas has been completed. All landscaped and rehabilitated areas shall be regarded as “no go” areas (as per Subclause 6.2.3), and no equipment, other than that required for establishment and maintenance purposes, shall be allowed to operate on these areas.

10 TOLERANCES

10.1 COMPLIANCE

Environmental management is concerned not only with the final results of the Contractor's operations to carry out the Works but also with the control of how those operations are carried out. Tolerance with respect to environmental matters applies not only to the finished product but also to the standard of the day-to-day operations required to complete the Works.

It is thus required that the Contractor shall comply with the environmental requirements on an ongoing basis. Moreover, the Contractor and his Subcontractors shall not direct any person to undertake any activities which would place such a person in contravention of this Specification.

10.2 COST OF NON-COMPLIANCE

Where environmental damage occurs as a result of the failure of the Contractor to comply with the requirements of this Specification, the requisite remediation shall be effected to the satisfaction of the Engineer and at the cost of the Contractor.

Compliance with this Specification will be assessed as part of the certification of each Payment Certificate. Payment for specific items related to environmental compliance will be withheld if it can be show that the Contractor has failed to comply with his obligations for said items. Should the Contractor fail entirely to provide or fulfil for a period of time all or part of the continuing services, obligations and liabilities required of him in respect of this Specification, the amount, or part of the amount for the item, which in the opinion of the Engineer fairly reflects such failure, will be omitted and the Contract Price reduced accordingly.

10.3 PENALTIES

Penalties will be issued for the various transgressions listed Table 2 below. Penalties may be issued per incident at the discretion of the Engineer. Such penalties will be issued in addition to any remedial costs incurred as a result of non-compliance with this Specifications. The Engineer will inform the Contractor of the contravention and the amount of the penalty, and will deduct the amount from monies due under the Contract.

Table 2: *Identified transgressions and associated penalties.*

Nature of transgression	Penalty
Any employees, vehicles, plant or equipment related to the Contractor’s operations operating within the designated boundaries of a “no-go” area.	R 5 000
Any vehicle driving in excess of designated speed limits.	R 5 000
Persistent and un-repaired oil leaks from machinery.	R 10 000
Persistent failure to monitor and empty drip trays timeously.	R 5 000
The use of inappropriate methods for refuelling.	R 5 000

Litter on site associated with construction activities.	R 5 000
Deliberate lighting of illegal fires on site.	R 10 000
Employees not making use of the site ablution facilities.	R 5 000
Failure to implement specified noise controls, particularly during blasting	R 10 000
Failure to empty waste bins on a regular basis.	R 5 000
Inadequate dust control.	R 10 000
A spillage, pollution, fire or any damage to the environment resulting from negligence on the part of the Contractor.	R 25 000
Any damage or degradation to a designated “no go” area	R 50 000

For each subsequent similar offence the fine shall be doubled in value to a maximum value of R 250 000

The Engineer shall be the judge as to what constitutes a transgression in terms of this clause, subject to the provisions of Clause 20.1 of the FIDIC CCC. In the event that transgressions continue the Contractor’s attention is drawn to the provisions outlined in Subclause 10.4.

10.4 REMOVAL FROM SITE AND SUSPENSION OF WORKS

In terms of the provisions of FIDIC CCC, the Engineer may instruct the Contractor to remove from Site any person who in their opinion is guilty of misconduct, or is incompetent, negligent or constitutes an undesirable presence on Site. The Contractor shall ensure that within 24 hours of such instruction, the employee has no further connection with the Contract.

Subclause 5.2 of this Specification requires that all Equipment be in good working order, and accordingly the Engineer may order that any Equipment not complying with this Specification be removed from Site. As per the provisions of Subclause 8.8 of the FIDIC CCC, where the Engineer deems the Contractor to be in breach of any of the requirements of this Specification, he may order the Contractor to suspend the progress of the Works or any part thereof.

11 MEASUREMENT AND PAYMENT

11.1 BASIC PRINCIPLES

Except as noted below as scheduled items, no separate measurement and payment will be made to cover the costs of complying with the provisions of this Specification and such costs shall be deemed to be covered by the rates tendered for the items in the Schedule of Quantities completed by the Contractor when submitting his tender.

The Contractor shall tender a rate or sum against each scheduled item and shall not price any item as nil or “0-00” and shall not indicate that the cost of any of the items listed in this schedule as being included elsewhere. In the event that the Contractor fails to provide a rate or sum, prices an item as nil or “0-00”, or indicates an item as being included elsewhere, the Engineer shall assign what he believes to be reasonable price to each of these items and the Tendered Sum shall not be adjusted to accommodate any additional costs.

11.2 FIXED VERSUS TIME-RELATED CHARGES

The scheduled items below have been categorised as Fixed Charges, Time-Related Charges, Quantity-Proportional Charges or Provisional Sums:

i) A Fixed Charge is a charge for a scheduled item which is deemed to remain unaltered throughout and which is deemed to be expended and due upon the fulfilment of the requirements under the item, irrespective of any time duration or any quantity measured;

ii) A Time-Related Charge is a charge for a scheduled item which is deemed to be expended and due in linear proportion to the time expended in the execution of the work or service or obligation in relation to the total length of time duration tendered for that item;

iii) A Quantity-Proportional Charge is a charge for a scheduled item which is deemed to be expended and due in linear proportion to the volume of work executed, the quantity of material, number of articles supplied, or services rendered, etc., as defined by the unit scheduled for the item; and

iv) Where required by this Specification, Provisional Sum items have been included in the Schedule of Quantities.

The sum tendered for each Fixed Charge item will be authorised for payment in terms of the first certificate issued after the Contractor's obligations have, in the opinion of the Engineer, been discharged as far as that item is concerned.

Payment for Time-Related Charge items will be certified by way of incremental amounts (calculated by the division of the tendered sum by the tendered duration) in each of the subsequent progress certificates until the sums tendered have been fully certified.

11.3 SCHEDULED ITEMS

11.3.1 General environmental obligations (Fixed Charge)

General environmental obligations Unit: lump sum (Sum)

All facilities and equipment not measured elsewhere, associated with complying with any requirement of this Specification will be measured as a sum.

The tendered sum shall cover any fixed costs associated with complying with this Specification not measured elsewhere.

11.3.2 General environmental obligations (Time-Related Charge)

General environmental obligations Unit: lump sum (Sum)

All work not measured elsewhere, associated with complying with any requirement of this Specification will be measured as a sum.

The tendered sum shall cover any time-related costs associated with complying with this Specification not measured elsewhere. Payment will be effected only after payment of the Fixed Charge has been made, and in accordance with the provisions of Subclause 10.2.

11.3.3 Environmental monitoring equipment and facilities

Environmental monitoring facilities and equipment Unit: lump sum (Sum)

The provision of all equipment and facilities related to fulfilling the environmental monitoring requirements of this Specification will be measured as a sum.

The tendered sum shall cover the fixed costs associated with procuring, fitting, operating and maintaining all equipment and facilities associated with the noise, water quality, dust and general environmental monitoring requirements of this Specification.

11.3.4 Environmental monitoring functions

Environmental monitoring functions Unit: lump sum (Sum)

The work related to undertaking environmental monitoring requirements of this Specification, including the provision of an Environmental Officer, will be measured as a sum.

The tendered sum shall cover all time-related costs associated with the noise, water quality, dust and general environmental monitoring requirements of this Specification, as well as the management of “no go” areas and the drafting and revision of the Contractor’s Environmental Policy. Payment will be effected only after payment of the Fixed Charge has been made, and in accordance with the provisions of Subclause 10.2.

11.3.5 Environmental awareness training

Environmental awareness training Unit: lump sum (Sum)

The provision of environmental awareness training to the Contractor’s staff will be measured as a sum.

The tendered sum shall cover all costs incurred by the Contractor in providing the venue and facilities as detailed in the Specification, in preparing and presenting the initial and refresher courses and in ensuring the attendance of his staff, including site management staff, at the courses.

11.3.6 Method statements: Additional work

Method statements: Additional work Unit: lump sum (Sum)

No separate measurement and payment will be made for the provision of Method Statements but, where the Engineer requires a change on the basis of his opinion that the proposal may result in, or carries a greater than warranted risk of damage to the environment in excess of that warranted by this Specification, then any additional work required, provided it could not reasonably have been foreseen by an experienced contractor, shall be valued in accordance with FIDIC CCC Subclause 50.4.

A stated sum is provided in the Schedule of Quantities to cover payment for such additional work.

11.3.7 Dealing with public complaints

Dealing with public complaints Unit: lump sum (Sum)

The monitoring and remediation of public complaints will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required to address public complaints, including maintaining a complaints register and implement the requisite measures to address public complaints, in accordance with the Specification and the instructions of the Engineer, where relevant. The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month

11.3.8 Dealing with heritage resources

Dealing with heritage resources Unit: provisional sum (PS)

Engaging a heritage specialist to identify heritage resources and guide the appropriate treatment of these resources, as well as the provision of any assistance to the heritage specialist, will be measured in Dayworks and paid against this Provisional Sum.

11.3.9 Dealing with watercourses, water bodies and wetlands

Dealing with watercourses, water bodies and wetlands Unit: lump sum (Sum)

The provision of the conservation and protection measures, as required by this Specification, when working within or adjacent to watercourses, water bodies and wetlands will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment associated with providing the requisite conservation and protection measures, as well as their subsequent removal.

11.3.10 Dealing with sensitive vegetation

Dealing with sensitive vegetation Unit: provisional sum (PS)

Engaging a botanical specialist to identify sensitive vegetation and guide the appropriate treatment of this vegetation, including assisting with the requisite rehabilitation or conservation measures, as well as the provision of any assistance to the botanical specialist, will be measured in Dayworks and paid against this Provisional Sum.

11.3.11 Fire control

Fire control Unit: lump sum (Sum)

The compliance with fire control requirements will be measured as a sum.

The tendered sum shall cover the cost of all labour, materials, equipment and any other operation or thing necessary to comply with the requirements of the Specification related to the prevention and control of fires.

11.3.12 Pollution control measures

Pollution control measures Unit: lump sum (Sum)

The provision of the requisite pollution control measures will be measured as a sum.

The tendered sum shall cover the fixed costs of materials, plant and equipment required to implement the necessary pollution control measures required by the environmental management specification, including facilities for the storage of fuel, oils, curing compounds, herbicides and pesticides, bunding of the workshop, the provision of drip trays, the provision of absorbent materials, the provision and subsequent removal of the settlement ponds, the installation of erosion control structures and the removal and disposal of sediment, contaminated soil and contaminated water.

11.3.13 Pollution management

Pollution management Unit: lump sum (Sum)

The implementation of the requisite pollution management requirements of the Specifications will be measured as a sum.

The tendered sum shall cover all time-related costs associated with the management of pollution, including the monitoring, emptying and overall management of oil separators, sumps and drip trays, the identification and remediation of leaks and spillages, the repair or removal from site of leaking equipment, the maintenance and management of erosion control structures, the maintenance of all settlement ponds and other facilities and plant that may be required for the effective treatment of water returned to the environment and incident reporting. Payment will be effected only after payment of the Fixed Charge has been made, and in accordance with the provisions of Subclause 10.2.

11.3.14 Dust control

Dust control Unit: lump sum (Sum)

The implementation of the requisite dust control measures will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required to implement the necessary measures to control dust, including watering of dust prone areas, enforcement of speed limits, securing of material loads, wheel cleaning, minimisation of disturbed areas, management of stockpile *etc.* The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month.

11.3.15 Noise control

Noise control Unit: lump sum (Sum)

The implementation of the requisite noise control measures will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required to implement the necessary measures to control noise. The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month.

11.3.16 Temporary fencing

Temporary fencing Unit: linear metre (m)

The erection of temporary fencing will be measured per net length of fencing erected as specified. Where fences have been dismantled and re-erected at other locations full payment will only be due if the re-erected fence complies in all aspects with this Specification. Payment for temporary fencing shall be certified as follows:

i) 85% of the rate tendered when the fencing is erected
ii) 15% of the rate tendered when the fencing is removed from site.

The tendered rate shall cover the costs of all labour, materials, plant and equipment required for furnishing fencing materials, transporting it to the point of application, erecting the fence, and for any other work which may be necessary to establish and maintain the temporary fencing as specified. The rate tendered shall also include full compensation for removing the temporary fencing, either to be erected at some other location or removing it from site, on completion of the Works.

11.3.17 "No go" fencing

"No go" fencing Unit: number (No)

The erection of "no go" fencing will be measured per pole erected/ removed as specified. Where "no go" fences have been dismantled and re-erected at other locations full payment will only be due if the re-erected fence complies in all aspects with this Specification. Payment for "no go" fencing shall be certified as follows:

iii) 85% of the rate tendered when the fencing is erected
iv) 15% of the rate tendered when the fencing is removed from site.

The tendered rate shall cover the costs of all labour, materials, plant and equipment required for furnishing fencing materials, transporting it to the point of application, erecting the fence, and for any other work which may be necessary to establish and maintain the "no go" fencing as specified. The rate tendered shall also include full compensation for removing the "no go" fencing, either to be erected at some other location or removing it from site, on completion of the Works.

11.3.18 Plant search and rescue

Plant search and rescue Unit: provisional sum (PS)

Plant search and rescue, as guided by the botanical specialist and including the replanting of rescued plants, will be measured in Dayworks and paid against this Provisional Sum.

11.3.19 Maintenance of rescued plants

Maintenance of rescued plants Unit: lump sum (Sum)

The maintenance of rescued plants, in terms of the requirements of this Specification, will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required to maintain the rescued plants until they are replanted, including establishment, maintenance and removal of the on-site nursery and watering, weeding and general maintenance of rescued plants. The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month.

11.3.20 Vegetation clearance

Vegetation clearance Unit: linear metre (m)

The area designated by the Engineer and cleared will be measured per line route metre.

The tendered rate shall cover the costs of all labour, materials, plant and equipment for all work necessary for the clearing of vegetation from the specified areas, including the trimming and cutting of shrubs and trees by hand, uprooting of tree stumps, the treatment of alien/ invasive species to prevent re-sprouting and the removal, transporting and disposal of all cleared vegetation.

11.3.21 Removal, stockpiling and re-spreading of topsoil

Removal, stockpiling and re-spreading of topsoil Unit: lump sum (Sum)

The removal, stockpiling and re-spreading of topsoil will be measured as a sum. Payment for removal, stockpiling, and re-spreading of topsoil shall be certified as follows:

i) 50% of the sum tendered when the topsoil is removed
ii) 50% of the sum tendered when the topsoil is replaced

The tendered sum shall cover the costs of all labour, materials, plant and equipment required for removing, loading, transporting to stockpile, stockpiling, and subsequent replacement of topsoil as well as ripping of areas prior to replacing the topsoil.

11.3.22 Maintenance of topsoil stockpiles

Maintenance of topsoil stockpiles Unit: lump sum (Sum)

The maintenance of topsoil stockpiles, in terms of the requirements of this Specification, will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required to maintain the topsoil stockpiles until the topsoil is loaded for re-spreading, including separation of topsoil stockpiles form those of other materials, ensuring topsoil stockpiles are appropriately located and meet the requirement of the specification with regard to height and ensuring that the requisite erosion measures have been installed. The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month.

11.3.23 Solid waste management

Solid waste management Unit: lump sum (Sum)

The collection, management and disposal of solid waste will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required for the collection, management and disposal of solid waste, including the provision of weatherproof and scavenger-proof bins, the collection of waste and its temporary storage and the removal of waste from site to an approved landfill. The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month.

11.3.24 Environmental requirements for Blasting

Environmental requirements for blasting Unit: cubic metre (m^3)

The implementation of the specified environmental requirements for blasting will be measured per cubic metre of rock removed.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required for “cover blasting” or blast mats, as well as the removal of fly rock from areas beyond the Working Area. The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month.

11.3.25 Treatment of Spoil

Treatment of spoil Unit: lump sum (Sum)

The treatment of spoil as per the requirements of this Specification will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required for loading, transporting and off-loading spoil, irrespective of haul distance, and for finishing and rehabilitating the spoil areas.

11.3.26 Shaping and trimming

Shaping and trimming Unit: lump sum (Sum)

Shaping and trimming will be measured as a sum. No payment will be made for shaping and trimming within cuts, fills and spoil areas, as this is measured elsewhere.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required for trimming the areas to the specified finish, including the moving of a small amount of material which would be inherent in this process and the removal of surplus material and stones. For payment purposes, a distinction shall be made between machine trimming that can reasonably be carried out by bulldozer or motor grader and hand trimming that cannot be done by machine owing to confined space, steep slopes, difficult shapes or sensitive areas.

11.3.27 Scarifying

Scarifying Unit: lump sum

Scarifying will be measured as a sum. Payment will only be made for areas scarified on the written instructions of the Engineer.

The sum tendered shall include full compensation for scarifying, removing stones and smoothing off the surface as specified.

11.3.28 Establishment and maintenance of vegetation

Establishment and maintenance of vegetation Unit: lump sum (Sum)

The establishment and maintenance of vegetation, in terms of the requirements of this Specification, will be measured as a sum.

The tendered sum shall cover the costs of all labour, materials, plant and equipment required to establish and maintain the vegetated areas, including preventing erosion and sedimentation, watering, weeding, prevention of traffic on revegetated areas and any other procedure consistent with good horticultural practice. The maintenance period shall commence when the vegetation has been planted and shall be not less than one year. The tendered sum will be divided by the number of months of the tendered project duration, and payment will be made against this sum for each month.

environment & tourism

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Environmental Affairs and Tourism
REPUBLIC OF SOUTH AFRICA

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Reference: 12/12/20/807
Enquiries: Mr Lesiba Ngoasheng
Telephone: (012) 310 3597**Fax:** (012) 320 7539 **E-mail:** pngoasheng@deat.gov.za

Ms D L Herbst
Eskom Holdings Limited
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Fax no: (011) 800 5140

PER FACSIMILE / MAIL

Dear Ms Herbst

THE AMENDMENT OF SECTIONS 6.3.5 AND 6.2.2 OF THE STANDARD ENVIRONMENTAL SPECIFICATION FOR THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (EMP): PROJECT BRAVO

Your letter letters dated 10 April 2008 regarding the above-mentioned matter has reference.

- Kindly note that your request for the amendment of Sections 6.3.5 and 6.2.2 of the Standard Environmental Specifications of the Construction Environmental Management Plan, which state "*topsoil and subsoil stockpiles shall not exceed two metres* ***(2m)*** *in height and shall be so placed as to occupy the minimum width compatible with the natural angle of repose of the material, and measures shall be taken to prevent the material from being spread over too wide a surface. Where required, appropriate precautions shall be taken to prevent the erosion and limit the compaction of the stockpiles*" and "*Temporary fencing shall be 1.8m in height and comprise the following:*

  i) *Metal or wooden standards at 20m centres, with three wooden droppers spaced evenly between the standards;*
  ii) *Four equally spaced strands of double strand high tensile wire, with the lowest strand being at a height of 500mm above natural ground level and the highest being at 1.8m;*

iii) *Diamond mesh or bonnix type fencing of 1.8m in height, secured to the wire strands and posts*

iv) *Gates to suite the width of access as required ,*

respectively, in respect of the project reference 12/12/20/807 - Project Bravo, has been carefully considered and is hereby accepted. The two specifications, for which the amendment is requested, will now read as follows:

Section 6.3.5

- *"Topsoil and subsoil stockpiles shall not exceed 18m in height and shall be so placed as to occupy the minimum width compatible with the natural angle of repose of the material, and measures shall be taken to prevent the material from being spread over too wide a surface. Where required, appropriate precautions shall be taken to prevent the erosion and limit unnecessary compaction of the stockpiles".*

Section 6.2.2

- *"Temporary fencing shall be 1.8m in height and comprise the following:*

v) *Metal or wooden standards at 20m centres, with three metal droppers spaced evenly between the standards;*

vi) *A minimum of four equally spaced strands of high tensile wire, with the lowest strand being at ground level and the highest being at 1.8m;*

vii) *Diamond mesh or bonnix type fencing of 1.8m in height, secured to the wire strands and posts;*

viii) *Topped by 'flat rap' barbed wire; and*

ix) *Gates to suite the width of access as required."*

Yours sincerely

Ms Nosipho Ngcaba
Acting Director – General
Department of Environmental Affairs and Tourism
Letter signed by: Mr Coenrad Agenbach
Designation: Deputy-Director: Environmental Impact Management (National & Parastatals)
Date: 7/5/09.

environmental affairs

Department:
Environmental Affairs
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Ms Deidre Herbst
ESKOM
Kusile Power Station
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2000

Fax no: (011) 800 3631

PER FACSIMILE / MAIL

Dear Ms Herbst

RE: MERCURY REMOVAL AT KUSILE POWER STATION.

With reference to the abovementioned application, please be advised that the Department in terms of the powers vested in it by regulation 43 of Environmental Impact Assessment Regulations, 2006, has decided to grant approval for the deferment of condition 3.7.6. contained in the RoD issued on 17 March 2008 for six months after the start of operation of Kusile Power Station.

This amendment must be read in conjunction with the authorisation issued on 17 March 2008.

In terms of regulation 10(2) of the Environmental Impact Assessment Regulations, 2006, you are instructed to notify all registered interested and affected parties, in writing and within 7 (seven) calendar days of the date of this letter, of the Department's decision in respect of your application as well as the provisions regarding the submission of appeals that are provided for in the regulations.

Your attention is drawn to Chapter 7 of the Regulations which regulates appeal procedures. Attached please find a simplified copy of the appeals procedure to be followed. Kindly include a copy of this procedure with the letter of notification to interested and affected parties.

A copy of the official appeal form can be obtained from:

Mr. TH Zwane Senior Appeals Administrator Tel: 012 310 3929 tzwane@environment.gov.za
Ms. MM Serite Appeals Administrator Tel: 012 310 3788 mserite@environment.gov.za
at the Department.

Should any party, including you, wish to appeal any aspect of the decision, they/you must, *inter alia*, lodge a notice of intention to appeal with the Minister, within 10 days of receiving notice of the decision, by means of one of the following methods:

By facsimile: 012-320-7561;

By post: Private Bag X447, Pretoria, 0001; or

By hand: 2nd Floor, Fedsure Building, North Tower, cnr. Van der Walt and Pretorius Streets, Pretoria.

You (applicant) must also serve a copy of the notice of intention to appeal on all registered interested and affected parties as well as a notice indicating where, and for what period, the appeal submission will be available for inspection, should you intend to appeal.

Please include the Department in the list of interested and affected parties, notified through your notification letter to interested and affected parties, for record purposes.

The authorised activity/ies shall not commence within thirty (30) days of the date of signature of the authorisation. Further, please note that the minister may, on receipt of appeals against the authorisation or conditions thereof suspend the authorisation pending the outcome of the appeals procedure.

Yours faithfully

Ms Lize McCourt
CHIEF DIRECTOR: ENVIRONMENTAL IMPACT MANAGEMENT
Department of Environmental Affairs

Date 25 August 2010

Eskom
Generation

Mr. Dumisane Mthembu
Director: Environmental Impact Management
Department of Water and Environmental Affairs
Private Bag X447
PRETORIA
0001

Date:
18 June 2009

Enquiries:
Deidre Herbst
Tel +27 11 800 3501

Reference: GEM09-L066

Dear Mr. Mthembu,

KUSILE PROJECT (ROD 12/12/20/807): EXCLUSION OF THE OCCUPATIONAL HEALTH AND SAFETY CONDITION OF THE ROD WHEN CONDUCTING AN ENVIRONMENTAL AUDIT

Eskom was issued with an Environmental Authorisation, EA (**Ref 12/12/20/807**) on 17 March 2008. One of the conditions of the EA, condition 3.17.2, states "All provisions of the occupational Health and Safety Act, 85 of 1993, and any other applicable legislation must be adhered to by the holder of this authorization".

Eskom acknowledges this requirement and would like to notify the Department that this condition and all other health and safety related conditions from both the Environmental Authorisation and Construction Environmental Management Plan will not be included in the external auditor's scope of work when conducting environmental audits.

Generation Division
Environmental Management
Megawatt Park Maxwell Drive Sunninghill Sandton P O Box 1091, Johannesburg 2000 SA
Tel +27 11 800 4622 Fax +27 11 800 5140 www.eskom.co.za

Eskom is comfortable that the Health and Safety issues are dealt with separately for now, and hence a separate process is in place to ensure compliance with the Occupational Health and Safety Act (OHS Act). Eskom would like to assure the Department that OHS issues are and will continue to be effectively addressed on sites, as one of the Eskom's high priorities to ensure the safety of its employees and that of its contractors. Reports on performance with respect to Health and Safety issues are kept on site, and may be presented to the authorities if needed.

I trust you find all acceptable.

Yours Sincerely

DL Herbst

Senior Manager: Generation Environmental Management

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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Ms D Herbst
Senior Manager: Environmental Management
Eskom: Generation Division
PO Box 1091
JOHANNESBURG
2000

Fax: 031 800 5140.

PER FACSIMILE / MAIL

Dear Ms Herbst

INTERPRETATION AND IMPLEMENTATION OF CONDITION 3.10.2 STATED IN THE RECORD OF DECISION DATED 17 MARCH 2008: CONSTRUCTION OF THE 4500MW KUSILE COAL FIRED POWER STATION

1. Your letter dated 22 June 2010 requesting clarification of condition 3.10.2 in the Record of Decision (RoD) issued on 17 March 2008 by the Minister has reference.

2. Condition 3.10.2 states that" *in order to establish whether the operation of the power station has adverse impacts on the health and reproduction of the chickens of the Kendal Poultry farm (hereinafter called Kendal Poultry Farm), situated on portion 30, 31, 62, 27 and 28 of the farm Klipfontein near Witbank, the ECO appointed in terms of paragraph 3.2.13 below must:*
   a) *During construction period compile baseline information, in consultation with Kendal Poultry, on Chicken fatality and reproduction rates on a quarterly basis. This information must indicate the number of fatalities per 1 000 chickens and the number of chickens per 1000 hens. This baseline information must represent statistics for a period of at least one year.*
   b) *Once the power station has come into operation, resume and continue this quarterly compilation of statistics for at least two years. After expiry of the two year period, Eskom must:*
      i) *Analyse the pre-operation (baseline) data and the post-operation to establish whether there has been any increase in chicken fatality or decrease in their reproduction rate.*

ii) *Undertake appropriate studies, should there be evidence of such increases and decreases, to establish whether there is a casual relation between the fertility and mortality fluctuations and the emissions emanating from the power station. These studies must be undertaken within six month after completion of the gathering of the post operational data.*

3. The intention of the stated condition is to address potential adverse impacts that may occur during the operational phase of the power station. The ECO is required to compile baseline information representing statistics for a period of at least one year prior to the operational phase and for a period of two years during the operation of the power station.

4. As the condition intend to address potential adverse impacts of the operational phase, the one year statistics compiled prior to operations shall be compared against the two years statistics compiled during operation. The aim of the comparison is to establish whether there has been any increase in chicken fatalities or decrease in their reproduction rate as a result of the sulphur dioxide emissions during operations and to implement appropriate mitigation measures should there be impacts on the poultry farm.

5. Condition 3.10.2 stated in the RoD dated 17 March 2008 is hereby interpreted as follows:

   To establish whether the sulphur dioxide emissions from the power station, which will occur during the operational phase, will have an impact on the Kendal Poultry farm:

   - Eskom must conduct quarterly baseline studies to obtain statistics one year before the power plant commence with operations.
   - Once operation commences, quarterly compilation of the baseline information must continue for 2 years.
   - Within six months from the end of the two years' information compilation exercise, Eskom must analyse the pre-operation (baseline) data and operation data to establish whether there has been any increase in chicken fatalities or a decrease in their reproduction rate.
   - Should there be any evidence of such increases and decreases from the analysis, the appropriate studies must be undertaken to establish whether there is a casual relation between the fertility and mortality fluctuations as a result of the emissions from the power station.

- Should the appropriate studies indicate such casual relation, Eskom must within two months submit a management plan for approval to this Department to mitigate the impacts of the losses (if any) including but not limited to compensation of such losses.

6. The Department confirm that condition 3.10.2 of the RoD dated 17 March 2008 for Kusile Power Station applies a year prior to operations and not during the entire construction phase.

Mr Dumisani Mthembu
CHIEF DIRECTOR: ENVIRONMENTAL IMPACT MANAGEMENT ACTING
Department of Environmental Affairs
Date: 29/10/2010

environmental affairs

Department:
Environmental Affairs
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Ms Deidre Herbst
Eskom Generation
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PER FACSIMILE / MAIL

Dear Ms Herbst

AMENDMENT OF THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN FOR KUSILE 4500MW COAL-FIRED POWER STATION

With reference to the abovementioned application, please be advised that the Department in terms of the powers vested in it by regulation 43 of Environmental Impact Assessment Regulations, 2006, has decided to amend the environmental authorisation as follows:

Specific section 5.2.2: *"The contractor shall provide, maintain and calibrate fall out dust collectors for the measurements of dust fallout. The* ***directional*** *dust collector devices shall consist of four removable dust collectors placed at right angles mounted at a height of 2m above ground. Should fallout exceed* ***0.25g/m²/day*** *the contractor shall cease with the operations that are causing the dust until such time as remedial measures have been put in place to ensure that dust levels are within the specified limit".*

Must be substituted as follows:

Section 5.2.2: *"The contractor shall provide, maintain and calibrate fallout dust collectors for the measurements of dust fallout. The* ***single*** *dust collector devices shall consist of four removable dust collectors placed at right angles mounted at a height of 2m above ground. Should fallout exceed* ***1.2g/m²/day*** *the contractor shall cease with the operations that are causing the dust until such time as remedial measures have been put in place to ensure that dust levels are within the specified limit".*

This amendment must be read in conjunction with the Environmental Authorisation dated 17 March 2008 and the construction EMP approved on 04 December 2007.

Yours faithfully

Ms Lize McCourt
CHIEF DIRECTOR: ENVIRONMENTAL IMPACT MANAGEMENT
Department of Environmental Affairs
Letter signed by: Mr Dumisani Mthembu
Designation: Director: Environmental Impact Evaluation
Date: 4/11/2010

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Department:
Environmental Affairs and Tourism
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Ms Deidre Herbst
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P O Box 1091
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2000

Fax: (011) 800 5140

Dear Ms Herbst

KUSILE PROJECT (ROD 12/12/20/807): CLARIFICATION OF INTERPRETATION AND IMPLEMENTATION OF CONDITIONS OF THE CONSTRUCTION MANAGEMENT PLAN (CEMP)

Your letter dated 18 June 2009 and the meeting between this Department and Eskom on the 28 May 2009 regarding the above-mentioned matter refers.

The Department has considered your request in respect of condition 6.1.1 of the RoD 12/12/20/807 and hereby confirm that it concurs with your interpretation of the said condition. Condition 6.1.1 only refers to the permanent buildings and structures on site and does not apply to the temporary buildings.

Yours sincerely

Mr Dumisane Mthembu
Director: Environmental Impact Evaluation
Department of Environmental Affairs and Tourism
Date: 15/07/2009

General ... Environmental Management
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21 -07- 2009

environmental affairs

Department:
Environmental Affairs
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Attention: Ms Deidre Herbst
Eskom Generation
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Fax: 031 800 5140

PER FACSIMILE / MAIL

Dear Ms Herbst

AMENDMENT OF THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN FOR KUSILE 4500MW COAL-FIRED POWER STATION

The abovementioned subject has reference. The amendment letter dated 04 December 2010 issued by this Department, in terms of the powers vested in it by regulation 43 of Environmental Impact Assessment Regulations: 2006, is hereby amended as follows:

Paragraph 4 of page 1 which read as follows,

Section 5.2.2: "*The contractor shall provide, maintain and calibrate fallout dust collectors for the measurements of dust fallout. The* ***single*** *dust collector devices shall consist of four removable dust collectors placed at right angles mounted at a height of 2m above ground. Should fallout exceed* ***1.2g/m²/day*** *the contractor shall cease with the operations that are causing the dust until such time as remedial measures have been put in place to ensure that dust levels are within the specified limit".*

Must be substituted as follows:

Section 5.2.2: *"The contractor shall provide, maintain and calibrate fallout dust collectors for the measurement of dust fallout. The single dust collector device shall consist of an open-topped cylinder* *not less than 150 mm in diameter with height not less than twice its diameter. The container will be mounted at a height of 2m above ground. Should fallout exceed 1.2 g/m²/day the contractor shall cease with the operation that are causing the dust until such time as remedial measures have been put in place to ensure that dust levels are within the specific limit".*

This amendment must be read in conjunction with the initial amendment dated 04 November 2010, Environmental Authorisation dated 17 March 2008 and the construction EMP approved on 04 December 2010.

In terms of regulation 10(2) of the Environmental Impact Assessment Regulations, 2006, you are instructed to notify all registered interested and affected parties (IAPs), in writing and within ten (10) calendar days of the date of this letter, of the Department's decision in respect of your application as well as the provisions regarding the making of appeals that are provided for in the regulations.

Your attention is drawn to Chapter 7 of the Regulations which regulates appeal procedures. Attached please find a simplified copy of the appeals procedure to be followed. Kindly include a copy of this procedure with the letter of notification to IAPs.

A copy of the official appeal form can be obtained from:
Mr Thamsanqa Zwane, Senior Legal Administration Officer (Appeals) Tel: 012 310 3929 TZwane@deat.gov.za.

Any party wishing to appeal any aspect of the decision must, *inter alia,* lodge a notice of intention to appeal with the Minister, within 10 days of receiving notice of the decision, by means of one of the following methods:

By facsimile:	(012) 310 7561;
By post:	Private Bag X447, Pretoria, 0001; or
By hand:	2nd Floor, Fedsure Forum Building, North Tower, cnr Pretorius and van der Walt Streets, Pretoria.

Should the applicant decide to appeal, the applicant must serve a copy of its notice of intention to appeal on all registered IAPs as well as a notice indicating where, and for what period, the appeal submission will be available for inspection. A new Construction EMP reflecting the amendments made, must be submitted to this Department after the appeal, if any, has been dealt with by the Minister.

Yours faithfully

Ms Lize McCourt
CHIEF DIRECTOR: ENVIRONMENTAL IMPACT MANAGEMENT
Department of Environmental Affairs
Letter signed by: Mr Dumisane Mthembu
Designation: Director: Environmental Impact Evaluation
Date: 2/12/2010

Appendix C

Copies of the 2006 Aquatic and Wetlands Specialist Studies and the 2011 Wetland Delineation Specialist Study Reports

ECOSUN

REPORT ON:

ESKOM KENDAL WETLAND DELINIATION SOIL SURVEY

Submitted to:

Ecosun

PO Box 2131

Florida Hills

1716

VILJOEN & ASSOCIATES

DISTRIBUTION:

1 Copy - Ecosun

1 Copy - Viljoen & Associates

October 2006

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EXECUTIVE SUMMARY

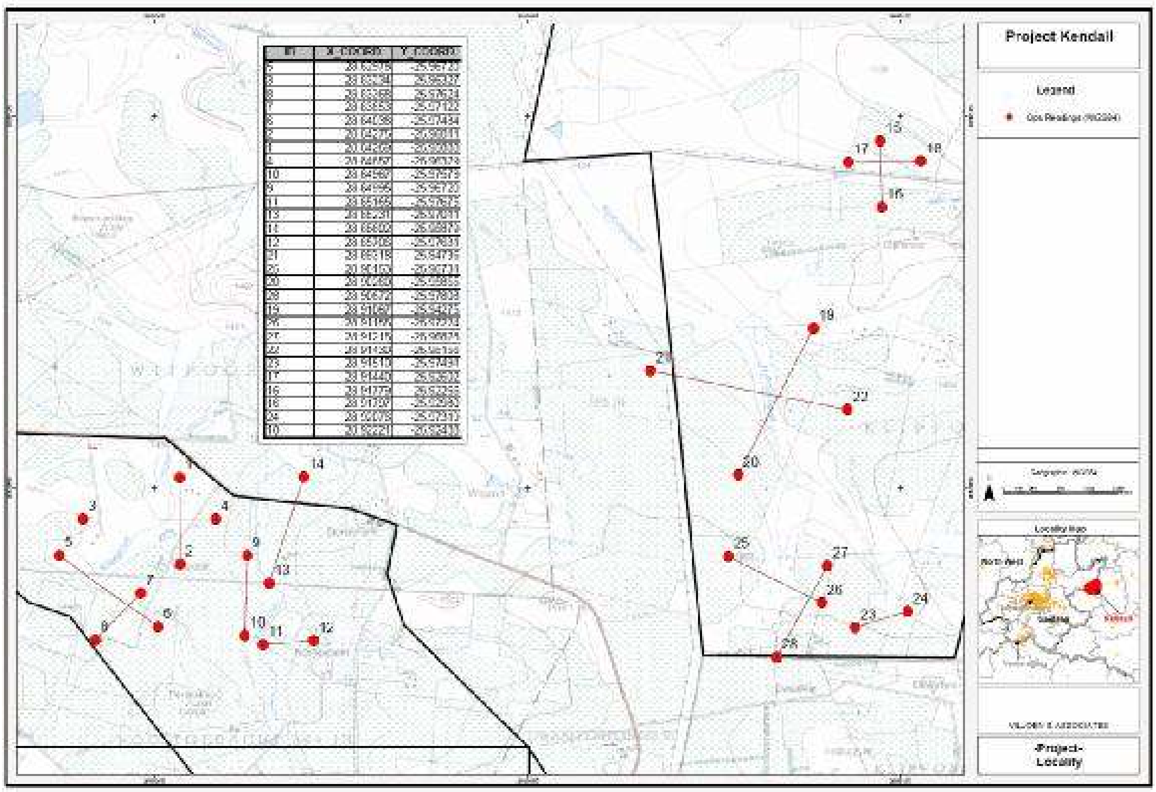


Figure 1. Eskom Kendal soil types and wetland areas associated with Katspruit soils.

Dr. J. Rall of Ecosun requested during September 2006 a wetland delineation soil survey (**Figure 1**) near Kendal Powerstation in Mpumalanga, with the primary objective to identify wetland soils on predetermined transects across potential wetland areas.

From the assessment it is conclusive the wetland areas are associated with one distintive soil type identified according to the South African Taxonomic Soil Classification System, *i.e.* Katspruit soil characterised by gley mottling anaerobic soil conditions. Demarcation of the wetland boundaries were conducted through identification of Hutton and Mispah soils characterised by low clay content well drained and aerated profiles.

ESKOM KENDAL WETLAND DELINIATION SOIL SURVEY

1 GENERAL PRINCIPALS

Before undertaking a wetland delineation it is important that the following general principles are understood:

- A wetland is defined as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (*Water Act 36 of 1998*).

- A wetland is therefore defined in terms of hydrology (*flooded or saturated soils*), plants (*adapted to saturated soils*) and soil (*saturated*).

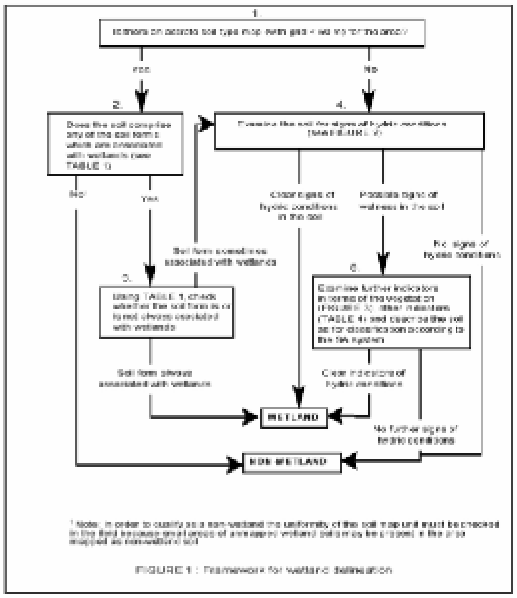
- Much of South Africa has a very variable climate so that in some years the wetland is much wetter than in others. This is particularly noticeable at the outer boundary areas of the wetland. Thus, unless long term data are available, the direct presence of water is often an unreliable indicator of wetland conditions, particularly for wetlands in arid and semi-arid regions.

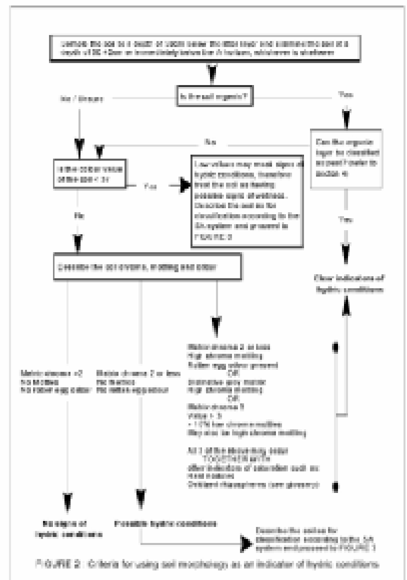
- Although data are often not available to describe the hydrology of a wetland directly, this can be reliably done in an indirect way using soil morphology or vegetation. Prolonged saturation of soil has a characteristic effect on soil morphology, affecting soil matrix chroma and mottling in particular.

- Because of a wetland's transitional nature, as one moves from outside into a wetland, the hydrology, soils and vegetation generally change gradually along a continuum of increasing wetness. Thus, the boundary of the wetland is often not clearly apparent in the field and must be identified and placed across what is often a gradually changing gradient. While it is recognized that this boundary may be a human construct, it is necessary from a management and legal point of view and can be undertaken on the basis of scientifically defensible criteria.

- The gradual change in the vegetation along a wetland boundary gradient means that the outer parts of the wetland often have a mixture of species that occur widely outside of wetlands (*e.g. ngongoni* grass [*Aristida junciformis*] and rooigras [*Themeda triandra*]) and species specifically adapted to saturated soil conditions and confined to wetlands (*e.g.* the sedge *Pycreus macranthus*).

- In the Water Act definition of wetlands, "normal circumstances" refers to that which would be present without human modifications. Such modifications may include, for example: (a) the drying out of a wetland with artificial drains or (b) the removal of the natural vegetation through cultivation. In the case of drying out of the wetland, it is important to note that even if the characteristic wetland vegetation is lost, the soil retains, for decades at least, indications of the hydric conditions under which it was formed. Upon artificial drying out of a wetland, the vegetation tends to change more rapidly than soil morphology in response to the altered hydrology.





Figures 2 & 3. Framework for wetland delineation and criteria using soil morphology as indication of hydromorphic soil conditions.

Figures 2 & 3 show a framework for wetland delineation and criteria using soil morphology to identify wetland soils, summarised in **Table 1**.

TABLE 1. SOIL FORMS ASSOCIATED WITH WETLANDS

Soil forms always associated with wetlands				
Champagne	Katspruit	Willowbrook	Rensburg	
Soil forms sometimes associated with wetlands				
Inhoek	Longlands	Wasbank	Lamotte	Estcourt
Klapmuts	Tukulu	Cartref	Fernwood	Westleigh
Dresden	Avalon	Pinedene	Glencoe	Bainsvlei
Bloemdal	Witfontein	Sterkspruit	Sepane	Valsrivier
Dundee				

2 TERMS OF REFERENCE

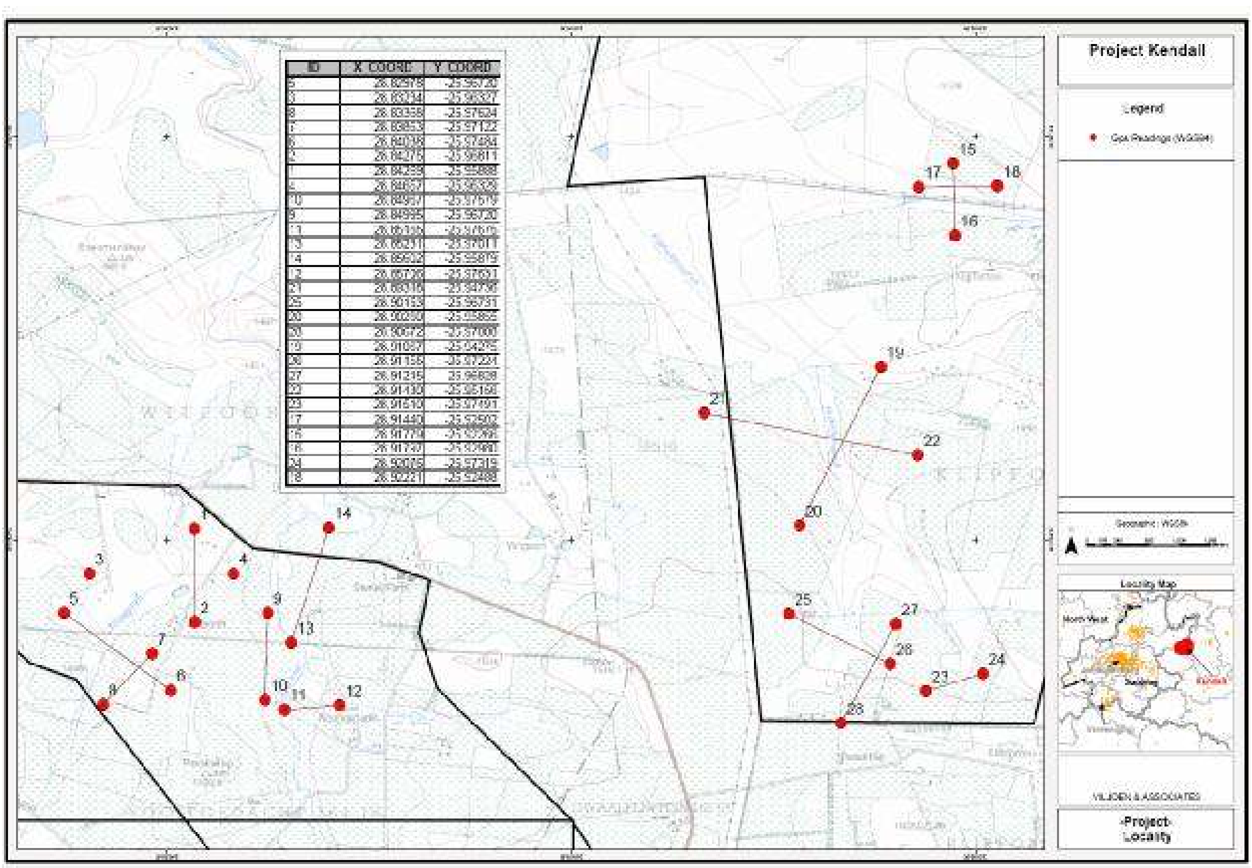


Figure 4. Eskom Kendal area of investigation.

During September 2006 Dr. J. Rall of Ecosun requested a proposal for a wetland delineation soil survey (**Figure 4**) near Kendal Powerstation in Mpumalanga.

3 INVESTIGATION OBJECTIVES

The primary objective of the investigation was interpreted as:

- o Identification of wetland soils to delineate wetland areas on predetermined transects across potential wetland areas.

4 METHOD OF INVESTIGATION

In order to meet the objective of the investigation, the following scope of work was proposed:

4.1 Site Assessment:

- Undertake a preliminary delineation of wetland boundaries using an orthophoto or topocadastral map together with airphoto interpretation.

- Verify and adjust the preliminary delineation of the wetland using the following field verification:

    - o Placement of lateral transects along the longitudinal length of the wetland. This spacing may need to vary depending on the complexity of the wetland. If a high level of accuracy is required in the delineation, and/or the wetland has been altered by artificial disturbance and land-use practices, then transects at more regular intervals may be required. Ensure that all transects are geographically referenced and marked on the orthophotos or topocadastral maps.

    - o Start each transect well outside the perceived boundary of the wetland, and describe the soil at regular intervals along the transect.

    - o Locate the point on the transect where the first clear signs of wetness are encountered. The boundary of the wetland may be unclear and it may be necessary to go back along the transect and take further samples.

    - o Once the boundary has been determined continue with the transect through the wetland describing the soil at regular intervals. For each transect note the percentage distance occupied by the temporary, seasonal and permanent zones respectively. Finally, locate the far boundary of the wetland at the end of the transect using the same procedure employed to determine the initial boundary.

- o When sampling the transects also take particular note of features not easily visible from the air- or orthophotos, including: artificial drains; localized features such as headcuts of erosion gullies and point sources of pollution. Mark the location of these features on the map.

- o Once all transects have been completed, use topographic and soil features to establish lines connecting boundary points of the outer limits of the wetland and the zones within the wetland. This is best done from a vantage point (*e.g.* on a hill next to the wetland) with the aid of features visible on the orthophotos. Make any changes to the preliminary delineation on the map.

5 PROBLEM ANALYSES

5.1 South African Environmental Soil Legislation

The following section outlines a summary of the most recent South African Environmental Legislation that needs to be considered for any new development with reference to management of soil:

- *The law on Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal.*

- *The Bill of Rights states that environmental rights exist primarily to ensure good health and well being, and secondarily to protect the environment through reasonable legislation, ensuring the prevention of the degradation of resources.*

- *The Environmental right is furthered in the National Environmental Management Act (No. 107 of 1998), which prescribes three principles, namely the precautionary principle, the "polluter pays" principle and the preventive principle.*

- *It is stated in the above-mentioned Act that the individual/group responsible for the degradation/pollution of natural resources is required to rehabilitate the polluted source.*

- *Soils and land capability are protected under the National Environmental Management Act 107 of 1998, the Environmental Conservation Act 73 of 1989, the Minerals Act 50 of 1991 and the Conservation of Agricultural Resources Act 43 of 1983.*

- *The National Veld and Forest Fire Bill of 10 July 1998 and the Fertiliser, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947 can also be applicable in some cases.*

- *The National Environmental Management Act 107 of 1998 requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided be minimized and remedied.*

- *The Minerals Act of 1991 requires an EMPR, in which the soils and land capability be described.*

- *The Conservation of Agriculture Resources Act 43 of 1983 requires the protection of land against soil erosion and the prevention of water logging and salinisation of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and water courses are also addressed*

5.2 Wetland Deleniation

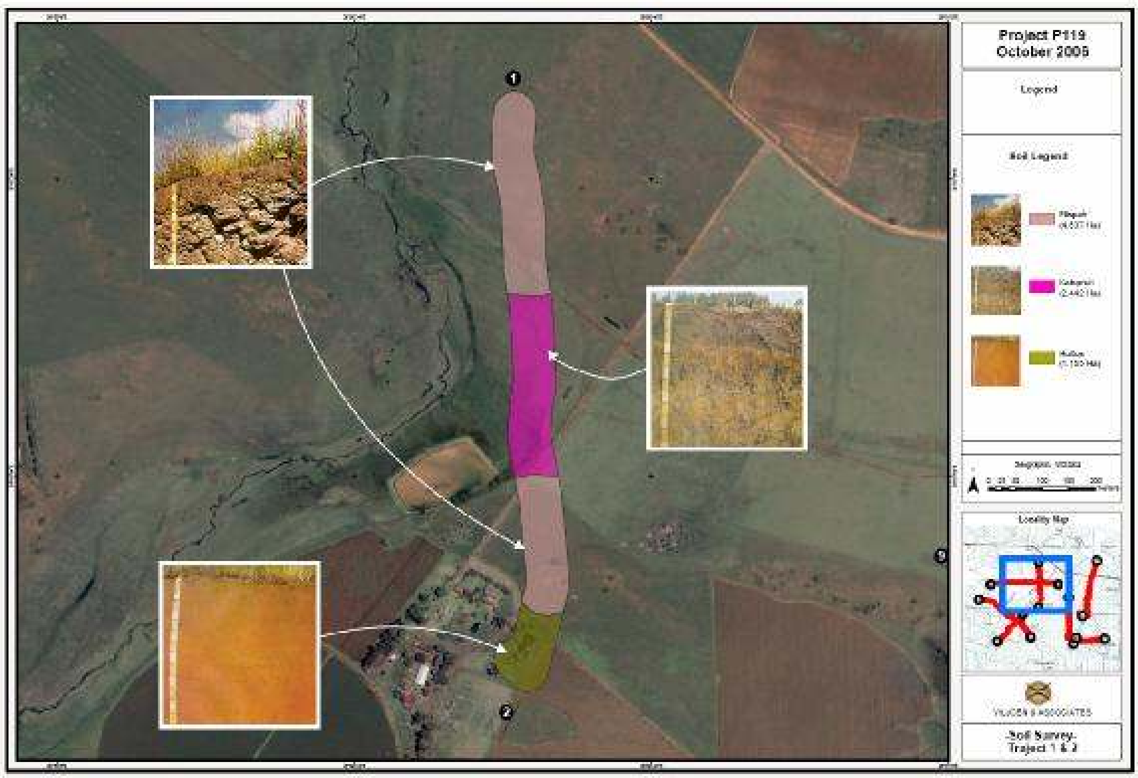


Figure 5. Transect 1 & 2 soil types.

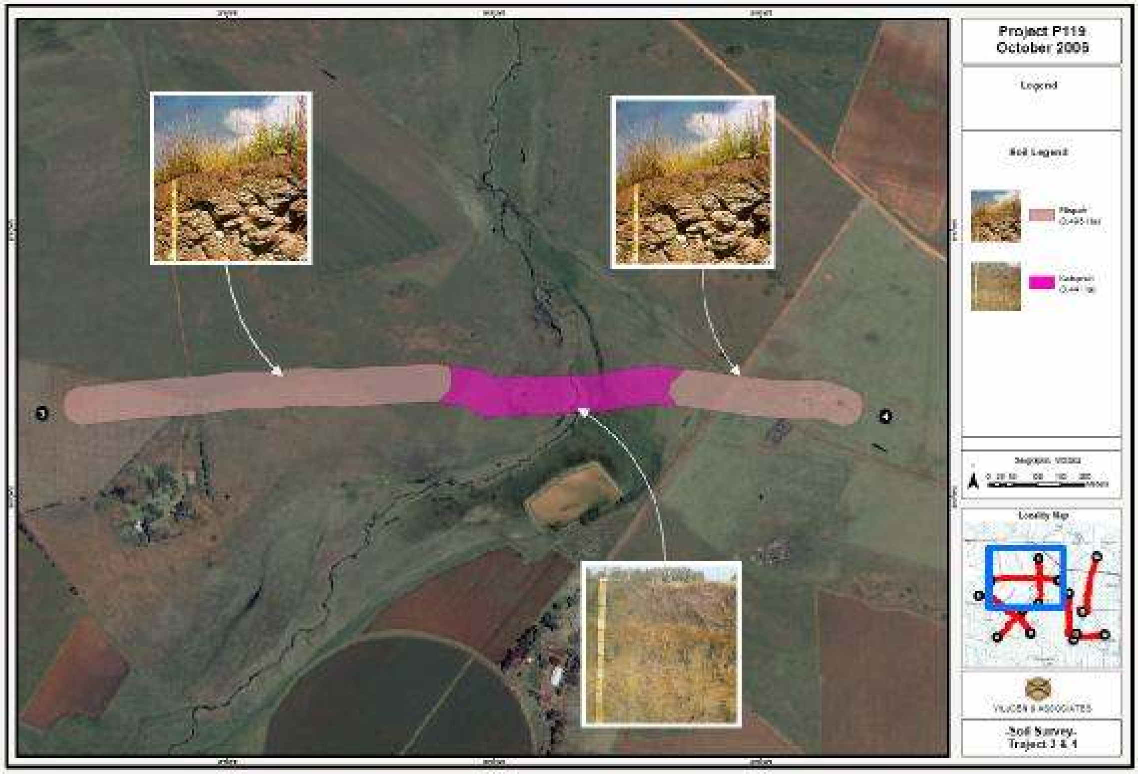


Figure 6. Transect 3 & 4 soil types.

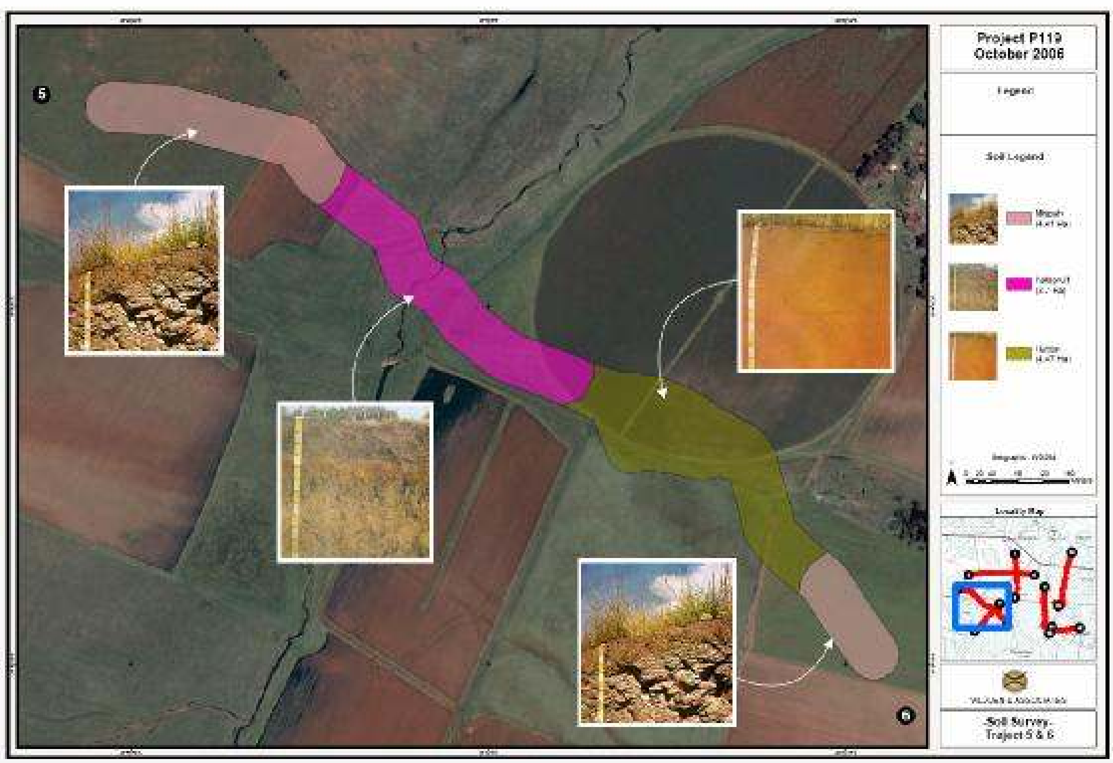


Figure 7. Transect 5 & 6.soil types.

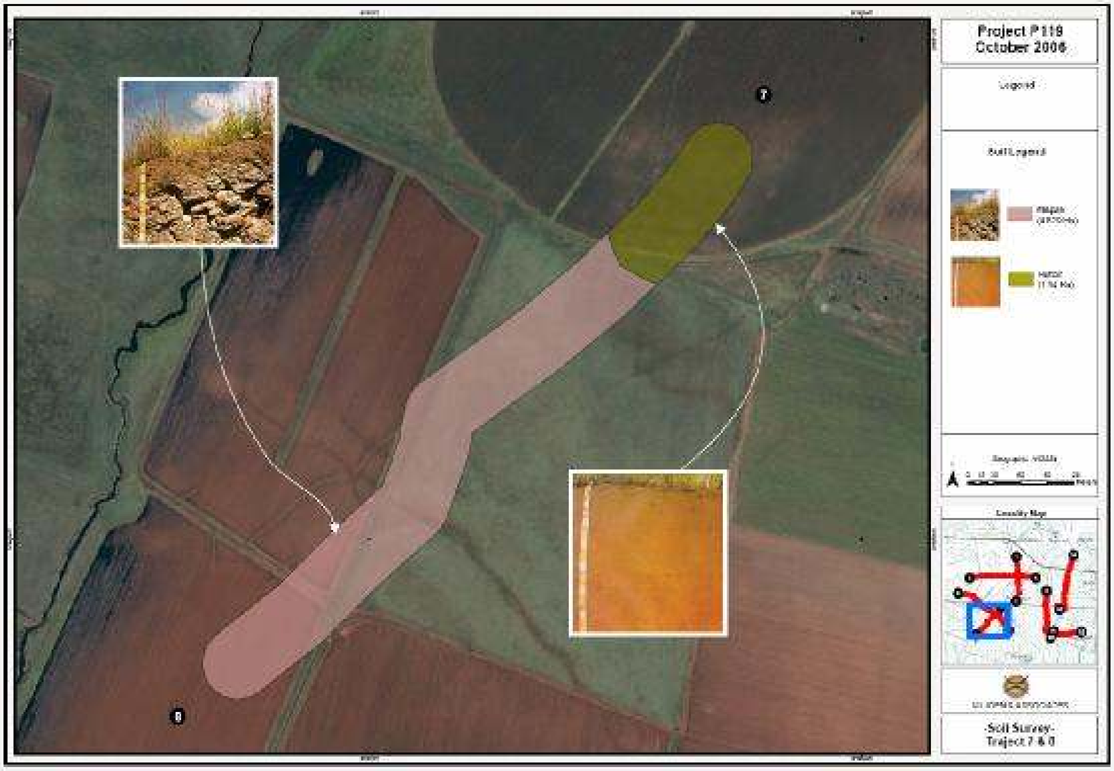


Figure 8. Transect 7 & 8 soil types.

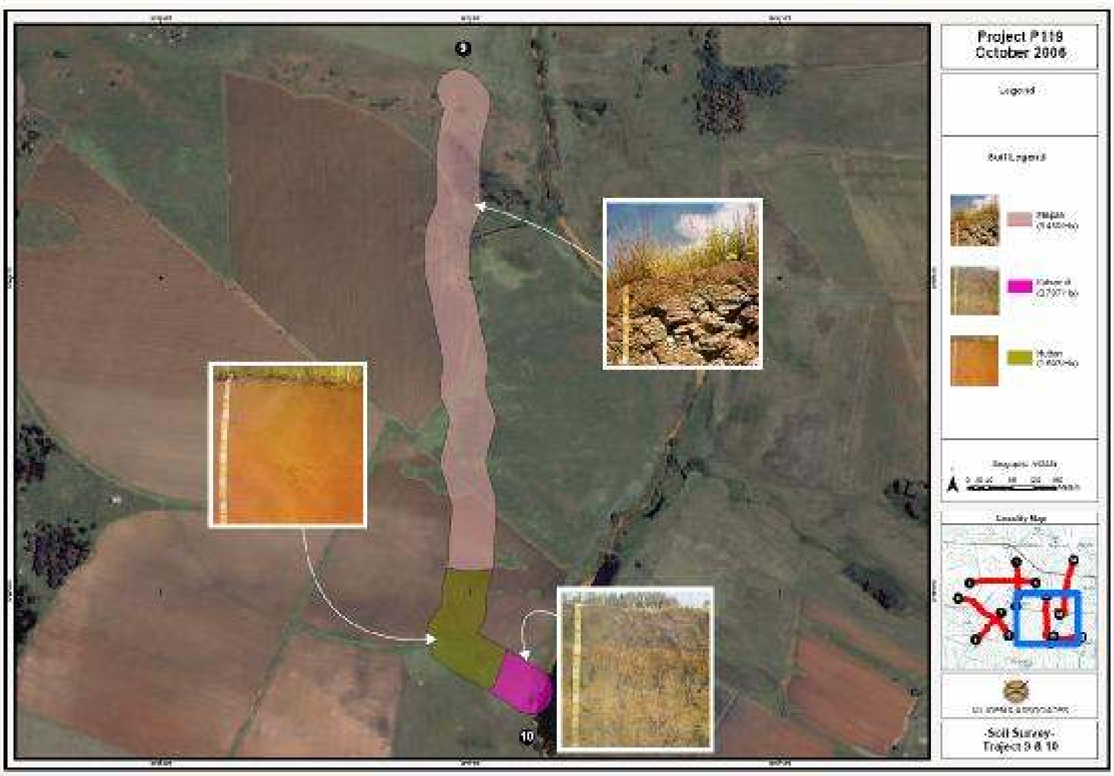


Figure 9. Transect 9 & 10 soil types.

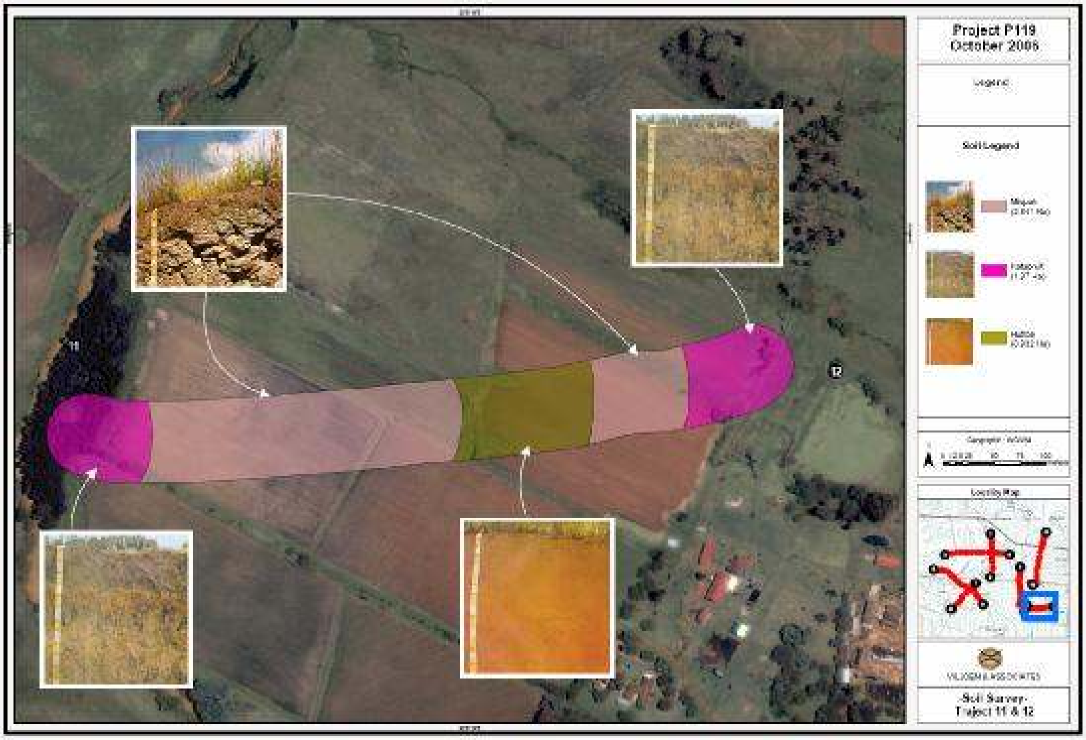


Figure 10. Transect 11 & 12 soil types.

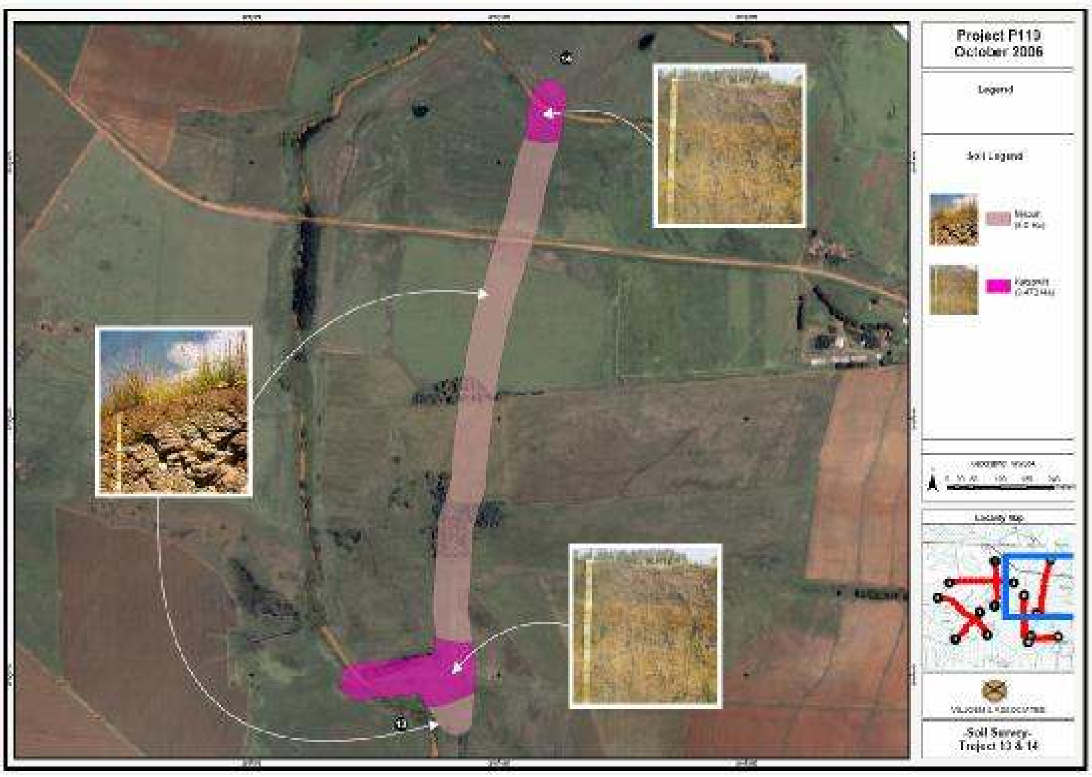


Figure 11. Transect 13 & 14 soil types.

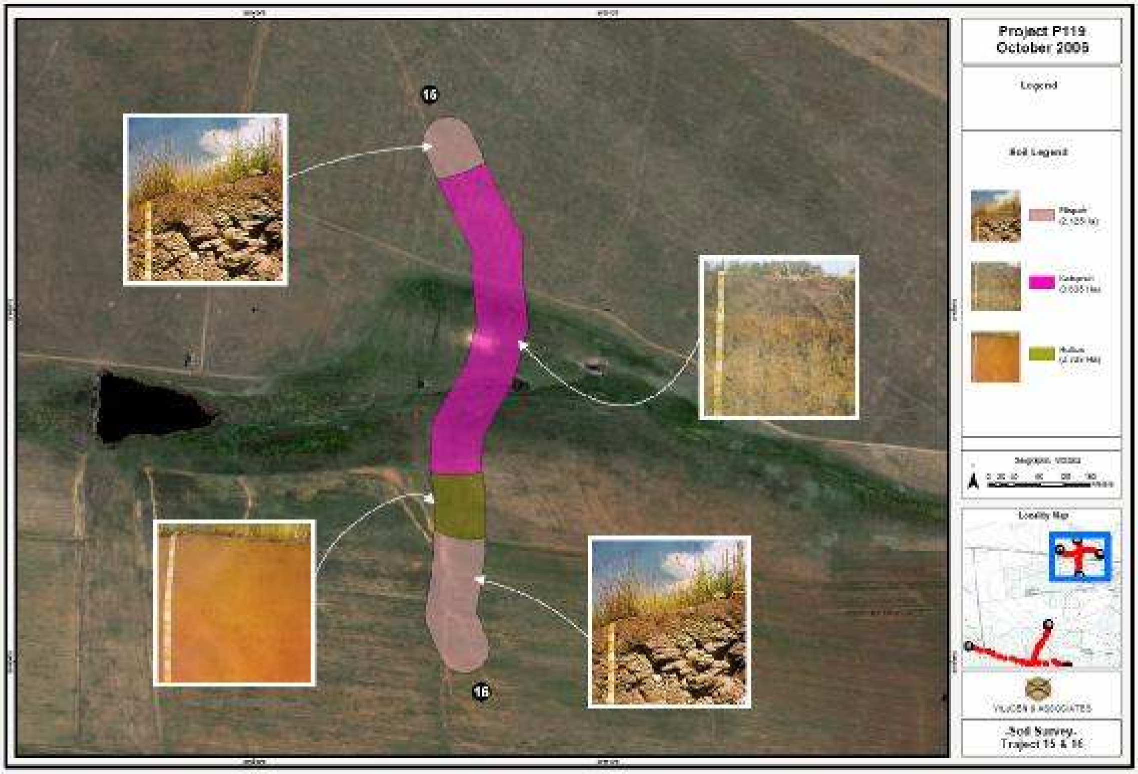


Figure 12. Transect 15 & 16 soil types.

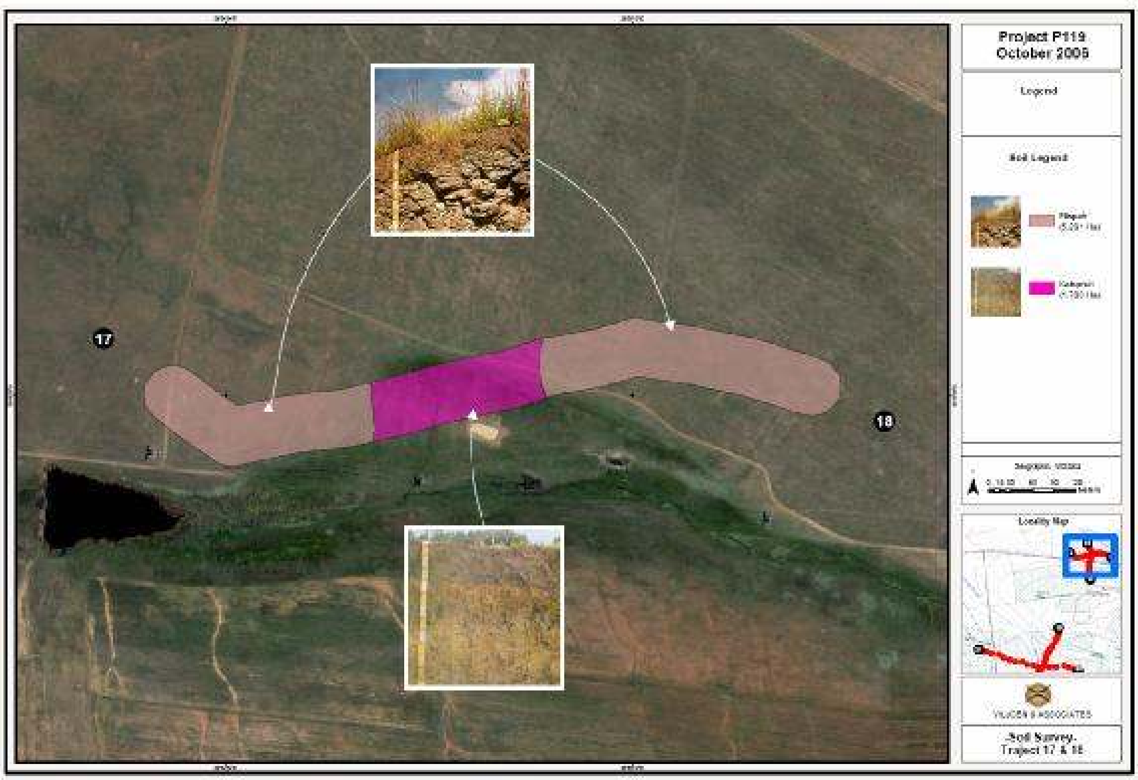


Figure 13. Transect 17 & 18 soil types.

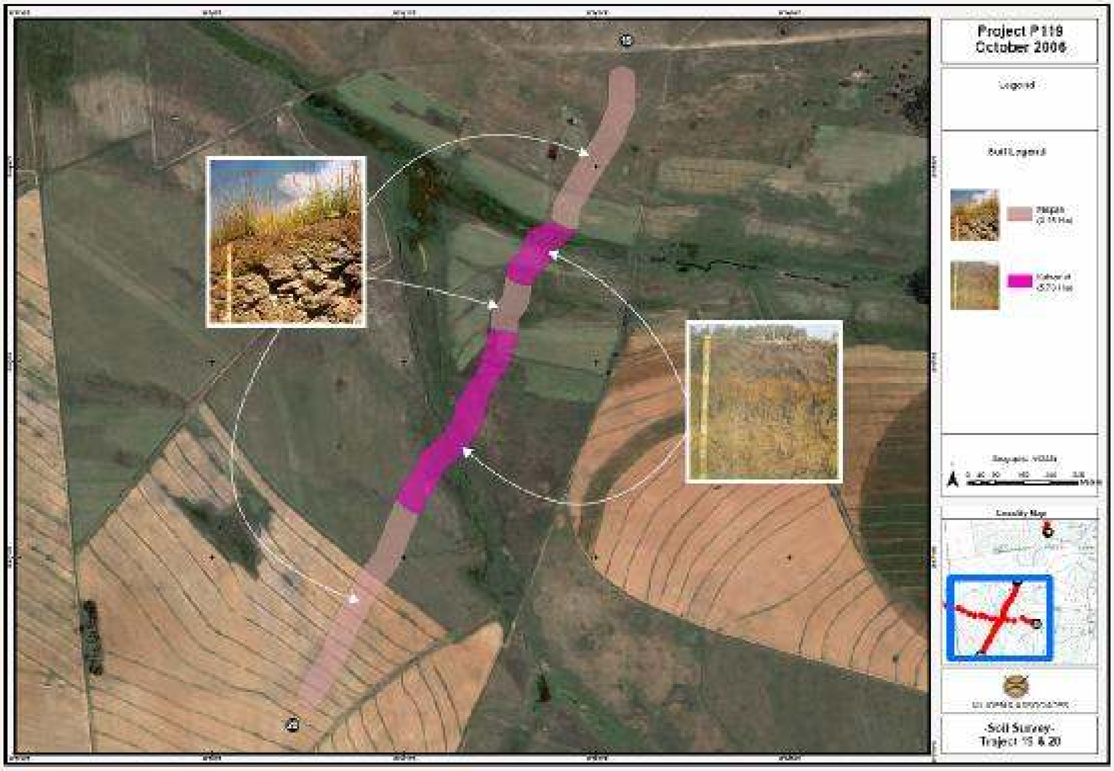


Figure 14. Transect 19 & 20 soil types.

Figure 15. Transect 21 & 22 soil types.

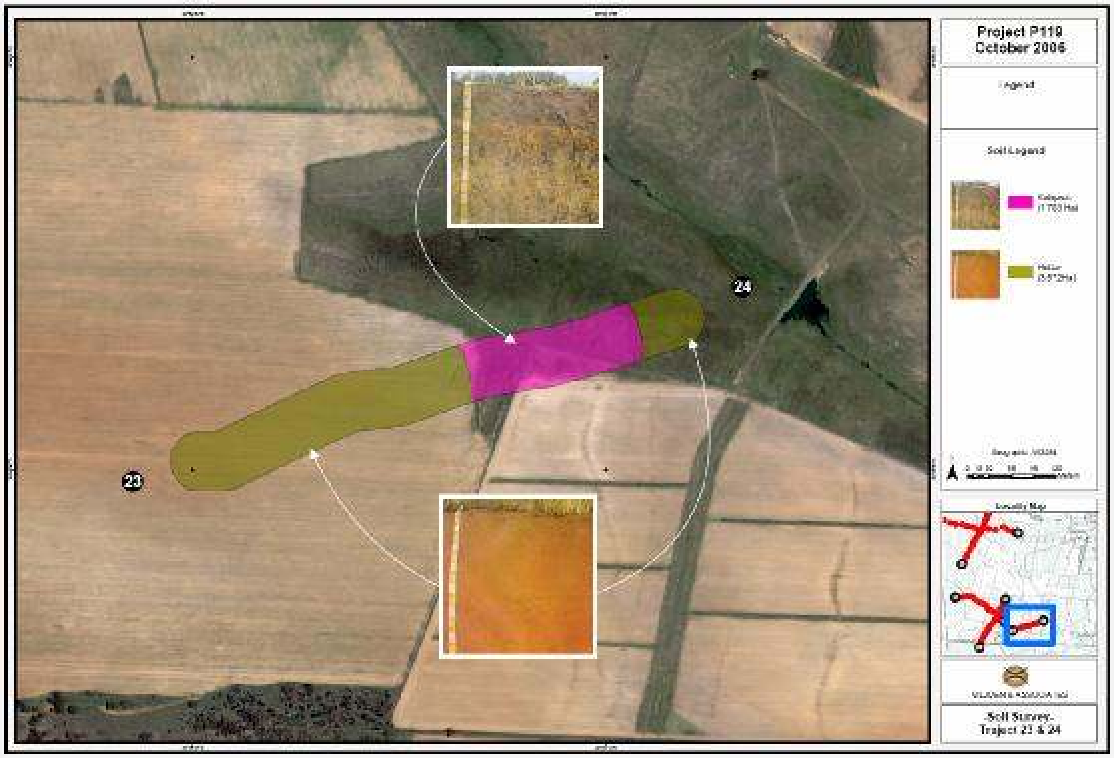


Figure 16. Transect 23 & 24 soil types.

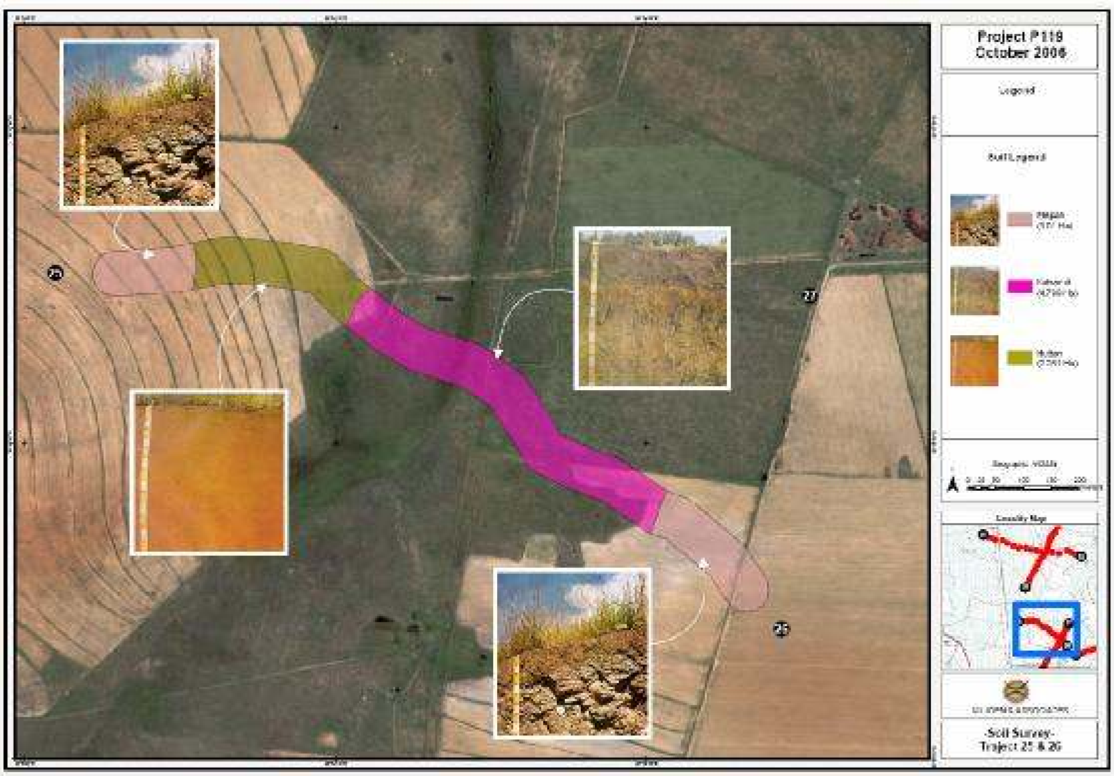


Figure 17. Transect 25 & 26 soil types.

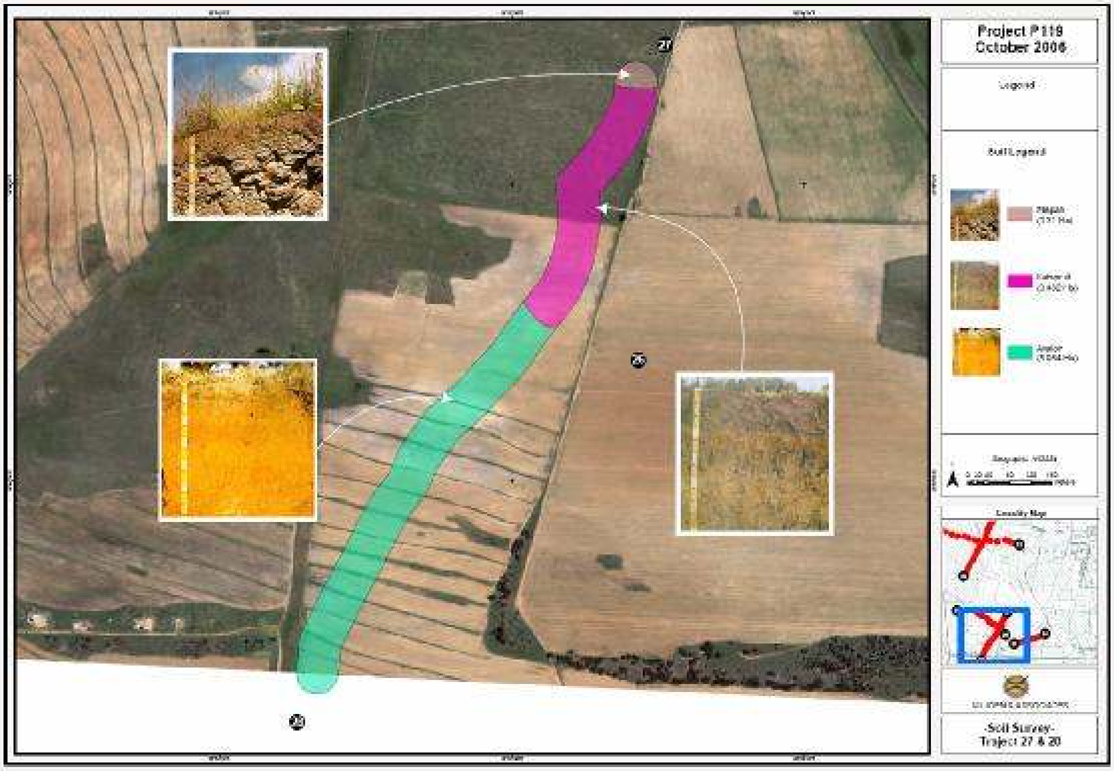


Figure 18. Transect 27 & 28 soil types.

The wetland boundaries associated with Katspruit soils along the predetermined transects are illustrated in **Figures 5** to **18**.

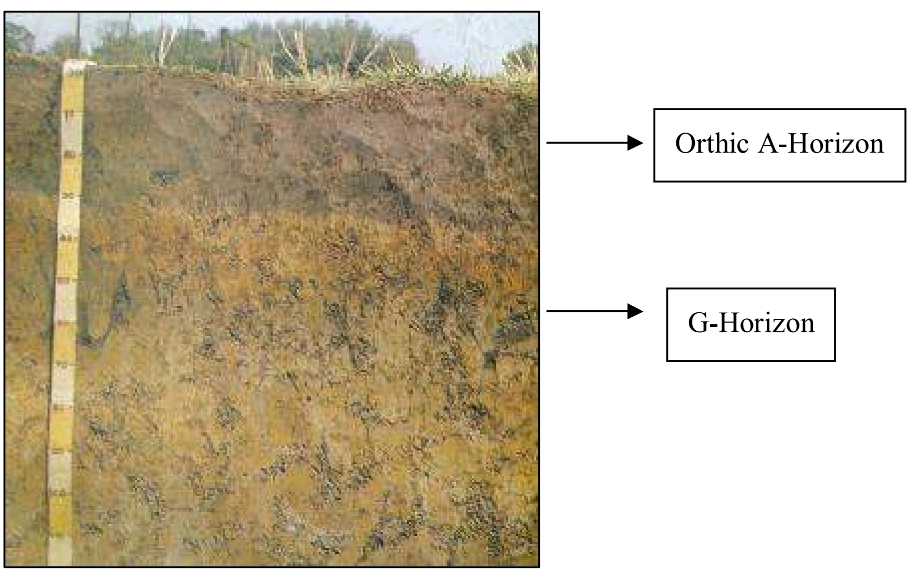


Figure 19. Katspruit soil.

One distinctive soil type, *i.e.* Katspruit (**Figure 19**) associated with wetland conditions was observed during the soil survey. The Katspruit soil is characterised by a G-Horizon underneath an orthic A-horizon with distinctive gley mottling characteristics caused by anaerobic soil moisture conditions resulting in the reduction and precipitation of iron and manganese. The G-horizon is characterised by a high clay content containing predominantly 2:1 clay minerals typical of wetland conditions.

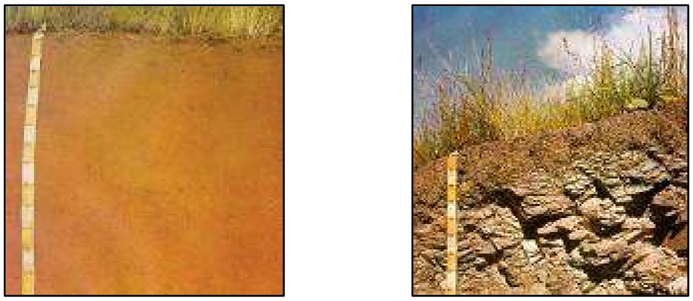


Figure 20. Hutton and Mispah soils (*left to right*).

Hutton and Mispah soils (**Figure 20**) were encountered on the wetland boundaries, with Hutton soil characterised by an orthic A-horizons overlying a red apedal B-horizon characterised by low clay content, well aerated and good drainage properties. The Mispah soil has a distinctive hard rock layer beneath the orthic A-horizon and under wetland conditions usually associates with sub-surface preferential seepage path ways.

6 CONCLUSIONS

- The wetland areas along the predetermined transects are associated with one distintive soil type classified according the South African Taxonimical Soil Classification System, *i.e.* Katspruit soil characterised by gley mottling anaerobic soil conditions.

- Demarcation of the wetland boundaries were conducted through identification of Hutton and Mispah soils characterised by low clay content well drained and aerated profiles.

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REPORT ON

ECOLOGICAL ASSESSMENT
Wetlands and Surface Waters associated with the proposed Coal Fired Power Station in the Witbank area.

Report No : E457/06/B

Submitted to:
Ninham Shand (Pty) Ltd
PO Box 1347
Cape Town
8000

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EXECUTIVE SUMMARY

ECOSUN cc was contracted by Ninham Shand Consulting Services (Pty) Ltd to conduct an ecological survey of two possible sites for the development of a new Coal Fired Power Station in the Witbank area with specific focus on aquatic and wetland ecosystems. The following assessments were conducted:

- *In situ* water quality assessment,
- General Habitat Assessment,
- South African Aquatic Scoring System (SASS5),
- Invertebrate Habitat Assessment System (IHAS) vers. 2,
- Wetland delineation,
- Present Ecological Status (PES) assessment of wetlands (wetland integrity),
- Wetland ecosystem services,
- Wetland flora and fauna, and an
- Assessment of potential impacts.

The above assessments reveiled that area Site Y has a higher aquatic biotic integrity (Class A/B, based on SASS5 scores) when compared to Site X (Class E). Two specimens of the Shortspine suckermouth (*Chiloglanis pretoriae*) were sampled in the Wilge River (site WR1). The presence of this species is of special significance, since it is extremely scarce in the upper Olifants River Catchment. The wetlands of Site Y were also found to have a higher level of integrity and offer a higher level of ecosystem services than Site X.

Mitigation measures for both sites included alternate layouts for the power station. However, based on above information, from an aquatic biota and wetland perspective, Site X would be the preferred option for the development of the proposed Coal Fired Power Station.

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1 INTRODUCTION

1.1 Background

ECOSUN cc was contracted by Ninham Shand Consulting Services (Pty) Ltd to conduct an aquatic and wetland assessment of two potential sites for the construction of a new power station by Eskom in the Kendal area, in the Mpumalanga and Gauteng provinces (Areas X and Y in Figure1). The main aim of the study was to assess whether any important ecological attributes could be identified within the two proposed regions earmarked as possibly suitable sites for the development of the proposed power station. Within these two areas a site outlay for a power station, coal storage facility and ash dam were further proposed. The proposed regions fall within the larger Wilge River catchment with land use mainly confined to commercial pastoral and agricultural farming areas and, as such, are subject to grazing, cultivation and fire management practices.

In order to evaluate the potential impact of the proposed development an assessment of the status and conservation importance of the aquatic ecosystems and wetlands was undertaken. Information from this assessment was used as the basis to assess the significance of impacts that may affect important ecological attributes associated with the aquatic ecosystems and wetlands.

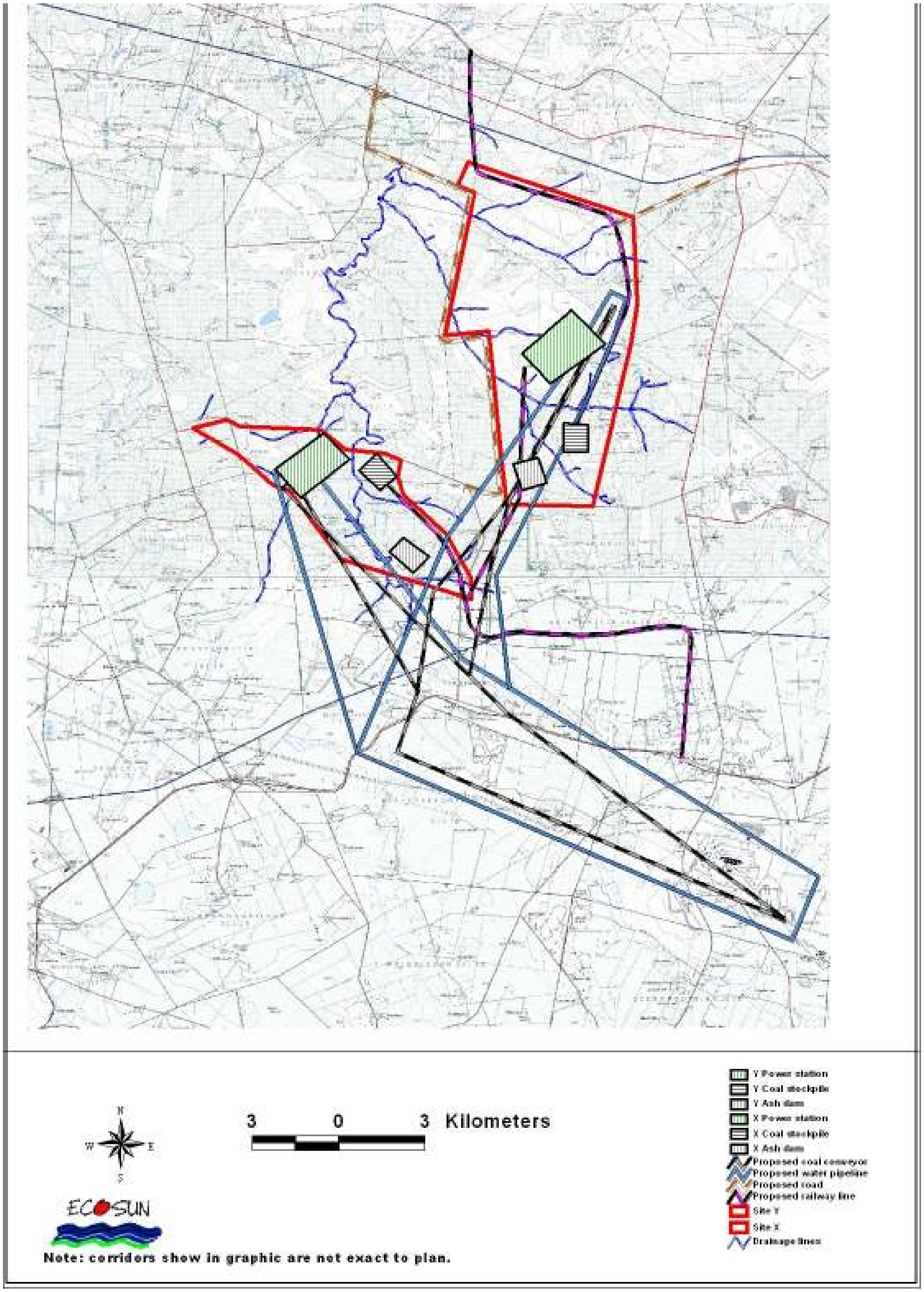


Figure 1: Locality map of Sites X and Y for the proposed Coal Fired Power Station in the Witbank area.

1.2 Objectives

The overall objective of this study was to provide a broad description of the wetlands and streams associated with the proposed development and included the following specific objectives:

- An assessment of biodiversity patterns & processes associated with wetlands and streams;
- A biotic integrity assessment and associated habitat classification;
- Delineation of aquatic ecosystems, as well as their ecological significance;
- Wetland and biotic status assessment;
- An impacts significance assessment and recommendations to prevent or mitigate identified impacts; and
- A recommendation regarding the preferred site in terms of aquatic and wetland ecosystems, with and without mitigation measures.

1.3 Approach

The approach was implemented along the following basic tasks:

- Desktop assessment – obtain relevant information (e.g. satellite imagery, existing literature) verify the likely presence of important ecological attributes – rare and endangered species (R&E), and important habitat types.
- Conduct a desktop delineation of the wetlands associated with the areas proposed for development;
- Design a field survey through identifying river reaches and wetland segments most likely to be under threat from impacts that may result from the proposed development. Select survey sites to represent these reaches of likely impact;
- Conduct a field survey to verify desktop delineations and the likely presence of important ecological attributes (e.g. biodiversity patterns and processes);
- Analyses of results and data interpretation involving the following:
    - ➢ Classification of aquatic and wetland areas into discernable ecosystem units;
    - ➢ Assessment of each unit's ecosystem integrity and services provided.

- Overlay proposed development footprints on important ecological attributes and assess likely impact significance;
- Generation of mitigation measures with the guiding principal of deferring impacts to ecosystem units with low integrity and services;
- Propose possible mitigation measures;
- Report the outcome.

1.4 Limitations

The study was conducted during September 2006, before the advent of the summer rains. Unequivocal identification of some of the species was therefore impossible, and some species (especially some annuals) may have been overlooked. This is of specific significance regarding the presence of red data species in relation to the proposed development. Many of the annual grass and forb species had also, as yet, not emerged. Many of the migratory bird species, which may inhabit this area in summer, had not yet returned from their migration to the northern hemisphere. These species were, therefore, not observed or included in this study. At some of the sites extensive burning of moribund material had also taken place and re-growth was negligible, making identification of the majority of floral species in these areas impossible.

The wetland and riparian assessment was conducted mainly at a desktop level to focus field survey efforts and assist in identifying the likely impacts associated with the different layouts to facilitate a preliminary impact significant assessment and identify major risks associated with the different layouts in order to recommend layouts with the least significant impacts.

2 STUDY AREA

The study area consists of two potential sites (Site X and Site Y, figure1) which lie approximately 35km east south east of Witbank. Situated in the Olifants River Catchment (Quaternary Catchment B20F) the study area falls within the Veld Types 61 (Bankenveld) and 19 (Sourish Mixed Bushveld) (Acocks, 1988). The location and description of the aquatic sampling sites, wetland and soils transects are given in Table 1 and illustrated in Figures 2 and 3 .

Table 1: Monitoring sites in sections of the Wilge River, Klipspruit, Klipfonteinspruit and Holfontienspruit associated with the proposed Coal Fired Power Staion.

Sample point	Description	Latitude	Longitude
Aquatic Sample points			
XHFSAD	Holfonteinspruit	-25.97046	28.90602
XKFSDS	Klipfonteinspruit downstream	-25.92415	28.88391
XKFSCSAD	Klipfonteinspruit downstream from the coal stockpile and ash dam	-25.94014	28.89805
XPSPAN	Pan in Site X	-25.91005	28.91005
XKFSPS	Klipfonteinspruit at Kendal Power Station	-25.92723	28.92301
YKSDS	Klipspruit, upper reaches of the Wilge River Catchment	-25.97013	28.83373
YKSUS	Klipspruit upstream	-25.97093	28.83352
YWRDS	Wilge River downstream	-25.9678	28.85118
YWRUS	Wilge River upstream	-25.99428	28.86267
Terrestrial Transects			
XKFSPS start	Site X, Transect on Klipfonteinspruit - Power Station, Start	-25.92795	28.92187
XKFSPS end	Site X, Transect on Klipfonteinspruit - Power Station, End	-25.92662	28.92238
XPAN start	Site X, Transect on Pan, Start	-25.93466	28.91048
XPAN end	Site X, Transect on Pan, End	-25.93797	28.90954
XKFSCFAD start	Site X, Transect on Klipfonteinspruit - Ash Dam & Coal Stockpile, Start	-25.93948	28.89854
XKFSCFAD end	Site X, Transect on Klipfonteinspruit - Ash Dam & Coal Stockpile, End	-25.94102	28.89846
XKFSAD start	Site X, Transect on Klipfonteinspruit - Ash Dam, Start	-25.97054	28.90722
XKFSAD end	Site X, Transect on Klipfonteinspruit - Ash Dam, End	-25.96925	28.90462
XKFSDS start	Site X, Transect on Klipfonteinspruit - Downstream, Start	-25.92337	28.87981
XKFSDS end	Site X, Transect on Klipfonteinspruit - Downstream, End	-25.92413	28.88360
YKSDS1start	Site Y, Transect 1 on Klipspruit, Downstream, Start	-25.95646	28.83742
YKSDS1 end	Site Y, Transect 1 on Klipspruit, Downstream, End	-25.95652	28.84085
YKSDS2 start	Site Y, Transect 2 on Klipspruit, Downstream, Start	-25.95267	28.83827
YKSDS2 end	Site Y, Transect 2 on Klipspruit, Downstream, End	-25.95407	28.84122
YKSUS start	Site Y, Transect on the Klipspruit, Start	-25.97133	28.83153
YWRDS start	Site Y, Transect on the Wilge River, Downstream, End	-25.97050	28.85016
YWRDS end	Site Y, Transect on the Wilge River, Downstream,	-25.97006	28.85194

	End		
YWRUS start	Site Y, Transect on the Wilge River, Upstream, Start	-25.96881	28.85403
YWRUS end	Site Y, Transect on the Wilge River, Upstream, End	-25.95912	28.85163
Soil Transects			
XST1S	Site X, Soil Transect 1, Start	-25.92270	28.91780
XST1E	Site X, Soil Transect 1, End	-25.92990	28.91790
XST2S	Site X, Soil Transect 2, Start	-25.92500	28.91430
XST2E	Site X, Soil Transect 2, End	-25.92490	28.92230
XST3S	Site X, Soil Transect 3, Start	-25.94270	28.91070
XST3E	Site X, Soil Transect 3, End	-25.95860	28.90260
XST4S	Site X, Soil Transect 4, Start	-25.94730	28.89310
XST4E	Site X, Soil Transect 4, End	-25.95160	28.91440
XST5S	Site X, Soil Transect 5, Start	-25.96730	28.90150
XST5E	Site X, Soil Transect 5, End	-25.97230	28.91160
XST6S	Site X, Soil Transect 6, Start	-25.96830	28.91210
XST6E	Site X, Soil Transect 6, End	-25.97800	28.90670
XST7S	Site X, Soil Transect 7, Start	-25.97500	28.91510
XST7E	Site X, Soil Transect 7, End	-25.97320	28.92080
YST1S	Site Y, Soil Transect 1, Start.	-25.95560	28.83290
YST1E	Site Y, Soil Transect 1, End	-25.95560	28.83390
YST2S	Site Y, Soil Transect 2, Start	-25.96330	28.83230
YST2E	Site Y, Soil Transect 2, End	-25.96330	28.84660
YST3S	Site Y, Soil Transect 3, Start	-25.95880	28.84270
YST3E	Site Y, Soil Transect 3, End	-25.96810	28.84270
YST4S	Site Y, Soil Transect 4, Start	-25.96720	28.82980
YST4E	Site Y, Soil Transect 4, End	-25.97490	28.84040
YST5S	Site Y, Soil Transect 5, Start	-25.97120	28.83850
YST5E	Site Y, Soil Transect 5, End	-25.97630	28.83360
YST6S	Site Y, Soil Transect 6, Start	-25.96730	28.84990
YST6E	Site Y, Soil Transect 6, End	-25.97590	28.84970
YST7S	Site Y, Soil Transect 7, Start	-25.97010	28.85230
YST7E	Site Y, Soil Transect 7, End	-25.95880	28.85610
YST8S	Site Y, Soil Transect 8, Start	-25.97630	28.85710
YST8E	Site Y, Soil Transect 8, End	-25.97680	28.85160

The location of the sampling sites and transects in the Wilge River Catchment is shown in Figures 2 and 3.

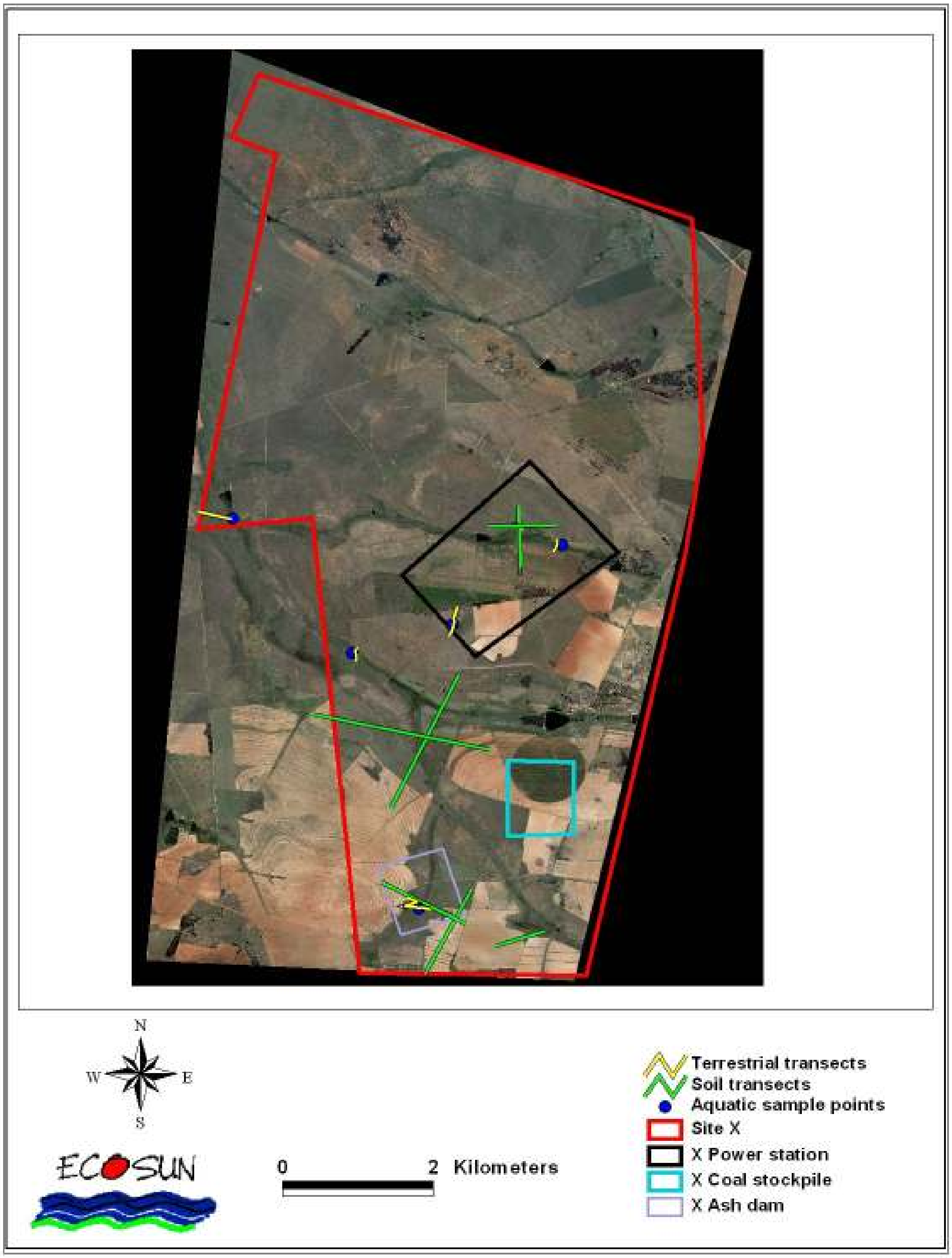


Figure 2: Aquatic sample sites, terrestrial and soil transects at Site X.

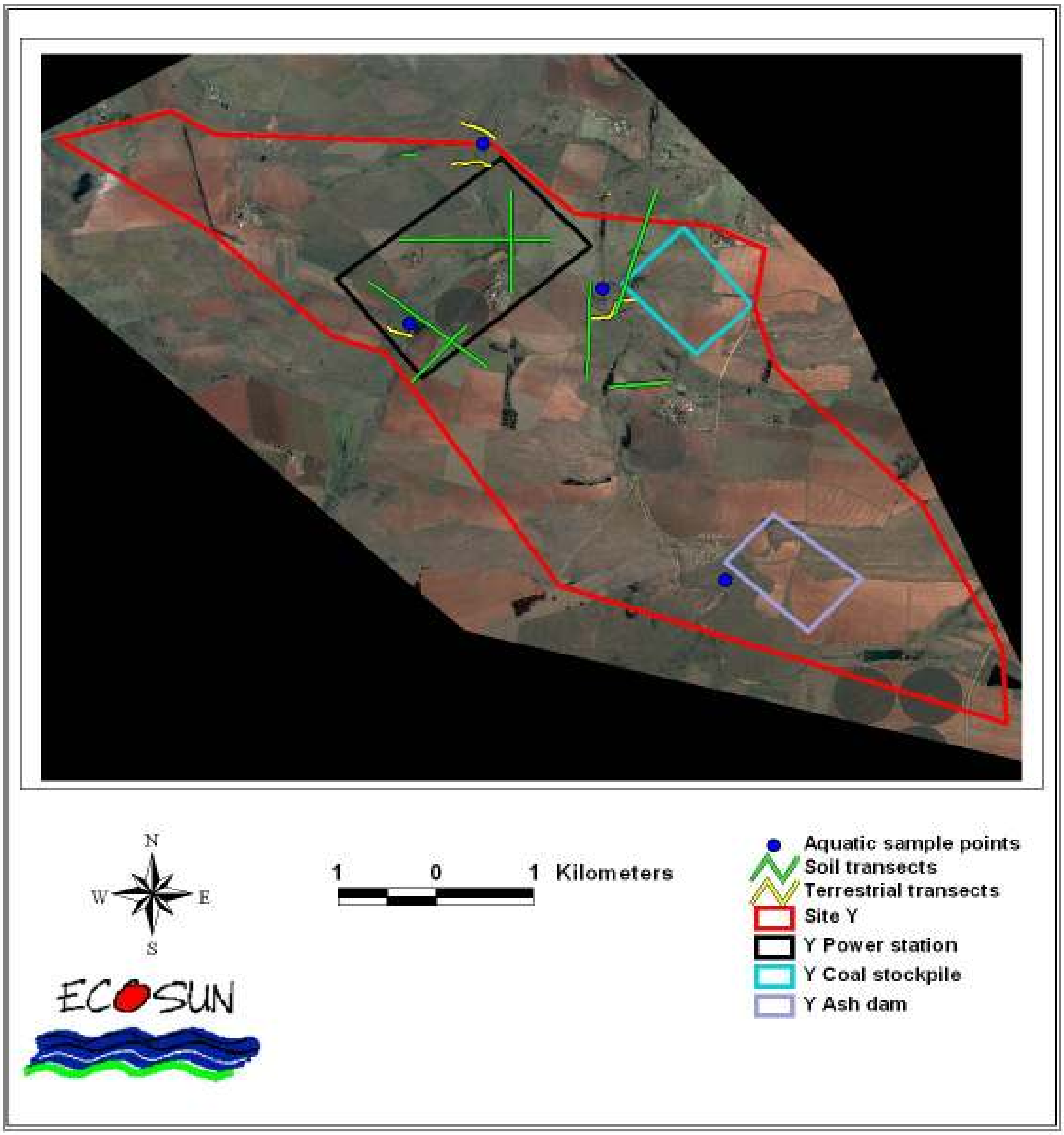


Figure 3: Sampling sites and soil transects at Site Y.

3 METHODOLOGY

In order to enable a characterization of the general integrity of the aquatic, littoral and riparian environments, certain ecological indicators were selected to represent each of the responding, habitat and stressor components involved in the natural environment. These included:

Stressor Indicators

- *In situ* water quality

Habitat Indicators

- General Habitat Assessment
- Invertebrate Habitat Assessment System (IHAS, version 2)
- Habitat Assessment for Low Gradient Streams
- Soils

Response Indicators

- Aquatic Macroinvertebrates (including SASS5)
- Ichthyofauna
- Small mammals
- Herpetofauna
- Avifauna
- Vegetation

3.1 In-stream Assessment

3.1.1 *In situ* water quality

During the field survey the following variables were determined on site with lightweight, compact field instruments:

- Total Dissolved Salts (TDScan)

- pH (pHScan)
- Dissolved Oxygen (Oxyguard Handy Alpha)
- Temperature (Alcohol Thermometer)

Water quality has a direct influence on aquatic life forms. Although these measurements only provide a “snapshot”, they can provide valuable insight into the characteristics of a specific sampling site.

3.1.2 General Habitat Assessment

Habitat assessment can be defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour *et al.*, 1996). Habitat quality and availability plays a critical role in the occurrence of aquatic biota. For this reason habitat evaluation is conducted simultaneously with biological evaluations in order to facilitate the interpretation of results.

3.1.3 Invertebrate Habitat Assessment System (IHAS, version 2)

The Invertebrate Habitat Assessment System (IHAS, version 2) was applied in order to assess the suitability of biotopes present for aquatic macroinvertebrates. The IHAS was developed specifically for use with the SASS5 index in South Africa (McMillan, 1998).

According to the SASS5 methodology, three major biotopes need to be evaluated at each site (Dickens and Graham, 2001). These are:

1. Stones-in-current (including stones-out-of-current & bedrock)
2. Sand, mud, gravel
3. Vegetation

The Invertebrate Habitat Assessment System (IHAS) evaluates the availability of these three biotopes at each site and expresses the availability & suitability as a percentage, where 100% represents "ideal" habitat availability. It is presently thought that a total score of over 65% represents good habitat conditions, and over 55% indicates adequate habitat conditions (McMillan, 2002).

3.1.4 Habitat Assessment for Low Gradient Streams

The US EPA generic habitat assessment approach for low-gradient streams was applied at selected sites in the study area (Plafkin *et al.*, 1989). Each sampling reach was evaluated in terms of epifaunal substrate/available cover, pool substrate, pool variability, channel alteration, sediment deposition, channel sinuosity, flow, bank vegetation protection, bank stability, riparian vegetation zone width. This data was used to facilitate interpretation of biological data.

3.1.5 Soils

In order to meet the objective of the investigation, the following method of investigation was employed (see APPENDIX 16):

- Undertake a preliminary delineation of the wetland boundaries using an ortophoto or topocadastral map together with airphoto interpretation.

- Verify and adjust the preliminary delineation of the wetland using field verification.

3.1.6 Aquatic Macroinvertebrates

The monitoring of benthic macroinvertebrates forms an integral part of the monitoring of the biotic integrity of an aquatic ecosystem as they are relatively sedentary and enable the detection of localized disturbances. Their relatively long life histories (±1 year) allow for the integration of pollution effects over time. Field sampling is easy and since the communities are heterogeneous and several phyla are usually represented, response to environmental impacts is normally detectable in terms of the community as a whole (Hellawell, 1977).

Aquatic macroinvertebrates were sampled using the qualitative kick sampling method generally referred to as SASS5 (South African Scoring System version 5) (Dickens and Graham, 2001). SASS5 was designed to incorporate all available biotypes at a given site and to provide an indication of the quality of the aquatic environment through recording the presence of various macroinvertebrate families at each site. The SASS5 protocol is essentially a biotic index of the condition of a river or stream, based on the resident macroinvertebrate community, whereby each taxon is allocated a score according to its level of tolerance to river health degradation (Dallas, 1997).

This method relies on churning up the substrate with your feet and sweeping a finely meshed SASS net, with a pore size of 1000 micron mounted on a 300 mm square frame, over the churned up area several times. In stony bottomed flowing water biotopes (rapids, riffles, runs, etc.) the net was rested on the bottom and the area immediately upstream of the net disturbed by kicking the stones over and against each other to dislodge benthic invertebrates. The net was also swept under the edge of marginal and aquatic vegetation to cover from 1-2 meters. Identification of the organisms was made to family level (Thirion *et al.*, 1995; Davies & Day, 1998; Dickens & Graham, 2001; Gerber & Gabriel, 2002).

Habitat is a major determinant of aquatic community potential. Both the quality and quantity of available habitat affect the structure and composition of benthic macroinvertebrate communities. The Invertebrate Habitat Assessment System (IHAS) was used to semiqualitatively evaluate the condition of the habitat at the selected sampling site and to assess the impact of physical habitat degradation on the SASS score.

The endpoint of any biological or ecosystem assessment is a value expressed either in the form of measurements (data collected) or in a more meaningful format by summarising these measurements into one or several index values (Cyrus *et al.*, 2000) The indices used for this study were, total score and average score per taxon (ASPT). The biotic integrity of the site was scored, according to these indices, based on macroinvertebrate diversity.

3.1.7 Ecological State based on SASS5 Results

Reference conditions reflect the best conditions that can be expected in rivers and streams within a specific area and also reflect natural variation over time. SASS and ASPT reference conditions were modelled for the Highveld Ecoregion by DWAF (Table 2) (data obtained from Gauteng Nature Conservation, Mr. Piet Muller).

Table 2: Classification protocol for determining the Present State Class as modelled for the Highveld Ecoregion, based on SASS5 & ASPT scores.

Class	Condition	SASS score	ASPT value
A	Excellent – Unimpaired; community structures and functions comparable to the best situation to be expected. Optimum community structure for stream size and habitat quality.	>120	>6
B	Very Good – Minimally impaired; Largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged	91-120	5-6
C	Good – Moderately impaired; community structure and function less than the reference condition. Community composition lower than expected due to loss of some sensitive forms. Basic ecosystem functions are still predominantly unchanged.	71-90	4.5-5.5
D	Fair- Largely impaired; fewer families present than expected, due to loss of most intolerant forms. Basic ecosystem functions have changed.	56-70	4.5-5.5
E	Poor – Seriously impaired; few aquatic families present, due to loss of most intolerant forms. An extensive loss of basic ecosystem functions has occurred.	30-55	Variable
F	Very Poor – Critically impaired; few aquatic families present. If high densities of organisms, then dominated by a few taxa. Only tolerant organisms present.	<30	Variable

3.1.8 Ichthyofauna

Whereas invertebrate communities are good indicators of localised conditions in a river over the short-term, fish being relatively long-lived and mobile,

- are good indicators of long-term influences,
- are good indicators of general habitat conditions,
- integrate effects of lower trophic levels, and
- are consumed by humans (Uys *et al*., 1996).

Fish samples were collected by means of a portable battery driven electrofishing device (DC 12V pulsating). Electrofishing is the use of electricity to catch fish. The electricity is generated by a system whereby a high voltage potential is applied between two electrodes that are placed in the water (USGS, 2004). The responses of fish to electricity are determined largely by the type of electrical current and its wave form. These responses include avoidance, electrotaxis (forced swimming), electrotetanus (muscle contraction), electronarcosis (muscle relaxation or stunning) and death (USGS, 2004). Electrofishing is regarded as the most effective single method for sampling fish communities in streams (Plafkin *et al*., 1989).

3.2 Riparian and Wetland Assessment

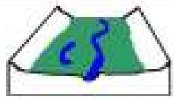
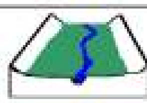
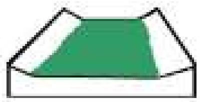
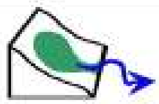
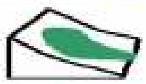
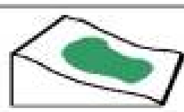
The wetland assessment consisted of the following aspects:

- Wetland classification and delineation;
- Wetland integrity;
- Ecosystem services supplied by the wetlands;
- Fauna & Flora survey;
- Soils survey.

3.2.1 Wetland Classification and delineation

The classification of the wetlands in the study area into different wetland types was based on the WET-EcoServices technique (Kotze *et al*, 2005). The WET-EcoServices technique identifies seven main types of wetland based on hydro-geomorphic characteristics (Table 3).

Table 3: Wetland Unit types based on hydro-geomorphic characteristics (Adapted from Kotze *et al*, 2005).

Hydro-geomorphic type	Code	Illustration	Description
Flood Plain	FP		Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.
Valley Bottom with a Channel	VBC		Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.
Valley Bottom Without a channel	VB		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.
Channelled Hillslope Seepage feeding a Water course	CHSW		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a watercourse.
Hillslope Seepage feeding a Water course	HSW		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow connecting the area directly to a watercourse.
Hillslope Seepage not feeding a water course	HS		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a watercourse.
Depression	D		A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent.

The field procedure for the wetland delineation was conducted according to the Guidelines for delineating the boundaries of a wetland (South African Water Act, DWAF, 1999). Due to the transitional nature of wetland boundaries, these are often not clearly apparent and the delineations should therefore be regarded as a human construct. The delineations are based on scientifically defensible criteria and are aimed at providing a tool to facilitate the decision making process regarding the assessment of the significance of impacts that may be associated with the proposed developments.

According to DWAF (1999) the following general principals should be applied as the basis to undertaking a wetland delineation:

1. *"A wetland is defined as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil* "(Water Act 36 of 1998 In DWAF, 2005).

2. Thus a wetland can be defined in terms of hydrology (flooded or saturated soils), plants (adapted to saturated soils) and soil (saturated).

3. Due to the variable nature of South Africa’s climate the direct presence of water is often an unreliable indicator of wetland conditions.

4. Prolonged saturation of soil has a characteristic effect on soil morphology, affecting soil matrix chroma and mottling in particular.

The following procedure was followed during the delineation of the wetland boundaries and zones:

- Desktop delineations were undertaken using satellite imagery of the study sites (Quickbird, 30cm, Natural Colour).

- Areas for verification were identified and transects for vegetation and soil specialists were generated.

- Each transect was then assessed by the respective specialists to verify the boundaries and zones.

- These verifications were then incorporated and adjustments to the desk top delineation were made to produce the final delineations.

3.2.2 Wetland Integrity

The Present Ecological Status (PES) Method (DWAF 2005) was used to establish the integrity of the wetlands in the study area and was based on the modified Habitat Integrity approach developed by Kleynhans (1996, 1999 In DWAF 2005). The delineated wetland units (as described under section 3.2.1.) were used as the basis to divide the wetlands into different segments to increase the resolution of the integrity assessment. Table 4 shows the criteria for assessing the habitat integrity of palustrine wetlands along with Table 5 describing the allocation of scores to attributes and the rating of confidence levels associated with each score. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 4: Habitat integrity assessment criteria for palustrine wetlands (DWAF, 2005).

Criteria and Attributes	Relevance
Hydrologic	
Flow Modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floralistic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water Quality	
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Hydraulic/Geomorphic	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities which reduces or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.

Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, etc.
Total	
Mean	

Table 5: Scoring guidelines and relative confidence scores for the habitat integrity assessment for palutrine wetlands (DWAF, 2005).

Scoring Guidelines per Attribute:	
Natural/Unmodified	5
Largely Natural	4
Moderately Modified	3
Largely Modified	2
Seriously Modified	1
Critically Modified	0
Relative Confidence of Scores:	
Very High Confidence	4
High Confidence	3
Moderate Confidence	2
Marginal/Low Confidence	1

Table 6 provides guidelines for the determination of the Present Ecological Status Category (PESC), based on the mean score determined for Table 4. This approach is based on the assumption that extensive degradation of any of the wetland attributes may determine the PESC (DWAF, 2005).

Table 6: Category's assigned to the scores achieved in the wetland habitat assessment (DWAF, 2005).

Category	**Mean Score**	**Category Description**
Within generally acceptable range		
A	>4	Unmodified or approximated natural condition.
B	>3 and <=4	Largely natural with few modifications, but with some loss of natural habitats.
C	>2 and <=3	Moderately modified, but with some loss of natural habitats.
D	2	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
Outside generally acceptable range		
E	>0 and <2	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.

F	0	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

3.2.3 Ecosystem Services Supplied by Wetlands

The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et* al (2005). A Level 2 assessment was undertaken which examines and rates the following services:

- Flood attenuation
- Stream flow regulation
- Sediment trapping
- Phosphate trapping
- Nitrate removal
- Toxicant removal
- Erosion control
- Carbon storage
- Maintenance of biodiversity
- Water supply for human use
- Natural resources
- Cultivated foods
- Cultural significance
- Tourism and recreation
- Education and research

The characteristics were scored according to the following general levels of services provided:

Table 7: Level of service ratings.

Score	Services Rating
0	Low
1	Moderately Low
2	Intermediate
3	Moderately High
4	High

The different wetland units (as delineated under section 3.2.1) were used as the basis for the level 2 assessment. The assessment was further focussed on those wetland units within the segments of likely impact associated with the different proposed site layouts. The relative importance of the different units, in relation to one another and between the two sites (X and Y), were then evaluated by summing the number of services regarded as high (scoring levels higher than intermediate) (Table 7). The wetland units with the highest number of important functions were then delineated to facilitate decision making.

3.2.4 Wetlands fauna and flora

The baseline characterization of the wetland and riparian fauna and flora was conducted by means of visual assessment surveys through areas selected based on the reach of likely impact approach mentioned under section 1.3. The main focus of these investigations was to classify vegetation communities as a main surrogate for biodiversity patterns and to assist with the wetland delineations and was conducted on a transect basis through the selected reaches. These transects were traversed on foot and all observed species (vegetation & vertebrates – visual sightings, scats, nests, calls) were recorded. Plant species that could not be identified during the site investigation were sampled and identified in the laboratory from field guides or comparison with herbarium examples. During the desktop analysis phase the data was captured in a database and preliminary species lists were compiled.

In order to assess the status of red data species in the study area, the following sources were used:

- South African Red Data Book – Reptiles and Amphibians (Branch, 1998);
- Red Data Book of the Mammals of South Africa (EWT, 2004);
- South African Red Data Book – Butterflies (Henning, S.F. & Henning, G.A,1989);
- IUCN Red List Categories and Criteria (IUCN, 2001);
- IUCN Red List of Threatened Species (IUCN, 2003);
- Atlas and Red Data Book of the Frogs of South Africa (Minter, Burger, Harrison, Braack, Bishop & Loafer, 2004); and
- South African Red Data Book – Terrestrial Mammals (Smithers, 1986).

4 RESULTS

4.1 *In situ* water quality

Water quality was measured (TDS, pH, Dissolved Oxygen, Temperature) in the field with lightweight compact field instruments and the results presented in Table 8. These results are important to assist in the interpretation of biological results because of the direct influence water quality has on aquatic life forms. Thus, an integrative approach, which included physical-chemical, habitat and biological assessments, was followed to provide increased accuracy.

Table 8: *In situ* water quality

Site	Time	pH	DO* (mg/ℓ)	TDS** (mg/ℓ)	Temp (ºC)
WR1	16h10	8.1	12.9	225	23
WR2	13h10	7.9	10.4	190	18.5
KS1	8h20	7.7	7.1	175	16
KS2	15h20	8.0	10.4	165	19
KFS1	8h15	7.9	6.4	30	12
KFS2	11h30	7.7	8.0	120	16
KFS3	15h00	7.9	14.2	140	21

* Dissolved Oxygen; ** Total Dissolved Salts;

The pH of natural waters is determined by both geological and atmospheric influences, as well as by biological activities. Most fresh waters are usually relatively well buffered and more or less neutral, with a pH range from 6 to 8, and most are slightly alkaline due to the presence of bicarbonates of the alkali and alkaline earth metals (DWAF, 1996). The *in situ* pH values measured in the study area were alkaline ranging between 7.7 and 8.1 (5.5) (Table 8). According to the South African Water Quality Guidelines for Aquatic Ecosystems (DWAF, 1996), the pH value should not be allowed to vary from the range of the background pH values for a specific site and time of day, by >0.5 of a pH unit, or by 5%, and should be assessed by whichever estimate is the more conservative.

The maintenance of adequate dissolved oxygen (DO) is critical for the survival and functioning of the aquatic biota because it is required for the respiration of all aerobic organisms. Therefore, DO concentration provides a useful measure of the health of an ecosystem (DWAF, 1996). The median guideline for DO for the protection of aquatic biota is >5mg/ℓ (Kempster *et al*., 1980). During the current survey the *in situ* DO concentrations in the surface waters ranged between 6.4mg/l and 12.9mg/l, and are therefore not expected to have a limiting effect on aquatic biota (Table 8).

Most macroinvertebrate taxa are sensitive to salinity, with toxic effects likely to occur in sensitive species at salinities > 1000mg/ℓ (DWAF, 1996). *In situ* TDS concentrations in the study area were relatively low, ranging between 30mg/l and 225mg/l (Table 8). According to the South African Water Quality Guidelines for Aquatic Ecosystems, the TDS concentrations should not be changed by more than 15% from the normal cycles of an inland water body under unimpacted conditions at any time of the year, and the amplitude and frequency of natural cycles in TDS concentrations should not be changed (DWAF, 1996).

Water temperature plays an important role in aquatic ecosystems by affecting the rates of chemical reactions and therefore also the metabolic rates of organisms (DWAF, 1996). Temperature affects the rate of development, reproductive periods and emergence time of organisms (DWAF, 2005). According to the South African Water Quality Guidelines (1996), water temperature should not be allowed to vary from the ecosystems background average daily temperature considered to be normal for that specific site and time of day by > 2˚C, or by > 10%, whichever estimate is the more conservative. The temperatures of inland waters in South Africa generally range from 5 - 30 ˚C (DWAF, 1996). During the current survey the water temperature ranged between 12^{o}C and 23^{o}C (Table 8).

4.2 Habitat Assessment

4.2.1 Invertebrate Habitat Assessment System, Version 2 (IHAS)

The quality of the instream and riparian habitat influences the structure and function of the aquatic community in a stream; therefore evaluation of habitat availability is critical to any assessment of aquatic biota.

Based on the IHAS scores, habitat availability for aquatic macroinvertebrates was generally adequate for the aquatic systems associated with site Y (Wilge River and Klipspruit) and poor for the streams of site X (Klipfonteinspruit) (Table 9). Based on this assessment habitat availability can only be considered as a limiting factor for aquatic macroinvertebrate diversity associated with site X.

Table 9: IHAS index conducted as part of the biomonitoring survey. Good is scripted in green, adequate/fair is scripted in blue and poor is scripted in red.

Site	IHAS (%)	
	Score	Description
WR1	72	Good
WR2	67	Good
KS1	66	Good
KS2	55	Fair
KFS1	42	Poor

KFS2	**52**	Poor
KFS3	**52**	Poor

Habitat availability in the Wilge River (WR1 & WR2) and in the upstream Klipsruit (KS1) was good, with IHAS values ranging between 66 and 72% (Table 4). Site KS2 displayed adequate habitat availability. Habitat availability in the Klipfonteinspruit was poor, ranging between 42 and 52%. The stones-in-current biotope was absent from all three sites in the Klipfonteinspruit.

4.3 Aquatic Macroinvertebrates

Aquatic macroinvertebrates collected in the sample area are listed in APPENDIX 1. A total of 40 aquatic macroinvertebrate taxa (10 to 28 taxa per site) were sampled in the study area. Pollutant sensitive Ephemeropterans (notably >2spp Baetidae, Heptagenidae and Leptophlebiidae) were sampled in the Wilge River (sites WS1 and WS2) and in the Klipspruit (sites KS1 and KS2) (APPENDIX 1). The low number of taxa sampled in the Klipfonteinspruit could largely be attributed to limited habitat availability, with an absence of the stones-in-current biotope which provides habitat for the majority of aquatic macroinvertebrate fauna.

4.3.1 South African Scoring System, Version 5 (SASS5)

SASS5 scores of 145 and 116 were recorded in the Wilge River and 110 and 128 in the Klipspruit. SASS5 scores recorded in the Klipfonteinspruit were significantly lower ranging between 38 and 53 (Table 10).

Table 10: SASS5 scores, Number of Taxa and ASPT*
scores obtained during the aquatic survey.

Site	SASS5 Score	Number of Taxa	ASPT*
YWR1	145	28	5.2
YWR2	116	20	5.8
YKS1	110	18	6.1
YKS2	128	25	5.1
XKFS1	38	10	3.8
XKFS2	47	10	4.7
XKFS3	53	13	4.1

* * Average Score Per Taxon

4.3.2 Biotic Integrity based on SASS5 Results

Biotic integrity for the sample area concerned was derived based on the modelled reference conditions for the Highveld region (Table 11).

Based on SASS5 results, biotic integrity in the Wilge River is regarded as Unimpaired to Minimally Impaired at site WR1 (Class A/B) and Minimally Impaired at site WR2 (Class B).

Class A/B recorded in the Klipspruit is indicative of Minimally Impaired biotic integrity, while that in the Klipfonteinspruit was indicated to be Seriously Modified (Class E at sites KFS1, KFS2 and KFS3). The latter is ascribed mainly to limited habitat availability, rather than water quality impairment.

Table 11: Biological integrity based on SASS5 and ASPT scores.

Site	Present Ecological State (PES)	
	Class	**Description**
WR1	A/B	Unimpaired/Minimally Impaired
WR2	B	Minimally Impaired
KS1	A/B	Unimpaired/Minimally Impaired
KS2	A/B	Unimpaired/Minimally Impaired
KFS1	E	Seriously Impaired
KFS2	E	Seriously Impaired
KFS3	E	Seriously Impaired

4.4 Ichthyofauna

A total of 121 specimens comprising 4 species were sampled in the study area. These include *Barbus anoplus* (Chubbyhead barb), *Chiloglanis pretoriae* (Shortspine suckermouth), *Pseudocrenilabrus philander* (Southern mouthbrooder) and *Tilapia sparrmanii* (Banded tilapia) (Table 7).

Table 12: Number of species of fish sampled in the study area.

Species	WR1	WR2	KS1	KS2	KFS1	KFS2	KFS3	TOTAL
CYPRINIDAE								
Barbus anoplus	12	52	14				8	86
MOCHOKIDAE								
Chiloglanis pretoriae	2							2
CICHLIDAE								
Pseudocrenilabrus philander	7	8	9					24
Tilapia sparrmanii	3	6						9
TOTAL	24	66	23	0	0	0	8	121

Barbus anoplus was the most abundant species in the study area comprising 71% of the total catch. This species has a wide distribution from the Highveld tributaries of the Limpopo to the highlands of Kwazulu-Natal, Transkei and the middle- and upper Orange River Basins including the Karoo. It prefers cool waters and occurs in a wide range of habitats (Skelton, 2001).

The cichlids *Tilapia sparrmanii* and *Pseudocrenilabrus philander* are common in different portions of particular habitats, but both prefer vegetated areas (Skelton, 1986; Skelton, 2001). Both these species were sampled in the Wilge River, while only *P. philander* was sampled in the Klipspruit (Table 12).

The presence of the Shortspine suckermouth (*Chiloglanis pretoriae*) in the Wilge River is of special significance. This species is intolerant towards poor water quality and has specialized habitat requirements. It is dependent on flowing water habitats and has a preference for substrate cover (Skelton, 2001). Two specimens of this species were sampled in the upstream section of the Wilge River at site WR1 (Table 7). Which probably represents one of the last remaining populations in the upper Olifants Catchment. No Red Data Fish species are expected to occur in the study area (IUCN, 2006; Skelton, 2001).

4.5 Wetland and Riparian Flora

According to Van Oudtshoorn (1999), approximately 110 (APPENDIX 2) grass species occur within the study area. Of these species 78 species were recorded during the study (APPENDIX 3.

Of these species 28 species were wetland grass types, 20 species were species associated with both wetlands and veld/grassland areas and 30 species were grass species associated with non-wetland grassland or veld. None of the species identified were classified as Red Data Book species. Wetland grasses such as *Imperata cylindrica* and *Pennisetum macrourum* were used to aid in the delineation of the wetlands for this study.

Falling within what can be described as a grassland area (Van Wyk & Van Wyk, 1997) tree species were not numerous and of the 45 indigenous species (APPENDIX 4) occurring in the region only 6 species were identified within the study area (APPENDIX 5).

All of the species recorded were common species and no Red Data list tree species were recorded. Plant and forb species were also not numerous and only 24 species were recorded, of which none are considered Red Data Book species.

4.6 Wetland and Riparian Fauna

Of the 346 bird species known to occur within the study area according to Harrison et al (1997a and b) (APPENDIX 6), only 73 species were recorded during the duration of the study (APPENDIX 7).

Most of the species recorded were wetland or grassland species with the Grass Owl being the only species found known to be a Red Data List species.

Of the 45 small mammals known to be resident in the region (APPENDIX 8) ten were recorded within the study area, of these none of the recorded species are classified as Red Data species (APPENDIX 9).

Twelve amphibian species are known to occur within the study area (Carruthers, 2001) (APPENDIX 10). Of these species only 4 (APPENDIX 11) species were recorded during the study. These species are common in the area and in many other areas in the country and are not listed as Red data species.

Of the 34 reptile species of the area (APPENDIX 12) (Branch, 1996)) four were recorded during the study. All of the recorded species are common and no Red Data species were recorded (APPENDIX 13).

4.7 Wetland Classification and delineation

From Figure 4 it is evident that site X supports six different wetland types: channelled valley bottom; hillslope feeding a watercourse; hillslope not feeding a watercourse; non channelled valley bottom; floodplain and depression wetland types.

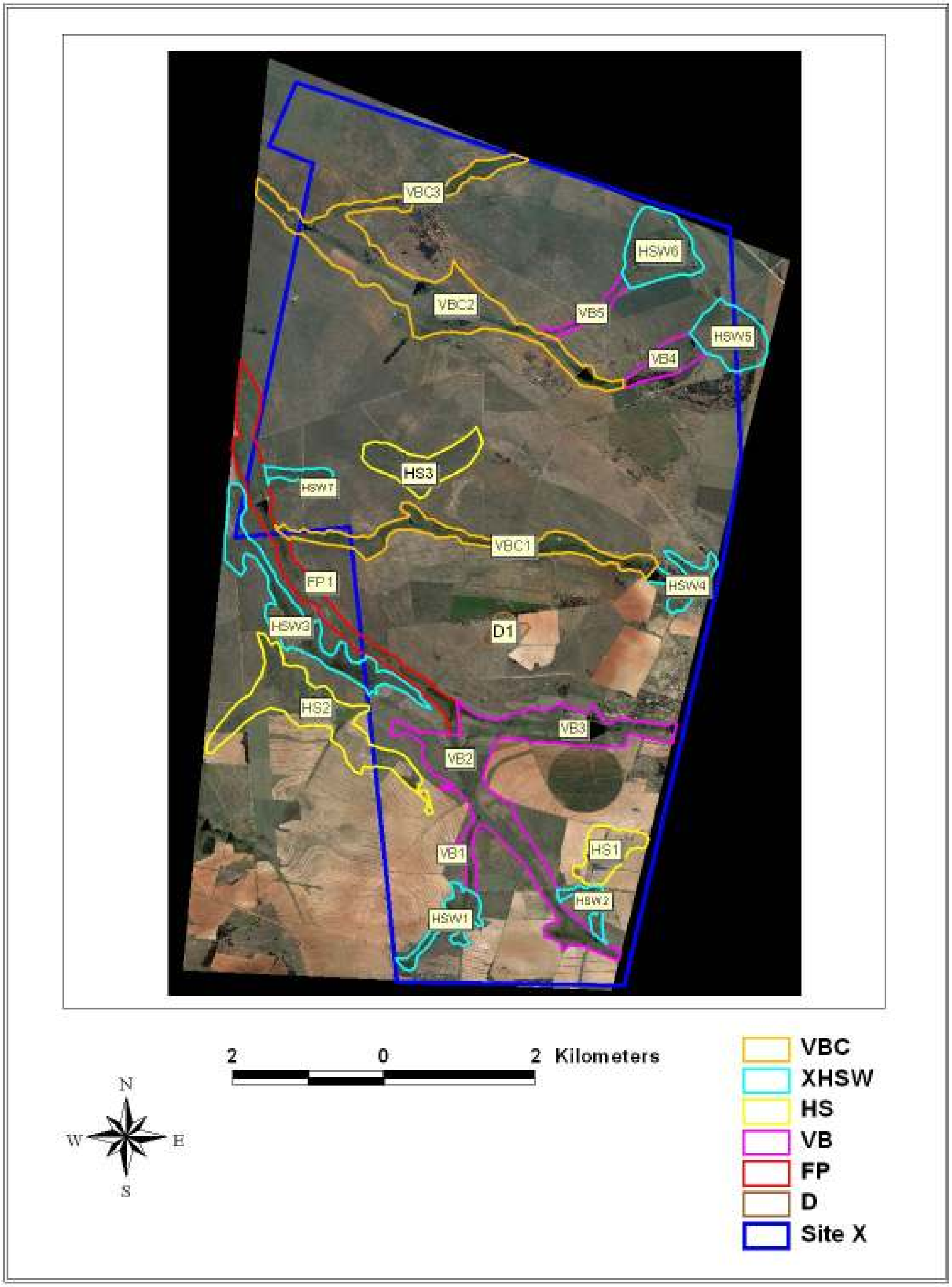


Figure 4: Site X wetland types**.**

Site Y supports five different wetland types: hillslope feeding a watercourse; channelled valley bottom; channelled hillslope feeding a watercourse; non channelled valley bottom and floodplain wetland types (Figure 5)

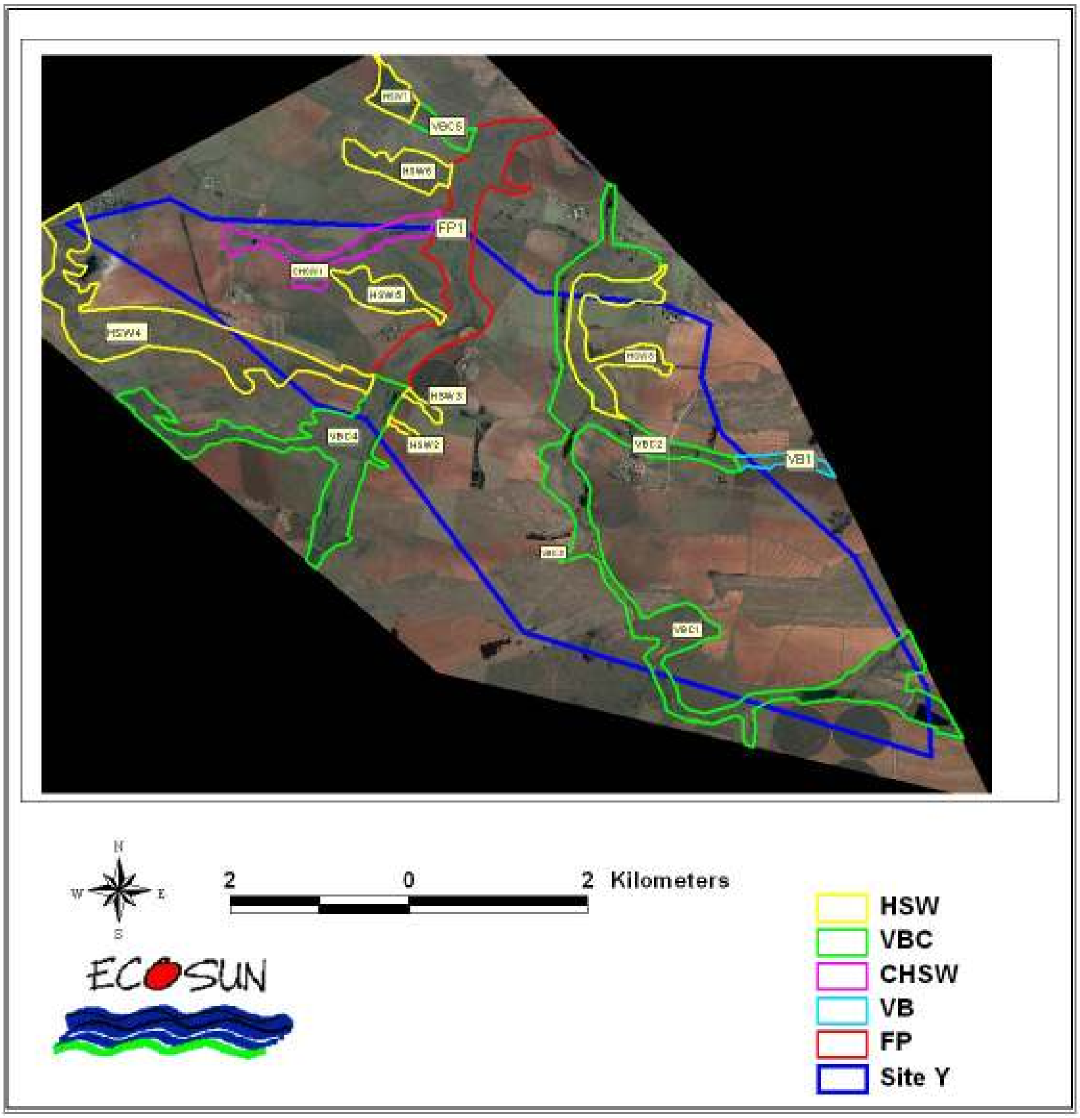


Figure 5: Site Y wetland types.

4.8 Wetland Integrity

The general integrity of the wetlands associated with site X can be regarded as impaired with only two wetland sections of high integrity (Figure 6).

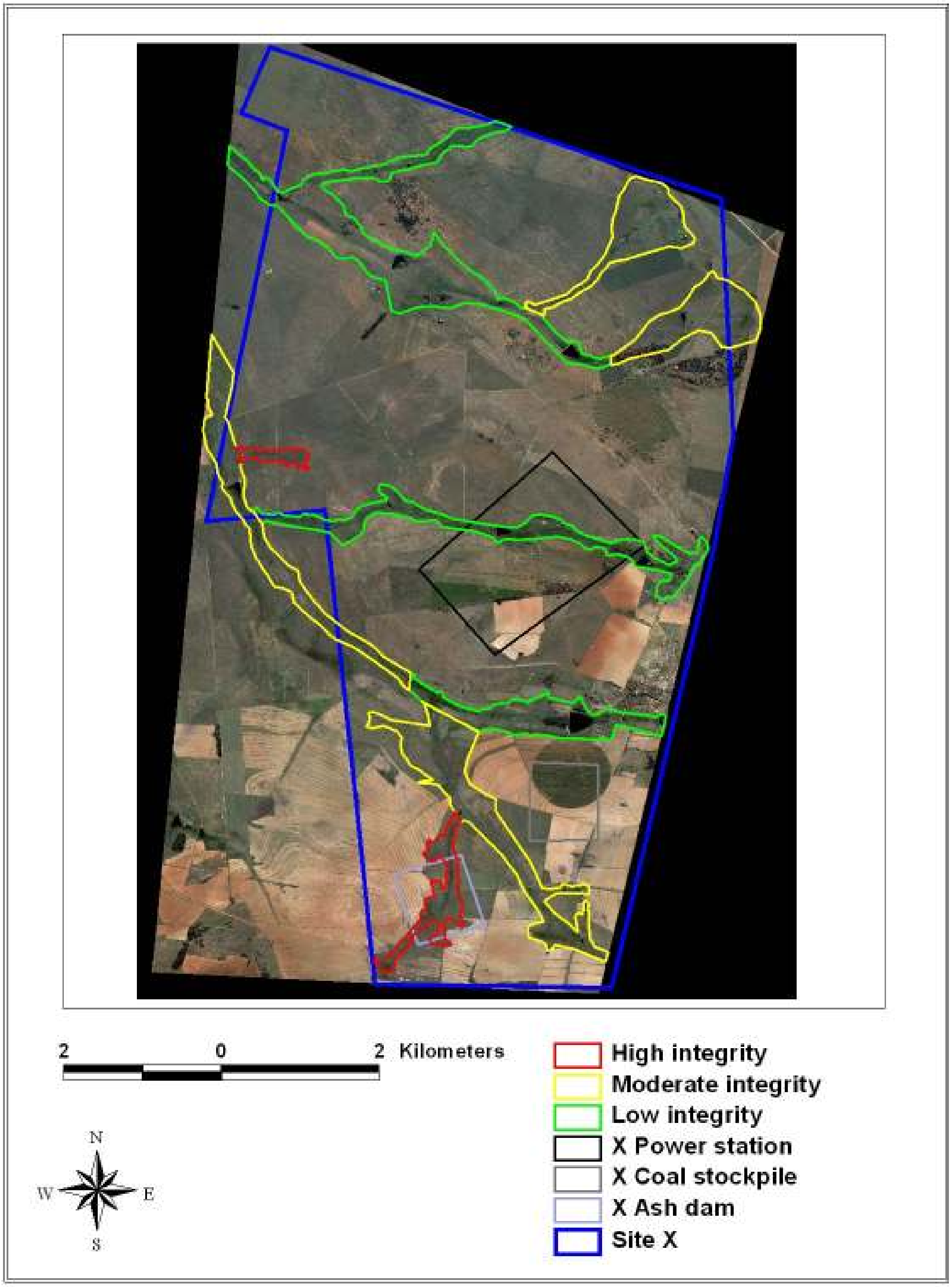


Figure 6: Site X wetland integrity**.**

The wetlands associated with site Y are generally of a higher integrity specifically those sections associated with the proposed lay-outs (Figure 7)

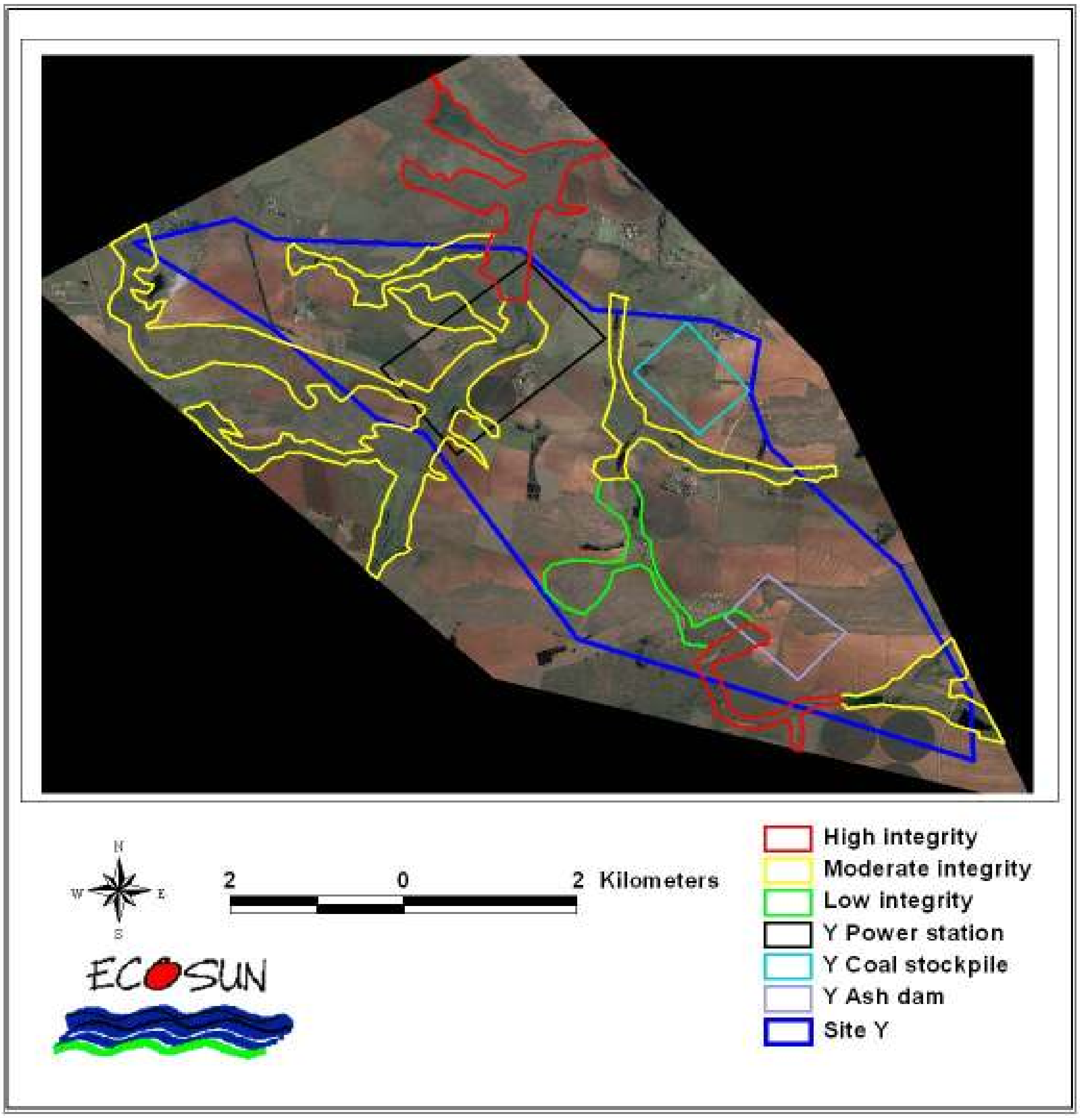


Figure 7: Site Y wetland integrity.

4.9 Ecosystem Services Supplied by the Wetlands

The ecosystems services supplied by the different wetland types present a similar picture to that of the wetland integrities with the most important and diverse services provided by the wetlands associated with site Y and specifically those wetland units that will be impacted upon by the proposed layouts (Figures 8 & 9).

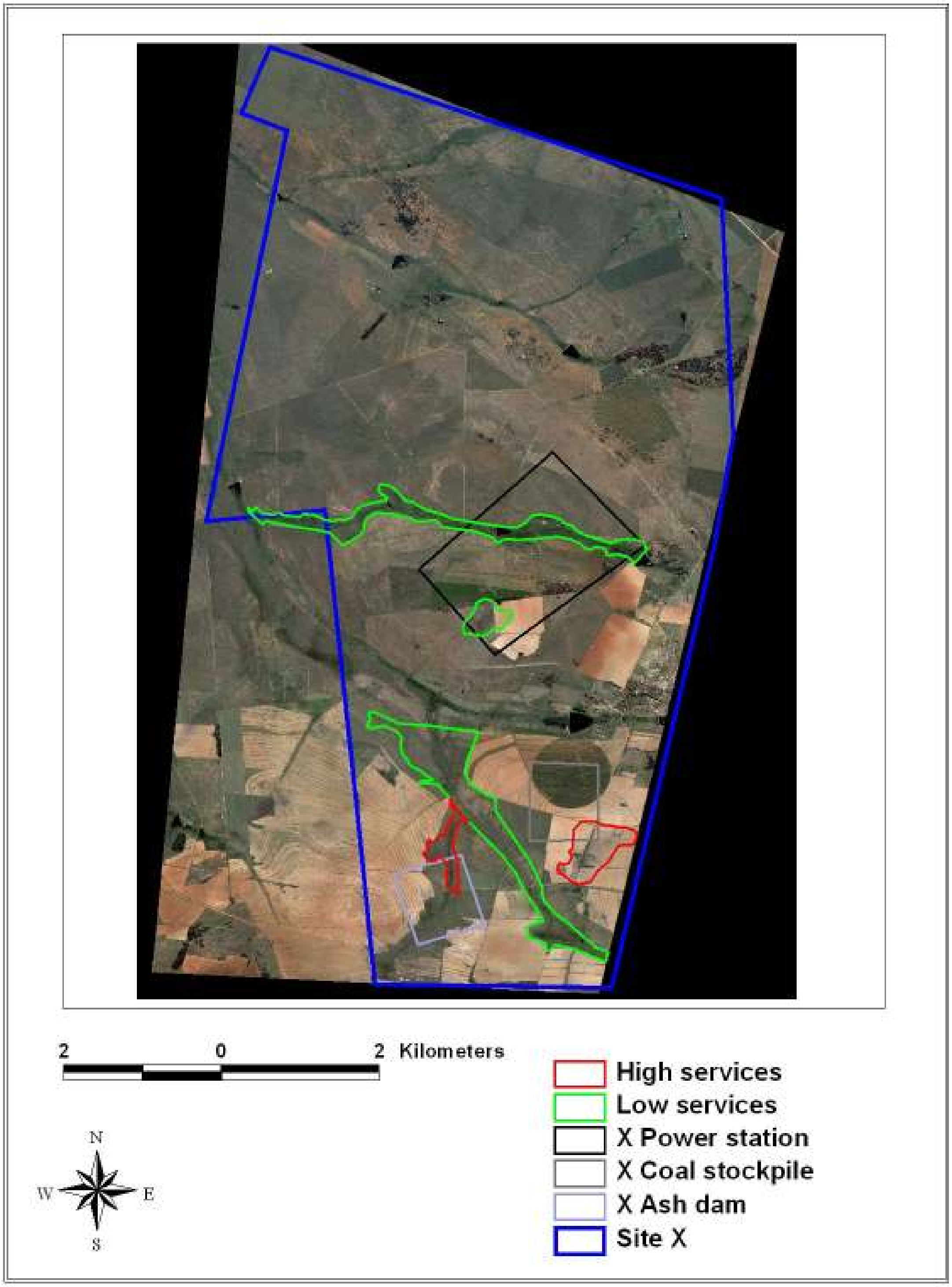


Figure 8: Site X wetland services.

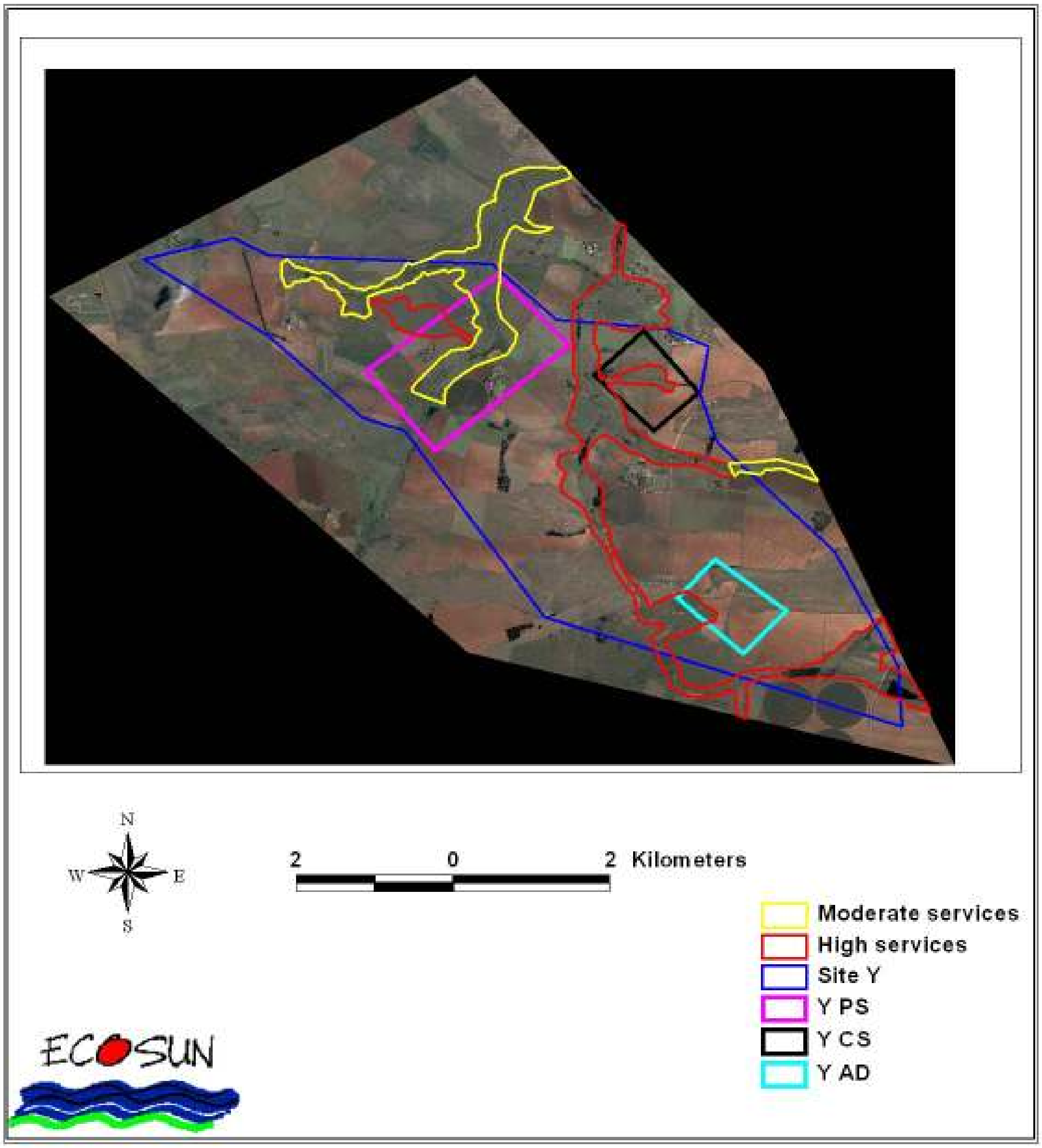


Figure 9: Site Y wetland services.

5 DISCUSSION

The most important ecological attributes associated with both study areas are regarded as:

- The presence of the water quality sensitive fish (*Chiloglanis pretoriae*) in the headwaters of the Wilge River at site Y;
- The importance of maintaining the integrity in the Wilge given the degraded state of the upper Olifant's River catchment;

- The consistently higher biodiversity at survey sites of area Y (Table 13);
- The high integrity of the wetlands associated with site Y; and
- The high number of ecosystem services provided by the wetlands of site Y.

Table 13: Comparison of species numbers.

	Number of Species						
	YWR1	YWR2	YKS1	YKS2	XKFS1	XKFS2	XKFS3
Aquatic Macro-invertebrates	28	20	18	25	10	10	13
Ichthyofauna	4	3	2	1	0	0	1
Grasses	45	43	46	43	32	38	No data
Plants/Forbs	18	12	11	16	11	10	No data
Trees	3	1	1	3	4	3	4
Birds	36	34	42	31	21	14	34
Small mammals	4	3	4	4	1	2	4
Reptiles	1	0	2	1	0	1	2
Amphibians	2	2	1	2	0	0	2
Total number of species	141	118	127	126	79	78	60

The generally poor riparian and wetland faunal and floral species richness (APPENDIX 3, 5, 7, 9, 11 and 13) can be attributed to a number of possible factors, which include the fact that the area has been greatly impacted upon by cropping, grazing and burning practices, as well as the fact that the study took place during a time when species richness is known to be reduced due to the adverse winter conditions and the fact that the wet season had not yet started.

It must be reiterated that this study did not take place during a time of optimum possible diversity and it is recommended that the study be repeated during the summer season in order to take optimal diversity into consideration and verify the likely presence of red data species.

6 ASSESSMENT OF POTENTIAL IMPACTS

Any development in a natural or semi-natural system will impact on the environment, usually with adverse effects. This phase of the study assesses the significance of potential impacts of current and proposed future activities at the study site on the receiving aquatic environment of the study area, and is intended to achieve the following:

- Describe and assess future impacts arising from activities on the fauna and flora of the streams and wetlands of the study area.
- Recommend mitigation measures to address significant impacts.
- Identify aspects which may require further study.

6.1 Assessment of Significance

From a technical, conceptual or philosophical perspective the focus of impact assessment ultimately narrows down to a judgment on whether the predicted impacts are significant or not (DEAT, 2002). The concept of significance is at the core of impact identification, prediction, evaluation and decision-making (DEAT, 2002). The determination of significant impacts relates to the degree of change in the environmental resource measured against some standard or threshold (DEAT, 2002). This requires a definition of the magnitude, prevalence, duration, frequency and likelihood of potential change (DEAT, 2002). The following criteria have been proposed by the Department of Environmental Affairs and Tourism (DEAT, 2002) for the description of the magnitude and significance of impacts (DEAT, 2002).

The *consequence* of impacts can be derived by considering the following criteria:

- Extent or spatial scale of the impact
- Intensity or severity of the impact
- Duration of the impact
- Potential for Mitigation
- Acceptability
- Degree of certainty/Probability
- Status of the impact
- Legal Requirements

Describing the potential impact in terms of the above criteria provides a consistent and systematic basis for the comparison and application of judgments (DEAT, 2002).

Calculation of the severity of the impact is based on the Department of Environmental Affairs' guideline document on EIA Regulations, April 1998.

Significance of Impact = Consequence (magnitude + duration + spatial scale) x Probability

Magnitude relates to how severe the impact is. Duration relates to how long the impact may be prevalent for and the spatial scale relates to the physical area that would be affected by the impact. Having ranked the severity, duration and spatial scale using the criteria outlined in Table 14, the overall consequence of impact can be determined by adding the individual scores assigned in the severity, duration and spatial scale. Overall probability of the impacts must then be determined. Probability refers to how likely it is that the impact may occur.

Table 14: Consequence and probability ranking.

Magnitude/Severity	**Duration**	**Spatial Scale**	**Probability**
10 - Very high/don't know	5 - Permanent	5 - International	5 - Definite/don't know
8 - High	4 - Long-term (impact ceases after operational life)	4 - National	4 - Highly probable
6 - Moderate	3 - Medium-term (5-15 years)	3 - Regional	3 - Medium probability
4 - Low	2 - Short-term (0-5 years)	2 - Local	2 - Low probability
2 - Minor	1 - Immediate	1- Site only	1 - Improbable
0 - None			0 - None

The maximum value, which can be obtained, is 100 significance points (**SP**). Environmental effects are rated as either of **High, Moderate, Low** or **No Impact** significance on the following basis:

SP>60 Indicates high environmental significance;

SP 30 to 60 Indicates moderate environmental significance;

SP<30 Indicates low environmental significance.

SP = 0 Indicated no environmental impact

The descriptors for the ratings are provided in Table 15 (DEAT, 2002).

Table 15: Categories for the rating of impact magnitude and significance.

High	Of the highest order possible within the bounds of impacts that could occur, There is no possible mitigation that could offset the impact, or mitigation is difficult.
Moderate	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. Mitigation is both feasible and fairly easily possible.
Low	Impact is of a low order and therefore likely to have little real effect. Mitigation is either easily achieved or little mitigation is required, or both.
No Impact	Zero Impact

Activities considered during the impact assessment are:

- Coal storage (seepage, habitat destruction, wind-blown coal dust)
- Ash dams (seepage, habitat destruction, wind-blown dust)
- Power Station (run-off, habitat destruction)

The phases considered are:

- Construction Impact
- Operational Phase Impact
- Residual/Remedial Risk

6.2 Description of Impact Mechanisms

A considerable development footprint will be caused by the construction of the power plant, coal storage facility and ash dams. In these areas the natural habitat will be completely removed with little or no chance of rehabilitation at a later stage. The seepage from ash dams or coal storage facilities to the surrounding areas and dust blowing from ash dams and coal storage facilities can be mitigated by putting certain procedures in place.

6.3 Development of Mitigation Measures

The quantitative accuracy and precision of impact predictions is particularly important for prescribing mitigation measures (DEAT, 2002). This is especially important for those impacts, pollutants or resources that require the setting of a site-specific discharge limit or need to be within legislated standards (DEAT, 2002). A common approach to describing mitigation measures for critical impacts is to specify a range of targets with predetermined acceptable range and an associated monitoring and evaluation plan (DEAT, 2002).

To ensure successful implementation, mitigation measures should be an unambiguous statement of actions and requirements that are practical to execute (DEAT, 2002). Table 16 summarizes the different approaches to prescribing and designing mitigation measures.

Table 16: Categories for prescribing and designing mitigation measures

Avoidance	Mitigation by not carrying out the proposed action.
Minimization	Mitigation by scaling down the magnitude of a development, reorienting the layout of the project or employing technology to limit the undesirable environmental impact.
Rectification	Mitigation through the restoration of environments affected by the action.
Reduction	Mitigation by taking maintenance steps during the course of the action.
Compensation	Mitigation through the creation, enhancement or acquisition of similar environments to those affected by the action.

6.4 Assessment of Potential Impacts

Table 17:X Alternative: Constructional and Operational Phase Impacts, Proposed Mitigation and Remedial Risk (SBM - significance before mitigation; SAM - significance after mitigation; L - low; M - moderate; H - high; P - probability; D - duration; SS – Spatial scale; Mag - Magnitude)

	Environmental Significance Score						
Current Impacts	**P**	**D**	**SS**	**Mag**	**TOTAL**		**Discussion and Recommended Mitigation**
CONSTRUCTIONAL PHASE							
Potential impacts on water quality due to construction activities, accidental spills	4 3	2 2	2 2	4 4	32 24	<u>SBM</u> M <u>SAM</u> L	For example, should any cement or aggregate reach the surface waters it could result in a temporary pH increase. This in turn will reduce availability of food for fish and invertebrates and induce physiological stress on aquatic fauna. This could affect sensitive species, thereby changing species diversity. This potential impact can be managed and mitigated by effective control of seepage and run-off. Seepage could be controlled by lining the ash dams, and placing the ash dams and coal stock piles clear from surface waters (at least not within the 1:100 year floodline). Run-off could be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose.
Aquatic habitat degradation due to increased sedimentation.	4 3	2 2	2 2	4 4	32 24	<u>SBM</u> M <u>SAM</u> L	Increased turbidity and suspended solids in the receiving surface water systems could reduce light penetration, thereby reducing photosynthesis; reduce visibility for food, reduce availability of food, clogging of gill filaments and gillrakes, physical abrasion of delicate structures such as gills, reduce breeding success, reduce growth rate of fish and their resistance to disease, affect oxygen consumption, haematology and social behaviour of aquatic fauna and affect sensitive species, thereby changing species diversity. These impacts may be mitigated by keeping dust to a minimum (this may be done by keeping construction areas damp to reduce dust), and containment of run-off (by placing cut-off

							berms around the area of construction).
Potential impacts on terrestrial biota due to construction activities, accidental spills and seepage.	5 4	2 2	2 1	6 4	50 28	SBM M SAM L	Construction of the power generation plant, ash dam and coal storage facility will, by nature cause the destruction of a substantial amount of terrestrial habitat. Furthermore, habitat may be degraded by accidental spills during the construction phase of the power plant. Certain species of biota such as some birds, small mammals and reptiles may be affected by noise associated with construction. This potential impact can be managed and mitigated by effective control of seepage and run-off. Seepage could be controlled by lining the ash dams. Run-off could be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose. Many of the impacts, such as habitat destruction and noise cannot be mitigated and it is advisable that the facilities are placed in areas so as to minimise the effects on sensitive areas and biota and that the spatial footprint be kept to a minimum.
Terrestrial habitat degradation due to increased dust blown from exposed soil, airborne pollutants and noise.	5 3	2 2	3 2	4 3	45 21	SBM M SAM L	Increased dust during the construction phase may cause the exacuation of the area by sensitive species or death of species of vegetation. Affected biota may include sensitive plant species, species of arthropod, bird and small mammal species. Noise may affect mainly small mammal species, bird species and some species of reptiles. These impacts may be mitigated by keeping dust to a minimum (this may be done by keeping construction areas damp to reduce dust. Other factors such as airborne pollution and noise are not easily mitigated and therefore it is advisable that the facilities are placed in areas so as to minimise the effects on sensitive areas and biota and that the spatial footprint be kept to a minimum.
Power station outlay: Loss of wetland units XVBC1 and XD1 with low integrity and low service provision	5 2	5 4	2 1	6 4	65 18	SBM H SAM	Construction of the power station over the wetland units will result in the destruction of this wetland type, the loss of its integrity as well as its services. Mitigation actions are limited to moving the outlay to minimize footprint area over the wetland see Figure 10. Mitigation will reduce impact and prevent loss of wetland units.

						L	
Coal stockpile outlay: Affect wetland units XHS1, XHSW2 and XVB2, with moderate integrity and low service provision	3 3	4 4	1 1	4 2	27 21	SBM L SAM L	Construction of the coal stockpile in the wetland unit's catchment will result in the loss of its integrity as well as its services. Mitigation actions are limited to moving the outlay to minimize footprint area over the wetland see Figure 10.
Ash Dam outlay: Loss of wetland unit XHSW1 and XVB1 with high integrity and high service provision	5 2	5 4	3 2	10 4	90 20	SBM H SAM L	Construction of the Ash Dam over the sensitive wetland types will result in the loss of a scarce wetland type the high integrity as well as the services provided by these wetland units. Mitigation actions are limited to moving the outlay to minimize footprint area affecting the wetland see Figure 10. Movement of the Ash Dam into a catchment of a more degraded wetland will reduce the overall impact of the Ash Dam. This site also provides for opportunities to mitigate and rehabilitate currently degraded wetlands.
Corridors for roads, railways, coal conveyors and pipelines	5 2	5 5	5 2	5 4	75 22	SBM H SAM L	Corridors for roads, railways, coal conveyors and pipelines will be impacting upon a number of wetland systems both in site X and Y as well as in areas outside the study area. Make it very difficult to assess the possible impacts. Impcts of dust, airborn pollution, waterborn pollution and spills durin the construction phase can be reduced by minimiseng the impact of the corridors on wetlands and other sensitive areas. Corridors should be routed so as to avoid wetlands and other sensitive areas as delineated in this reportConveyor belts should be kept
OPERATIONAL PHASE							
Potential impacts on water quality due to seepage and/or run-off from coal stock piles	4	4	2	6	48	SBM M	Impacts on water quality may have significant impacts on the aquatic ecology of the study area due to increased physiological stress on aquatic fauna. In severe cases aquatic fauna may be completely eliminated from the sample area and for some distance downstream. This potential impact can be managed and mitigated by effective control of seepage and run-

	3	4	2	4	30	<u>SAM</u> L	off. Seepage could be controlled by lining the ash dams, and placing the ash dams and coal stock piles clear from surface waters (at least not within the 1:100 year floodline). Run-off could be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose.
Aquatic habitat degradation due to increased sedimentation.	4 3	4 4	2 2	6 4	48 30	<u>SBM</u> M <u>SAM</u> L	The addition of wind blown dust from ash dams may result in increased sediment levels in the aquatic ecosystems, resulting in loss of vital habitats due to smothering, increased turbidity levels and decreased photosynthesis as well as placing physiological stress on aquatic organisms. These impacts may be mitigated by keeping dust to a minimum and containment of run-off.
Potential impacts on terrestrial biota due to seepage and/or run-off from coal stock piles	3 2	4 4	2 2	5 4	36 20	<u>SBM</u> M <u>SAM</u> L	Impacts on water quality may have significant impacts on the terrestrial ecology of the study area due to increased stress on vegetation. In severe cases terrestrial vegetation may be completely eliminated from the sample area causing the elimination of animal specie that utilise that vegetation. This potential impact can be managed and mitigated by effective control of seepage and run-off. Seepage could be controlled by lining the ash dams, and placing the ash dams and coal stock piles in areas of least terrestrial biological diversity thereby reducing the potential effect of these impacts. Run-off could furthermore be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose.
Terrestrial habitat degradation due to increased dust blown from exposed soil, airborne pollutants and noise.	4 3	2 2	3 2	5 3	40 21	<u>SBM</u> M <u>SAM</u> L	Increased dust during the construction phase may cause the exacuation of the area by sensitive species or death of species of vegetation. Affected biota may include sensitive plant species, species of arthropod, bird and small mammal species. Noise may affect mainly small mammal species, bird species and some species of reptiles. Airborne pollution and noise are not easily mitigated and therefore it is advisable that the facilities are placed in areas so as to minimise the effects on sensitive areas and biota and that the spatial footprint be kept to a minimum.

Corridors for roads, railways, coal conveyors and pipelines	5 2	5 5	5 2	5 4	75 22	SBM H SAM L	Corridors for roads, railways, coal conveyors and pipelines will be impacting upon a number of wetland systems both in site X and Y as well as in areas outside the study area. Make it very difficult to asses the possible impacts. Impcts can be reduced by minimiseng the impact of the corridors on wetlands. This can be done by making sure as little disturbance within the wetland takes place as possible. Pipelines should where possible be kept above ground, as buried pipelines crossing wetlands may impede subterranean hydrology. Alternatively corridors should be routed so as to avoid wetlands and other sensitive areas as delineated in this report.

Table 18:Y Alternative: Constructional and Operational Phase Impacts, Proposed Mitigation and Remedial Risk (SBM - significance before mitigation; SAM - significance after mitigation; L - low; M - moderate; H - high; P - probability; D - duration; SS – Spatial scale; Mag - Magnitude)

	Environmental Significance Score						
Current Impacts	**P**	**D**	**SS**	**Mag**	**TOTAL**		**Discussion and Recommended Mitigation**
CONSTRUCTIONAL PHASE							
Potential impacts on water quality due to construction activities, accidental spills	4 3	2 2	3 3	8 4	52 27	SBM M SAM L	For example, should any cement or aggregate reach the surface waters it could result in a temporary pH increase. This in turn will reduce availability of food for fish and invertebrates and induce physiological stress on aquatic fauna. This could affect sensitive species, thereby changing species diversity. Of special concern in this regard is the presence of the Shortspine suckermouth (*Chiloglanis pretoriae*) in the Wilge River is of special significance. This species is intolerant towards poor water quality and has specialized habitat requirements. It is dependent on flowing water habitats and has a preference for substrate

							cover (Skelton, 2001). Two specimens of this species were sampled in the upstream section of the Wilge River at site WR1. This species is extremely scarce in the upper Olifants River Catchment, and this may well be the last remaining population in this area. In addition, the SASS5 data indicated the surface waters to be affected by the Y alternative footprint to be of good biotic integrity (Class A/B). This potential impact can be managed and mitigated by effective control of seepage and run-off. Seepage could be controlled by lining the ash dams, and placing the ash dams and coal stock piles clear from surface waters (at least not within the 1:100 year floodline). Run-off could be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose.
Aquatic habitat degradation due to increased sedimentation.	4 3	2 2	3 2	6 4	44 24	<u>SBM</u> M <u>SAM</u> L	Increased turbidity and suspended solids in the receiving surface water systems could reduce light penetration, thereby reducing photosynthesis; reduce visibility for food, reduce availability of food, clogging of gill filaments and gillrakes, physical abrasion of delicate structures such as gills, reduce breeding success, reduce growth rate of fish and their resistance to disease, affect oxygen consumption, haematology and social behaviour of aquatic fauna and affect sensitive species, thereby changing species diversity. The good biotic integrity of the concerned aquatic systems is of special significance in this regard. These impacts may be mitigated by keeping dust to a minimum (this may be done by keeping construction areas damp to reduce dust), and containment of run-off (by placing cut-off berms around the area of construction).
Potential impacts on terrestrial biota due to construction activities, accidental spills and seepage.	5 5	2 2	2 1	10 8	70 55	<u>SBM</u> H <u>SAM</u> M	Construction of the power generation plant, ash dam and coal storage facility will, by nature cause the destruction of a substantial amount of terrestrial habitat. Furthermore, habitat may be degraded by accidental spills during the construction phase of the power plant. Certain species of biota such as some birds, small mammals and reptiles may be affected by noise associated with construction. This potential impact can be managed and mitigated by effective control of seepage and run-off. Seepage could be controlled by lining the ash dams. Run-off could be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose. Many of the impacts, such as habitat destruction and noise cannot be mitigated and it is advisable that the facilities are placed in

							areas so as to minimise the effects on sensitive areas and biota and that the spatial footprint be kept to a minimum.
Terrestrial habitat degradation due to increased dust blown from exposed soil, airborne pollutants and noise.	5 3	2 2	3 2	6 4	55 24	SBM M SAM L	Increased dust during the construction phase may cause the exacuation of the area by sensitive species or death of species of vegetation. Affected biota may include sensitive plant species, species of arthropod, bird and small mammal species. Noise may affect mainly small mammal species, bird species and some species of reptiles. These impacts may be mitigated by keeping dust to a minimum (this may be done by keeping construction areas damp to reduce dust. Other factors such as airborne pollution and noise are not easily mitigated and therefore it is advisable that the facilities are placed in areas so as to minimise the effects on sensitive areas and biota and that the spatial footprint be kept to a minimum.
Corridors for roads, railways, coal conveyors and pipelines	5 2	5 5	4 2	5 4	70 22	SBM H SAM L	Corridors for roads, railways, coal conveyors and pipelines will be impacting upon a number of wetland systems both in site X and Y as well as in areas outside the study area. Make it very difficult to asses the possible impacts. Impcts of dust, airborn pollution, waterborn pollution and spills durin the construction phase can be reduced by minimiseng the impact of the corridors on wetlands and other sensitive areas. Corridors should be routed so as to avoid wetlands and other sensitive areas as delineated in this reportConveyor belts should be kept
OPERATIONAL PHASE							
Potential impacts on water quality due to seepage and/or run-off from coal stock piles	4 3	4 4	3 3	6 6	52 39	SBM M SAM M	Impacts on water quality may have significant impacts on the aquatic ecology of the study area due to increased physiological stress on aquatic fauna. In severe cases aquatic fauna may be completely eliminated from the sample area and for some distance downstream. Of special concern in this regard is again the presence of the Shortspine suckermouth (*Chiloglanis pretoriae*) in the Wilge River. This species is intolerant towards poor water quality (Skelton, 2001). The current high biotic integrity of the Wilgespruit and Klipspruit in this area is also a cause for concern. This potential impact can be managed and mitigated by effective control of seepage and run-off. Seepage could be controlled by lining the ash dams, and placing the ash dams and coal stock piles clear

							from surface waters (at least not within the 1:100 year floodline). Run-off could be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose.
Aquatic habitat degradation due to increased sedimentation.	4 3	4 4	3 2	6 4	52 30	SBM M SAM L	Addition of wind blown dust from the ash dam may result in increased sediment levels in the aquatic ecosystems, resulting in loss of vital habitats due to smothering, increased turbidity levels and decreased photosynthesis as well as placing physiological stress on aquatic organisms. These impacts may be mitigated by keeping dust to a minimum and containment of run-off.
Potential impacts on terrestrial biota due to seepage and/or run-off from coal stock piles	4 3	4 4	2 2	6 4	48 30	SBM M SAM L	Impacts on water quality may have significant impacts on the terrestrial ecology of the study area due to increased stress on vegetation. In severe cases terrestrial vegetation may be completely eliminated from the sample area causing the elimination of animal specie that utilise that vegetation. This potential impact can be managed and mitigated by effective control of seepage and run-off. Seepage could be controlled by lining the ash dams, and placing the ash dams and coal stock piles in areas of least terrestrial biological diversity thereby reducing the potential effect of these impacts. Run-off could furthermore be contained by placing cut-off berms around the ash dams and coal stock piles and containing any run-off water in a dam designed for this purpose.
Terrestrial habitat degradation due to increased dust blown from exposed soil, airborne pollutants and noise.	5 3	2 2	3 2	6 4	55 24	SBM M SAM L	Increased dust during the construction phase may cause the exacuation of the area by sensitive species or death of species of vegetation. Affected biota may include sensitive plant species, species of arthropod, bird and small mammal species. Noise may affect mainly small mammal species, bird species and some species of reptiles. These impacts may be mitigated by keeping dust to a minimum. Other factors such as airborne pollution and noise are not easily mitigated and therefore it is advisable that the facilities are placed in areas so as to minimise the effects on sensitive areas and biota and that the spatial footprint be kept to a minimum.

Power station outlay: Loss of wetland units YFP1 and YHSW 2,3 and 5 with moderate to high integrity; and high service provision.	5 4	5 5	4 3	8 8	85 64	<u>SBM</u> H <u>SAM</u> H	Construction of the power station over the Klipspruit will result in the destruction of this wetland type, the loss of its integrity as well as its services. Mitigation actions are limited to moving the outlay to minimize footprint area over the wetland see Figure 11. Mitigation will reduce impact but affect other wetlands thus no overall change
Coal stockpile outlay: Loss of wetland unit YHSW8 with moderate integrity and high service provision.	4 4	5 4	3 3	8 6	64 54	<u>SBM</u> H <u>SAM</u> M	Construction of the coal stockpile over the wetland unit will result in the loss of its integrity as well as its services. Mitigation actions are limited to moving the outlay to minimize footprint area over the wetland see Figure 11.
Ash Dam outlay: Loss of wetland unit YVBC1 with moderate integrity and high service provision	5 4	5 5	3 3	10 8	90 64	<u>SBM</u> H <u>SAM</u> H	Construction of the Ash Dam in the upper Wilge threatens the *Chiloglanis* population which is regarded as of specific importance given the scarcity of this fish in the upper Olifants River catchment. Construction of the ash dam will also result in the loss of the high integrity as well as the services provided by this section. Mitigation actions are limited to moving the outlay to minimize footprint area affecting the wetland see Figure 11. The proximity of the overall development still threatens the continued survival of this population in the headwaters of the Wilge despite moving the Ash Dam.
Corridors for roads, railways, coal conveyors and pipelines	5 2	5 5	3 2	5 4	65 22	<u>SBM</u> H <u>SAM</u>	Corridors for roads, railways, coal conveyors and pipelines will be impacting upon a number of wetland systems both in site X and Y as well as in areas outside the study area. Make it very difficult to asses the possible impacts. Impcts can be reduced by minimiseng the impact of the corridors on wetlands. This can be done by making sure as little disturbance within the wetland takes place as possible. Pipelines should where possible be kept above ground, as buried pipelines crossing

						L	wetlands may impede subterranean hydrology. Alternatively corridors should be routed so as to avoid wetlands and other sensitive areas as delineated in this report.

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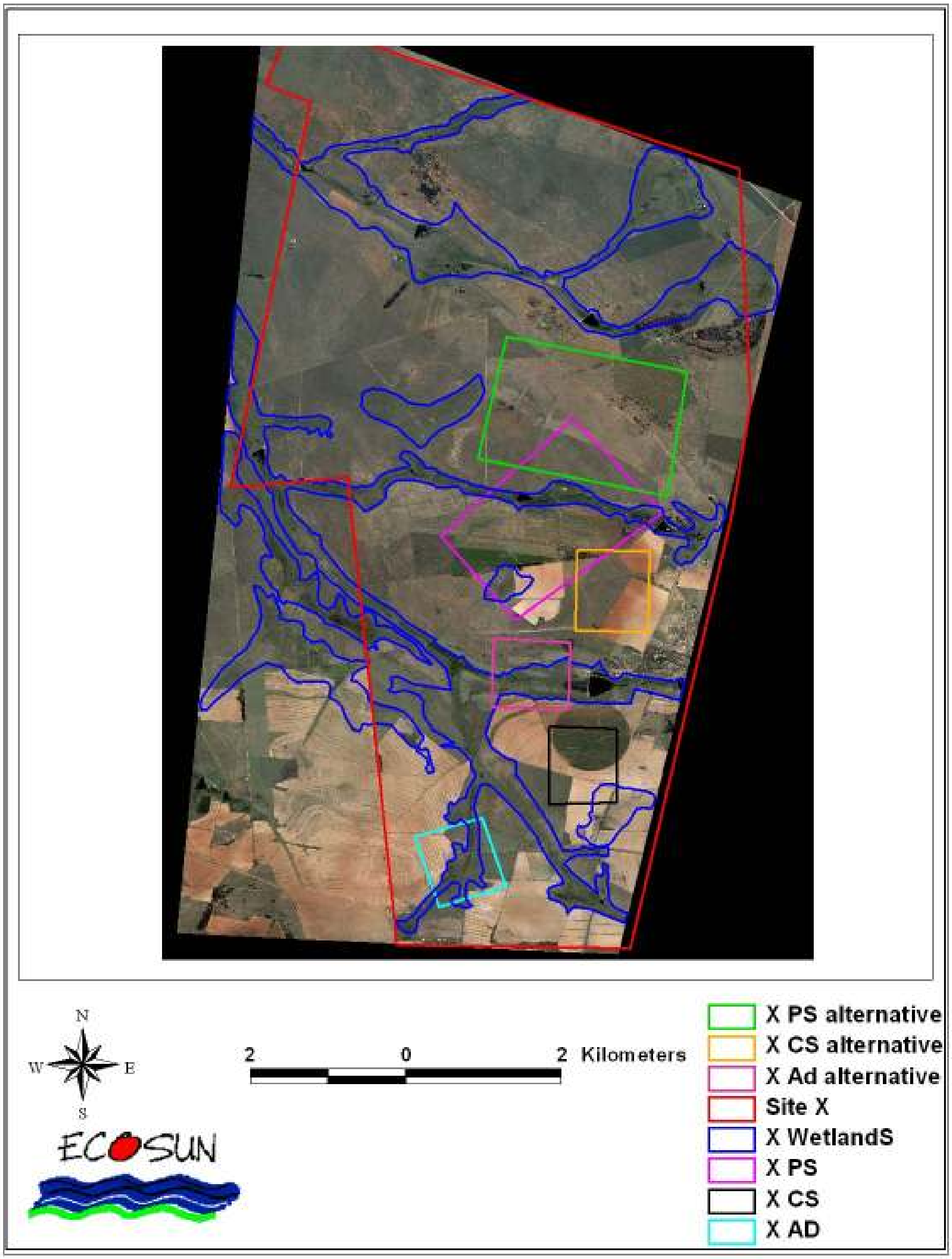

Figure 10: Present and alternate layouts for Site X

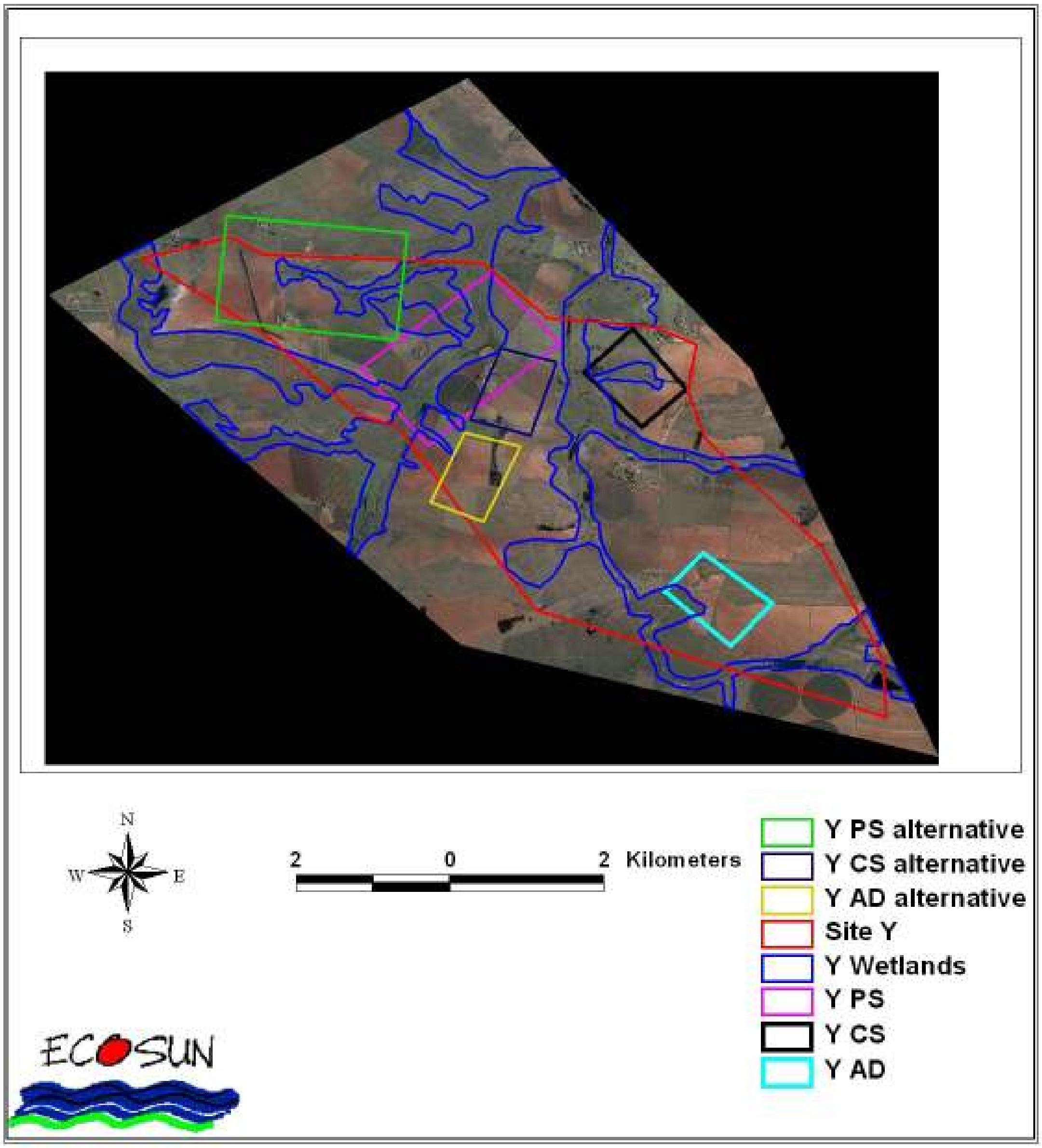

Figure 11: Present and alternate layouts for Site Y.

7 CONCLUSIONS

Site Y: The high biodiversity and biotic integrity (Class A/B, based on SASS5 scores) in the concerned sections of the Wilge River and Klipspruit is of specific significance. Fish species diversity and abundance in this area is also good with all expected species being sampled (i.e. the Chubbyhead barb *Barbus anoplus*, Banded tilapia *Tilapia sparrmanii* and the Southern Mouthbrooder *Pseudocrenilabrus philander*). In addition two specimens of the Shortspine suckermouth (*Chiloglanis pretoriae*) were sampled in the Wilge River (site WR1). The presence of this species is of special significance, since it is extremely scarce in the upper Olifants River Catchment. *Chiloglanis pretoriae* is intolerant towards poor water quality and has specialized habitat requirements. This high in-stream integrity as well as the high wetland integrity and service provision provides for an ecological template that is regarded as unsuitable for development.

Site X: The poor biotic integrity (Class E, based on SASS5 scores), low biodiversity and poor integrity associated with the site X option provides for a generally degraded section that (provided appropriate mitigation measures are implemented) will have a low impact on the Wilge River catchment and overall in the Olifants River upper catchment.

Corridors for pipelines, roads, railways and coal conveyors: The proposed corridors for transport to and from the power plants cross many wetland systems in both the case of site X and site Y. The number of systems traversed in site Y is, however slightly less than that of site X therefore indicating that the corridors should have less of an impact in site the case of site Y than site X. In order to mitigate these impacts it is suggested that the construction of the corridors as well as the route followed by these corridors should be planned in such a way as to minimised the impacts on wetlands An important method of mitigation would be to make sure that any construction in wetland areas be done so as to minimised disturbance of the pedology which would directly affect subterranean hydrology in wetland systems. (See Tables 17 and 18).

Based on above information, from an aquatic biota perspective, Site X would be the preferred option for the development of the proposed Coal Fired Power Station.

8 RECOMMENDATIONS

Conduct a detailed Rare and Endangered species survey as well as a wetland assessment focussing on the preferred layouts once these have been selected. It is of critical importance to conduct such a survey during the appropriate season.

The area outside of the study area of this study, but which will be directly impacted by transport corridors, should be investigated for possible serious impacts arising from the construction or operation of these transport corridors.

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APPENDIX 1

LIST OF AQUATIC MACRO INVERTEBRATES SAMPLED.

Taxon	Common Name	Sampling Site						
		WR1	WR2	KS1	KS2	KFS1	KFS2	KFS3
Turbellaria								
Planarians	Flatworms	A	B	A	A			
Annelida								
Oligochaeta	Segmented worms	1					A	1
Hirudinae								
	Leeches							
Crustacea								
Potamonautidae	Crabs	1	1		A			
	Shrimps							
Hydracarina	Water mites		A	A	A			
Ephemeroptera								
Polymitarcyidae	Pale Burrowers							
Baetidae 1sp	Small Minnow Mayflies					1		
Baetidae 2spp	Small Minnow Mayflies							A
Baetidae >2spp	Small Minnow Mayflies	B	C	C	C			
Heptageniidae	Flatheaded Mayflies	B						
Leptophlebiidae	Prongills	B	A	B	B			
Tricorythidae	Stout Crawlers							
Caenidae	Cainflies	B	B	B	B	A		
Odonata								
Lestidae	Damselflies							
Coenagrionidae	Damselflies	B	B	B	B			A
Gomphidae	Dragonflies				B	A	A	1
Aeshnidae	Dragonflies							
Corduliidae	Dragonflies							
Libellulidae	Dragonflies			1			A	A
Hemiptera								
Notonectidae	Backswimmers				A		A	
Pleidae	Pygmy backswimmers	B	A	A	A			

Naucoridae	Creeping Water Bugs							
Nepidae	Water scorpions					1		
Belostomatidae	Giant Water Bugs	B			B			A
Corixidae	Water Boatman	A				A	A	
Gerridae	Pond Skaters	A			A			
Veliidae	Ripple bugs	A			A		B	A
Trichoptera								
Hydropsychidae 1spp	Caddis flies							
Hydropsychidae 2spp	Caddis flies				A			
Hydropsychidae > 2spp	Caddis flies	B	B	B				
Other case larvae	Caddis larvae							
Coleoptera								
Dytiscidae	Predacious Diving Beetles	B	A	A	A	A		A
Elmidae	Riffle Beetles	A	1	1				
Gyrinidae	Whirligig Beetles	B	A	B	A	A		
Haliplidae	Crawling Water Beetles	A			A			
Hydraenidae	Minute Moss Beetles	A	A		A		A	A
Helodidae	Marsh Beetles			A				
Hydrophilidae	Water Scavenger Beetles		A		1			
Diptera								
Culicidae	Mosquitoes	A	1	A	A	1		A
Chironomidae	Midges	A	A	B	A	B	A	A
Dixidae	Dixid midge						A	
Ceratopogonidae	Biting Midges	A	A	A	A			
Simuliidae	Black flies	A	A	B	A			A
Tabanidae	Horse flies							
Tipulidae	Crane flies	A	1					
Muscidae	House flies/Stable flies	A						
Gastropoda								
Planorbidae	Orb snails	A						A
Physidae	Pouch snails							
Lymnaeidae	Pond snails							

Corbiculidae				1				
Ancylidae	Limpets	A	1		1			
Pelecypoda								
Unionidae	Perly mussels				1			
Sphaeridae	Clams	1						
Number of Taxa		**28**	**20**	**18**	**25**	**10**	**10**	**13**
% Air Breathers		**46**	**40**	**28**	**48**	**50**	**60**	**46**
BIOTOPE SCORES								
SIC		98	81	81	94	0	0	0
G,S,Mud and SOOC		53	57	45	66	0	26	19
Vegetation (MV & or AV)		75	84	69	73	38	26	46

Key: * Not present; SIC = Stones in current; SOOC = Stones out of current; MV = Marginal vegetation; AV = Aquatic vegetation

APPENDIX 2

LIST OF EXPECTED GRASS SPECIES

Common Name	Biological Name
Red grass	*Themeda triandra*
Broad leaved turpentine grass	*Cymbopogon excavatus.*
Narrow leaved turpentine grass	*Cymbopogon plurinodis*
Common thatching grass	*Hyparrhenia hirta*
Fine thatching grass	*Hyparrhenia filipendula*
Yellow thatching grass	*Hyperthelia dissolute*
Spear grass	*Heteropogon contortus*
One finger grass	*Digitaria monodactyla*
sickle grass	*Ctenium concinnum*
Blue buffalo grass	*Cenchrus ciliais*
Tassel three awn	*Aristida congesta* subsp. congesta
bur bristle grass	*Setaria verticillata*
Annual three awn	*Aristida adscensionis*
Bottlebrush Grass	*Enneapogon scoparius*
Shade erharta	*Ehrfarta erecta*
Pale three awn	*Aristida canescens*
Wether love grass	*Eragrostis nindensis*
Narrow heart love grass	*Eragrostis racemosa*
Bristle leaved red top	*Melinis nerviglumis*
Hairy love grass	*Eragrostis trichophora*
curly leaf	*Eragrostis rigidor*
gum grass	*Eragrostis gummiflua*
Small panicum	*Panicum ecklonii*
natal panicum	*Panicum natalense*
Natal Red Top	*Melinis repens*
Stink love grass	*Eragrostis cilianensis*
Dew grass	*Eragrostis obtusa*
Footpath love grass	*Eragrostis pseudosclerantha*
Lehmann's love grass	*Eragrostis lehmanniana*
Iron grass	*Aristida diffusa*
Purple three awn	*Aristida scabrivalvis*
Common wild oats	*Avena fatua*
annual blue grass	*Poa annua*
narrow curly leaf	*Eragrostis chloromelas*
weeping love grass	*Eragrostis curvula*
small buffalo grass	*Panicum colloratum*
Munnik fescue	*Festuca scabra*
spreading three awn	*Aristida congesta* subsp. *Barbicollis*
broom needle grass	*Triraphis andropogonoides*
tough love grass	*Eragrostis plana*
Catstail dropseed	*Sporobolus pyramidalis*
Olive dropseed	*Sporobolus centrifugus*
herringbone grass	*Pogonarthria squarrosa*
brown seed finger grass	*Digitaria diagonalis*
False love grass	*Bewsia biflora*
Goose grass	*Eleusine coracana*
Pinhole grass	*Bothriochloa insculpta*

Silver finger grass	*Digitaria argyrograpta*
Purple finger grass	*Digitaria tricholaenoides*
Black seed finger grass	*Digitaria ternata*
Crab finger grass	*Digitaria sanguinalis*
Feather top chloris	*Chloris virgata*
Black seed grass	*Alloteropsis semialata*
brown Rhodes grass	*Eustachys paspaloides*
Broad leaved bluestem	*Diheteropogon amplectens*
Broad leaved bluestem	*Diheteropogon filifolius*
Stab grass	*Andropogon schirensis*
Large silver andropogon	*Andropogon huillensis*
Giant turpentine grass	*Cymbopogon validus*
Red Autumn grass	*Schizachyrium sanguineum*
Giant spear grass	*Trachypogon spicatus*
Pincushion grass	*Microchloa cafra*
Perennial rye grass	*Lolium perenne*
Common bristle grass	*Setaria sphacelata*
Ratstail dropseed	*Sporobolus africanus*
Hairy trident grass	*Tristachya leucothrix*
Gongoni three awn	*Aristida junciformis*
common russet grass	*Loudetia simplex*
tite grass	*Eragrostis inamoena*
River grass	*Arundinella nepalensis*
jungle rice	*Echinochloa colona*
small rolling grass	*Trichoneura grandiglumis*
common finger grass	*Digitaria eriantha*
Couch grass	*Cynodon dactylon*
veld paspalum	*Paspalum scrobiculatum*
common signal grass	*Brachiaria brizantha*
Garden uruchloa	*Urucloa panicoides*
sweet signal grass	*Brachiaria eruciformis*
velvet signal grass	*Brachiaria serrata*
Snowflake grass	*Andropogon eucomus*
Swamp couch	*Hemarthria altissima*
Thunberg's Pennisetum	*Pennisetum thunbergii*
Riverbed grass	*Pennisetum macrourum*
Vlei bristle grass	*Setaria incrassata*
Stiburus	*Stiburus alopecuroides*
Cottonwool grass	*Imperata cylindrical*
Small oats grass	*Helictotrichon turgidulum*
Heartseed lovegrass	*Eragrostis capensis*
Rescue grass	*Bromus catharticus*
dropseed grass	*Sporobolus fimbriatus*
sweet grass	*Panicum schinzii*
Red dropseed	*Sporobolus festivus*
rolling grass	*Aristida bipartita*
Bronze love grass	*Eragrostis heteromera*
Common wild sorghum	*Sorghum bicolor*
Common reed	*Phragmites australis*
Couch panicum	*Panicum repens*
Bent grass	*Agrostis lachnantha*
Rice grass	*Leersa hexandra*

wireleaf daba grass	*Miscanthus junceus*
swamp grass	*Diplachne fusca*
Vasey grass	*Paspalum urvillei*
Hippo grass	*Ischaemum fasciculatum*
Turf grass	*Ischaemum afrum*
vlei bluestem	*Andropogon appendiculatus*
Rhodes grass	*Chloris gayana*
Water couch	*Paspalum distichum*
Dallis grass	*Paspalum dilatatum*
Nile grass	*Acroceras macrum*
Kikuyu	*Pennisetum clandestinum*

APPENDIX 3

LIST OF RECORDED GRASS SPECIES

Common Name	**Biological Name**
Red grass	*Themeda triandra*
Broad leaved turpentine grass	*Cymbopogon excavatus.*
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Snowflake grass	*Andropogon eucomus*
Swamp couch	*Hemarthria altissima*
Thunberg’s Pennisetum	*Pennisetum thunbergii*
Riverbed grass	*Pennisetum macrourum*
Vlei bristle grass	*Setaria incrassata*
Stiburus	*Stiburus alopecuroides*
Cottonwool grass	*Imperata cylindrical*
Small oats grass	*Helictotrichon turgidulum*
Heartseed lovegrass	*Eragrostis capensis*
Rescue grass	*Bromus catharticus*
dropseed grass	*Sporobolus fimbriatus*
sweet grass	*Panicum schinzii*
Red dropseed	*Sporobolus festivus*
rolling grass	*Aristida bipartita*
Bronze love grass	*Eragrostis heteromera*
Common wild sorghum	*Sorghum bicolor*
Common reed	*Phragmites australis*
Couch panicum	*Panicum repens*
Bent grass	*Agrostis lachnantha*
Rice grass	*Leersa hexandra*
wireleaf daba grass	*Miscanthus junceus*
swamp grass	*Diplachne fusca*

Vasey grass	*Paspalum urvillei*
Hippo grass	*Ischaemum fasciculatum*
Turf grass	*Ischaemum afrum*
vlei bluestem	*Andropogon appendiculatus*
Rhodes grass	*Chloris gayana*
Water couch	*Paspalum distichum*
Dallis grass	*Paspalum dilatatum*
Nile grass	*Acroceras macrum*
Kikuyu	*Pennisetum clandestinum*

APPENDIX 4

LIST OF EXPECTED TREE SPECIES

Biological Name	Common Name
Aloe marlothii	Mountain Aloe
Cussonia paniculata	Highveld Cabbage Tree
Cussonia spicata	Common Cabbage Tree
Tarchonanthuscamphoratus	Wild Camphor Bush
Kiggelaria africana	Wild peach
Salix mucronata	Cape Willow
Solanum mauritianum	Bug tree
Solanum giganteum	Healing leaf tree
Gymnosporia buxifolia	Common spike thorn
Scolopia zeyheri	Thorn pear
Chrysanthemoides monilifera	Bush thick berry
Cassine transvaalensis	Transvaal saffron
Maytenus undata	Koko tree
Myrsine africana	Cape myrtle
Rhamnus rinoides	Dogwood
Salix babylonica	Weeping willow
Ilex mitis	Cape holly
Ehretia rigida	Puzzle bush
Diospyros lycioides	Blue bush
Diospyros whyteana	Bladder nut
Clutea pulchella	Common lightning bush
Protea caffra	Common sugarbush
Protea roupelliae	Sliver sugarbush
Ziziphus mucronata	Buffalo thorn
Grewia flava	Raisin bush
Grewia occidentalis	Cross berry
Celtis africana	White stinkwood
Buddleja salviifolia	Sagewood
Pavetta gardeniifolia	Common brides bush
Cassinopsis ilicifolia	Lemon thorn
Halleria lucida	Tree fuschia
Carissa bispinosa	Forest num-num
Buddleja saligna	False olive
Combretum molle	Velvet bushwillow
Euclea undulata	common guarrie
Olea europea subsp. Africana	Wild olive
Olinia emarginata	Mountain hard pear
Scutia myrtina	Cat thorn
Rhoicissus tridentata	Bushman grape
Rhus dentata	Nana berry
Rhus lancea	Karee
Rhus pyroides	Common wild currant
Leucosidea sericea	Oldwood
Heteromorpha trifoliata	Parsley tree
Acacia karroo	Sweet thorn

APPENDIX 5

LIST OF RECORDED TREE SPECIES

Common Name	Biological Name
Common spike thorn	*Gymnosporia buxifolia*
Thorn pear	*Scolopia zeyheri*
Weeping willow	*Salix babylonica*
Velvet bushwillow	*Combretum molle*
Karee	*Rhus lancea*
Sweet thorn	*Acacia karroo*

APPENDIX 6

LIST OF EXPECTED BIRD SPECIES

Roberts No.	Biological Name	Common Name
1	*Struthio camelus*	Ostrich
6	*Crested Podiceps cristatus*	Grebe Great
7	*Podiceps nigricollis*	Grebe Blacknecked
8	*Tachybaptus ruficollis*	Dabchick
55	*Phalacrocorax carbo*	Cormorant Whitebreasted
58	*Phalacrocorax africanus*	Cormorant Reed
60	*Anhinga rufa*	Darter
62	*Ardea cinerea*	Heron Grey
63	*Ardea melanocephala*	Heron Blackheaded
64	*Ardea goliath*	Heron Goliath
65	*Ardea purpurea*	Heron Purple
66	*Casmerodius albus*	Egret Great White
67	*Egretta garzetta*	Egret Little
68	*Mesophoyx intermedia*	Egret Yellowbilled
69	*Egretta ardesiaca*	Egret Black
71	*Bubulcus ibis*	Egret Cattle
72	*Ardeola ralloides*	Heron Squacco
74	*Butorides striatus*	Heron Greenbacked
76	*Nycticorax nycticorax*	Heron Blackcrowned Night
78	*Ixobrychus minutus*	Bittern Little
81	*Scopus umbretta*	Hamerkop
83	*Ciconia ciconia*	Stork White
84	*Ciconia nigra*	Stork Black
85	*Ciconia abdimii*	Stork Abdim's
89	*Leptoptilos crumeniferus*	Stork Marabou
90	*Mycteria ibis*	Stork Yellowbilled
91	*Threskiornis aethiopicus*	Ibis Sacred
92	*Geronticus calvus*	Ibis Southern Bald
93	*Plegadis falcinellus*	Ibis Glossy
94	*Bostrychia hagedash*	Ibis Hadeda
95	*Platalea alba*	Spoonbill African
96	*Phoenicopterus ruber*	Flamingo Greater
97	*Phoenicopterus minor*	Flamingo Lesser
99	*Dendrocygna viduata*	Duck Whitefaced
100	*Dendrocygna bicolor*	Duck Fulvous
101	*Thalassornis leuconotus*	Duck Whitebacked
102	*Alopochen aegyptiacus*	Goose Egyptian
103	*Tadorna cana*	Shelduck South African
104	*Anas undulata*	Duck Yellowbilled
105	*Anas sparsa*	Duck African Black
106	*Anas capensis*	Teal Cape
107	*Anas hottentota*	Teal Hottentot
108	*Anas erythrorhyncha*	Teal Redbilled
112	*Anas smithii*	Shoveller Cape
113	*Netta erythrophthalma*	Pochard Southern
114.1	*Anas platyrhynchos*	Mallard
115	*Sarkidiornis melanotos*	Duck Knobbilled
116	*Plectropterus gambensis*	Goose Spurwinged

117	*Oxyura maccoa*	Duck Maccoa
118	*Sagittarius serpentarius*	Secretarybird
122	*Gyps coprotheres*	Vulture Cape
126	*Milvus migrans*	Kite Black
126.1	*Milvus aegyptius*	Kite Yellowbilled
127	*Elanus caeruleus*	Kite Blackshouldered
128	*Aviceda cuculoides*	Hawk Cuckoo
130	*Pernis apivorus*	Buzzard Honey
131	*Aquila verreauxii*	Eagle Black
136	*Hieraaetus pennatus*	Eagle Booted
138	*Hieraaetus ayresii*	Eagle Ayres'
140	*Polemaetus bellicosus*	Eagle Martial
142	*Circaetus cinereus*	Eagle Brown Snake
143	*Circaetus pectoralis*	Eagle Blackbreasted Snake
148	*Haliaeetus vocifer*	Eagle African Fish
149	*Buteo buteo*	Buzzard Steppe
152	*Buteo rufofuscus*	Buzzard Jackal
156	*Accipiter ovampensis*	Sparrowhawk Ovambo
157	*Little Accipiter minullus*	Sparrowhawk
158	*Accipiter melanoleucus*	Sparrowhawk Black
159	*Accipiter badius*	Goshawk Little Banded
161	*Micronisus gabar*	Goshawk Gabar
164	*Circus aeruginosus*	Harrier Eurasian Marsh
165	*Circus ranivorus*	Harrier African Marsh
166	*Circus pygargus*	Harrier Montagu's
167	*Circus macrourus*	Harrier Pallid
168	*Circus maurus*	Harrier Black
169	*Polyboroides typus*	Gymnogene
170	*Pandion haliaetus*	Osprey
171	*Falco peregrinus*	Falcon Peregrine
172	*Falco biarmicus*	Falcon Lanner
173	*Falco subbuteo*	Falcon Northern Hobby
179	*Falco vespertinus*	Kestrel Western Redfooted
180	*Falco amurensis*	Kestrel Eastern Redfooted
181	*Falco tinnunculus*	Kestrel Rock
182	*Falco rupicoloides*	Kestrel Greater
183	*Falco naumanni*	Kestrel Lesser
188	*Francolinus coqui*	Francolin Coqui
189	*Francolinus sephaena*	Francolin Crested
192	*Francolinus levaillantii*	Francolin Redwing
193	*Francolinus levaillantoides*	Francolin Orange River
196	*Francolinus natalensis*	Francolin Natal
199	*Francolinus swainsonii*	Francolin Swainson's
200	*Coturnix coturnix*	Quail Common
201	*Coturnix delegorguei*	Quail Harlequin
203	*Numida meleagris*	Guineafowl Helmeted
205	*Turnix sylvatica*	Buttonquail Kurrichane
208	*Anthropoides paradiseus*	Crane Blue
210	*Rallus caerulescens*	Rail African
211	*Crex crex*	Corncrake
212	*Crex egregia*	Crake African
213	*Amaurornis flavirostris*	Crake Black

215	*Porzana pusilla*	Crake Baillon's
217	*Sarothrura rufa*	Flufftail Redchested
223	*Porphyrio porphyrio*	Gallinule Purple
226	*Gallinula chloropus*	Moorhen Common
228	*Fulica cristata*	Coot Redknobbed
231	*Neotis denhami*	Bustard Stanley's
233	*Eupodotis senegalensis*	Korhaan Whitebellied
234	*Eupodotis caerulescens*	Korhaan Blue
239.1	*Eupodotis afraoides*	Korhaan Whitewinged
240	*Actophilornis africanus*	Jacana African
242	*Rostratula benghalensis*	Snipe Painted
245	*Charadrius hiaticula*	Plover Ringed
247	*Charadrius pallidus*	Plover Chestnutbanded
248	*Charadrius pecuarius*	Plover Kittlitz's
249	*Charadrius tricollaris*	Plover Threebanded
255	*Vanellus coronatus*	Plover Crowned
258	*Vanellus armatus*	Plover Blacksmith
260	*Vanellus senegallus*	Plover Wattled
264	*Tringa hypoleucos*	Sandpiper Common
265	*Tringa ochropus*	Sandpiper Green
266	*Tringa glareola*	Sandpiper Wood
269	*Tringa stagnatilis*	Sandpiper Marsh
270	*Tringa nebularia*	Greenshank
272	*Calidris ferruginea*	Sandpiper Curlew
274	*Calidris minuta*	Stint Little
284	*Philomachus pugnax*	Ruff
286	*Gallinago nigripennis*	Snipe Ethiopian
287	*Limosa limosa*	Godwit Blacktailed
294	*Recurvirostra avosetta*	Avocet Pied
295	*Himantopus himantopus*	Stilt Blackwinged
297	*Burhinus capensis*	Dikkop Spotted
300	*Temminck's Cursorius temminckii*	Courser
305	*Glareola nordmanni*	Pratincole Blackwinged
313	*Larus fuscus*	Gull Lesser Blackbacked
315	*Larus cirrocephalus*	Gull Greyheaded
322	*Sterna caspia*	Tern Caspian
338	*Chlidonias hybridus*	Tern Whiskered
339	*Chlidonias leucopterus*	Tern Whitewinged
348	*Columba livia*	Pigeon Feral
349	*Columba guinea*	Pigeon Rock
350	*Columba arquatrix*	Pigeon Rameron
352	*Streptopelia semitorquata*	Dove Redeyed
354	*Streptopelia capicola*	Dove Cape Turtle
355	*Streptopelia senegalensis*	Dove Laughing
356	*Oena capensis*	Dove Namaqua
366	*Psittacula krameri*	Parakeet Roseringed
373	*Corythaixoides concolor*	Lourie Grey
374	*Cuculus canorus*	Cuckoo Eurasian
377	*Cuculus solitarius*	Cuckoo Redchested
378	*Cuculus clamosus*	Cuckoo Black
380	*Clamator glandarius*	Cuckoo Great Spotted

381	*Oxylophus levaillantii*	Cuckoo Striped
382	*Oxylophus jacobinus*	Cuckoo Jacobin
385	*Chrysococcyx klaas*	Cuckoo Klaas's
386	*Chrysococcyx caprius*	Cuckoo Diederik
391	*Centropus burchellii*	Coucal Burchell's
392	*Tyto alba*	Owl Barn
393	*Tyto capensis*	Owl Grass
395	*Asio capensis*	Owl Marsh
397	*Otus leucotis*	Owl Whitefaced
398	*Glaucidium perlatum*	Owl Pearlspotted
400	*Bubo capensis*	Owl Cape Eagle
401	*Bubo africanus*	Owl Spotted Eagle
402	*Bubo lacteus*	Owl Giant Eagle
404	*Caprimulgus europaeus*	Nightjar Eurasian
405	*Caprimulgus pectoralis*	Nightjar Fierynecked
406	*Caprimulgus rufigena*	Nightjar Rufouscheeked
408	*Caprimulgus tristigma*	Nightjar Freckled
411	*Apus apus*	Swift Eurasian
412	*Apus barbatus*	Swift Black
415	*Apus caffer*	Swift Whiterumped
416	*Apus horus*	Swift Horus
417	*Apus affinis*	Swift Little
418	*Tachymarptis melba*	Swift Alpine
421	*Cypsiurus parvus*	Swift Palm
424	*Colius striatus*	Mousebird Speckled
426	*Urocolius indicus*	Mousebird Redfaced
428	*Ceryle rudis*	Kingfisher Pied
429	*Megaceryle maxima*	Kingfisher Giant
430	*Alcedo semitorquata*	Kingfisher Halfcollared
431	*Alcedo cristata*	Kingfisher Malachite
433	*Halcyon senegalensis*	Kingfisher Woodland
435	*Halcyon albiventris*	Kingfisher Brownhooded
437	*Halcyon chelicuti*	Kingfisher Striped
438	*Merops apiaster*	Bee-eater Eurasian
443	*Merops bullockoides*	Bee-eater Whitefronted
444	*Merops pusillus*	Bee-eater Little
446	*Coracias garrulus*	Roller Eurasian
451	*Upupa africana*	Hoopoe African
452	*Phoeniculus purpureus*	Woodhoopoe Redbilled
464	*Lybius torquatus*	Barbet Blackcollared
465	*Tricholaema leucomelas*	Barbet Pied
470	*Pogoniulus chrysoconus*	Barbet Yellowfronted Tinker
473	*Trachyphonus vaillantii*	Barbet Crested
474	*Indicator indicator*	Honeyguide Greater
476	*Indicator minor*	Honeyguide Lesser
478	*Prodotiscus regulus*	Honeyguide Sharpbilled
486	*Dendropicos fuscescens*	Woodpecker Cardinal
487	*Thripias namaquus*	Woodpecker Bearded
489	*Jynx ruficollis*	Wryneck Redthroated
492	*Mirafra cheniana*	Lark Melodious
494	*Mirafra africana*	Lark Rufousnaped
495	*Mirafra apiata*	Lark Clapper

496	*Mirafra rufocinnamomea*	Lark Flappet
498	*Mirafra sabota*	Lark Sabota
500	*Mirafra curvirostris*	Lark Longbilled
506	*Chersomanes albofasciata*	Lark Spikeheeled
507	*Calandrella cinerea*	Lark Redcapped
508	*Spizocorys conirostris*	Lark Pinkbilled
509	*Spizocorys fringillaris*	Lark Botha's
515	*Eremopterix leucotis*	Finchlark Chestnutbacked
518	*Hirundo rustica*	Swallow Eurasian
520	*Hirundo albigularis*	Swallow Whitethroated
523	*Hirundo dimidiata*	Swallow Pearlbreasted
524	*Hirundo semirufa*	Swallow Redbreasted
526	*Hirundo cucullata*	Swallow Greater Striped
527	*Hirundo abyssinica*	Swallow Lesser Striped
528	*Hirundo spilodera*	Swallow South African Cliff
529	*Hirundo fuligula*	Martin Rock
530	*Delichon urbica*	Martin House
532	*Riparia riparia*	Martin Sand
533	*Riparia paludicola*	Martin Brownthroated
534	*Riparia cincta*	Martin Banded
541	*Dicrurus adsimilis*	Drongo Forktailed
545	*Oriolus larvatus*	Oriole Blackheaded
547	*Corvus capensis*	Crow Black
548	*Corvus albus*	Crow Pied
554	*Parus niger*	Tit Southern Black
560	*Turdoides jardineii*	Babbler Arrowmarked
568	*Pycnonotus barbatus*	Bulbul Blackeyed
576	*Turdus libonyanus*	Thrush Kurrichane
577	*Turdus olivaceus*	Thrush Olive
580	*Psophocichla litsitsirupa*	Thrush Groundscraper
581	*Monticola rupestris*	Rockthrush Cape
582	*Monticola explorator*	Rockthrush Sentinel
586	*Oenanthe monticola*	Chat Mountain
587	*Oenanthe pileata*	Wheatear Capped
589	*Cercomela familiaris*	Chat Familiar
593	*Thamnolaea cinnamomeiventris*	Chat Mocking
595	*Myrmecocichla formicivora*	Chat Anteating
596	*Saxicola torquata*	Stonechat
601	*Cossypha caffra*	Robin Cape
619	*Sylvia borin*	Warbler Garden
620	*Sylvia communis*	Whitethroat
621	*Parisoma subcaeruleum*	Titbabbler
625	*Hippolais icterina*	Warbler Icterine
628	*Acrocephalus arundinaceus*	Warbler Great Reed
631	*Acrocephalus baeticatus*	Warbler African Marsh
633	*Acrocephalus palustris*	Warbler Eurasian Marsh
634	*Acrocephalus schoenobaenus*	Warbler Eurasian Sedge
635	*Acrocephalus gracilirostris*	Warbler Cape Reed
637	*Chloropeta natalensis*	Warbler Yellow
638	*Bradypterus baboecala*	Warbler African Sedge

643	*Phylloscopus trochilus*	Warbler Willow
645	*Apalis thoracica*	Apalis Barthroated
651	*Sylvietta rufescens*	Crombec Longbilled
661	*Sphenoeacus afer*	Grassbird
664	*Cisticola juncidis*	Cisticola Fantailed
665	*Cisticola aridulus*	Cisticola Desert
666	*Cisticola textrix*	Cisticola Cloud
667	*Cisticola ayresii*	Cisticola Ayres'
670	*Cisticola lais*	Cisticola Wailing
672	*Cisticola chinianus*	Cisticola Rattling
677	*Cisticola tinniens*	Cisticola Levaillant's
679	*Cisticola aberrans*	Cisticola Lazy
681	*Cisticola fulvicapillus*	Neddicky
683	*Prinia subflava*	Prinia Tawnyflanked
685	*Prinia flavicans*	Prinia Blackchested
689	*Muscicapa striata*	Flycatcher Spotted
694	*Melaenornis pammelaina*	Flycatcher Black
695	*Bradornis mariquensis*	Flycatcher Marico
698	*Sigelus silens*	Flycatcher Fiscal
706	*Stenostira scita*	Flycatcher Fairy
710	*Terpsiphone viridis*	Flycatcher Paradise
711	*Motacilla aguimp*	Wagtail African Pied
713	*Motacilla capensis*	Wagtail Cape
714	*Motacilla flava*	Wagtail Yellow
716	*Anthus cinnamomeus*	Pipit Grassveld
717	*Anthus similis*	Pipit Longbilled
718	*Anthus leucophrys*	Pipit Plainbacked
719	*Anthus vaalensis*	Pipit Buffy
720	*Anthus lineiventris*	Pipit Striped
726	*Tmetothylacus tenellus*	Pipit Golden
727	*Macronyx capensis*	Longclaw Orangethroated
731	*Lanius minor*	Shrike Lesser Grey
732	*Lanius collaris*	Shrike Fiscal
733	*Lanius collurio*	Shrike Redbacked
735	*Corvinella melanoleuca*	Shrike Longtailed
736	*Laniarius ferrugineus*	Boubou Southern
739	*Laniarius atrococcineus*	Boubou Crimsonbreasted
743	*Tchagra australis*	Tchagra Threestreaked
744	*Tchagra senegala*	Tchagra Blackcrowned
746	*Telophorus zeylonus*	Bokmakierie
758	*Acridotheres tristis*	Myna Indian
759	*Spreo bicolor*	Starling Pied
760	*Creatophora cinerea*	Starling Wattled
761	*Cinnyricinclus leucogaster*	Starling Plumcoloured
764	*Lamprotornis nitens*	Starling Glossy
769	*Onychognathus morio*	Starling Redwinged
775	*Nectarinia famosa*	Sunbird Malachite
779	*Nectarinia mariquensis*	Sunbird Marico
785	*Nectarinia afra*	Sunbird Greater Doublecollared
787	*Nectarinia talatala*	Sunbird Whitebellied
792	*Nectarinia amethystina*	Sunbird Black

796	*Zosterops pallidus*	White-eye Cape
799	*Plocepasser mahali*	Sparrowweaver Whitebrowed
801	*Passer domesticus*	Sparrow House
803	*Passer melanurus*	Sparrow Cape
804	*Greyheaded Passer diffusus*	Sparrow Southern
805	*Petronia superciliaris*	Sparrow Yellowthroated
807	*Amblyospiza albifrons*	Weaver Thickbilled
811	*Ploceus cucullatus*	Weaver Spottedbacked
813	*Ploceus capensis*	Weaver Cape
814	*Ploceus velatus*	Weaver Masked
820	*Anomalospiza imberbis*	Finch Cuckoofinch
821	*Quelea quelea*	Quelea Redbilled
824	*Euplectes orix*	Bishop Red
826	*Euplectes afer*	Bishop Golden
827	*Euplectes capensis*	Widow Yellowrumped
828	*Euplectes axillaris*	Widow Redshouldered
829	*Euplectes albonotatus*	Widow Whitewinged
831	*Euplectes ardens*	Widow Redcollared
832	*Euplectes progne*	Widow Longtailed
834	*Pytilia melba*	Finch Melba
840	*Lagonosticta rubricata*	Firefinch Bluebilled
842	*Lagonosticta senegala*	Firefinch Redbilled
846	*Estrilda astrild*	Waxbill Common
847	*Estrilda erythronotos*	Waxbill Blackcheeked
852	*Ortygospiza atricollis*	Finch Quail
854	*Sporaeginthus subflavus*	Waxbill Orangebreasted
855	*Amadina fasciata*	Finch Cutthroat
856	*Amadina erythrocephala*	Finch Redheaded
857	*Spermestes cucullatus*	Mannikin Bronze
860	*Vidua macroura*	Whydah Pintailed
862	*Vidua paradisaea*	Whydah Paradise
864	*Vidua funerea*	Widowfinch Black
867	*Vidua chalybeata*	Widowfinch Steelblue
869	*Serinus mozambicus*	Canary Yelloweyed
870	*Serinus atrogularis*	Canary Blackthroated
872	*Serinus canicollis*	Canary Cape
878	*Serinus flaviventris*	Canary Yellow
881	*Serinus gularis*	Canary Streakyheaded
884	*Emberiza flaviventris*	Bunting Goldenbreasted
885	*Emberiza capensis*	Bunting Cape
886	*Emberiza tahapisi*	Bunting Rock
887	*Emberiza impetuani*	Bunting Larklike

APPENDIX 7

LIST OF RECORDED BIRD SPECIES

Roberts No.	Common Name	Biological Name
58	Cormorant Reed	*Phalacrocorax africanus*
60	Darter	*Anhinga rufa*
62	Heron Grey	*Ardea cinerea*
66	Egret Great White	*Casmerodius albus*
71	Egret Cattle	*Bubulcus ibis*
81	Hamerkop	*Scopus umbretta*
91	Ibis Sacred	*Threskiornis aethiopicus*
93	Ibis Glossy	*Plegadis falcinellus*
94	Ibis Hadeda	*Bostrychia hagedash*
95	Spoonbill African	*Platalea alba*
102	Goose Egyptian	*Alopochen aegyptiacus*
127	Kite Blackshouldered	*Elanus caeruleus*
193	Francolin Orange River	*Francolinus levaillantoides*
196	Francolin Natal	*Francolinus natalensis*
199	Francolin Swainson's	*Francolinus swainsonii*
200	Quail Common	*Coturnix coturnix*
203	Guineafowl Helmeted	*Numida meleagris*
208	Crane Blue	*Anthropoides paradiseus*
233	Korhaan Whitebellied	*Eupodotis senegalensis*
234	Korhaan Blue	*Eupodotis caerulescens*
242	Snipe Painted	*Rostratula benghalensis*
248	Plover Kittlitz's	*Charadrius pecuarius*
255	Plover Crowned	*Vanellus coronatus*
258	Plover Blacksmith	*Vanellus armatus*
260	Plover Wattled	*Vanellus senegallus*
284	Ruff	*Philomachus pugnax*
286	Snipe Ethiopian	*Gallinago nigripennis*
297	Dikkop Spotted	*Burhinus capensis*
300	Courser Temminck's	*Cursorius temminckii*
349	Pigeon Rock	*Columba guinea*
354	Dove Cape Turtle	*Streptopelia capicola*
355	Dove Laughing	*Streptopelia senegalensis*
356	Dove Namaqua	*Oena capensis*
393	Owl Grass	*Tyto capensis*
428	Kingfisher Pied	*Ceryle rudis*
451	Hoopoe African	*Upupa africana*
494	Lark Rufousnaped	*Mirafra africana*
495	Lark Clapper	*Mirafra apiata*
496	Lark Flappet	*Mirafra rufocinnamomea*
498	Lark Sabota	*Mirafra sabota*
500	Lark Longbilled	*Mirafra curvirostris*
506	Lark Spikeheeled	*Chersomanes albofasciata*
507	Lark Redcapped	*Calandrella cinerea*
526	Swallow Greater Striped	*Hirundo cucullata*
527	Swallow Lesser Striped	*Hirundo abyssinica*
548	Crow Pied	*Corvus albus*
568	Bulbul Blackeyed	*Pycnonotus barbatus*
586	Chat Mountain	*Oenanthe monticola*
587	Wheatear Capped	*Oenanthe pileata*

589	Chat Familiar	*Cercomela familiaris*
595	Chat Anteating	*Myrmecocichla formicivora*
664	Cisticola Fantailed	*Cisticola juncidis*
665	Cisticola Desert	*Cisticola aridulus*
677	Cisticola Levaillant's	*Cisticola tinniens*
681	Neddicky	*Cisticola fulvicapillus*
698	Flycatcher Fiscal	*Sigelus silens*
713	Wagtail Cape	*Motacilla capensis*
727	Longclaw Orangethroated	*Macronyx capensis*
731	Shrike Lesser Grey	*Lanius minor*
732	Shrike Fiscal	*Lanius collaris*
746	Bokmakierie	*Telophorus zeylonus*
759	Starling Pied	*Spreo bicolor*
760	Starling Wattled	*Creatophora cinerea*
803	Sparrow Cape	*Passer melanurus*
814	Weaver Masked	*Ploceus velatus*
824	Bishop Red	*Euplectes orix*
826	Bishop Golden	*Euplectes afer*
828	Widow Redshouldered	*Euplectes axillaris*
829	Widow Whitewinged	*Euplectes albonotatus*
846	Waxbill Common	*Estrilda astrild*
847	Waxbill Blackcheeked	*Estrilda erythronotos*
862	Whydah Paradise	*Vidua paradisaea*
870	Canary Blackthroated	*Serinus atrogularis*

APPENDIX 8

LIST OF EXPECTED MAMMAL SPECIES

Biological Name	Common Name
Chrysopalax villosus	Rough haired Golden Mole
Amblysomus hottentotus	Hottentot Golden Mole
Elephantulus myurus	Rock Elephant Shrew
Myosorex varius	Forest Shrew
Crocidura mariquensis	Swamp Musk Shrew
Crocidura cyanea	Reddish-grey Musk Shrew
Crocidura hirta	Lesser Red Musk Shrew
Nycteris thebiaca	Egyptian Slit-faced Bat
Rhinolophus clivosus	Geoffreys Horseshoe Bat
Miniopterus schreibersii	Schriebers Long-fingered Bat
Eptesicus capensis	Cape serotine Bat
Myotis tricolor	Temmincks Hairy Bat
Tadarida aegyptica	Egyptian Free-taled Bat
Lepus saxatilis	Scrub Hare
Graphiurus murinus	Woodland Dormouse
Graphiurus parvus	Lesser Savanna Dormouse
Cryptomus hottentotus	Common Molerat
Hystrix africaeaustralis	Porcupine
Dendromus melatonis	Grey Climbing Mouse
Dendromus mystacalis	Chestnut Climbing Mouse
Tatera leucogaster	Bushveld Gerbil
Tatera brantsii	Highveld Gerbil
Aethomys namaquensis	Namaqua Rock Mouse
Aethomys chrysophilus	Red Veld Rat
Dasymys incomtus	Water Rat
Rhabdomys pumilio	Striped Mouse
Mus minutoides	Pygmy mouse
Mus musculus	House mouse
Thallomys paeduculus	Tree mouse
Mastomys coucha/natalensis	(Natal) Multimammate Mouse
Rattus rattus	House Rat
Otomys angoniensis	Angoni Vlei Rat
Otomys irroratus	Vlei Rat
Aonyx capensis	Cape Clawless Otter
Lutra maculicollis	Spotted-necked Otter
Poecilogale albinucha	Striped Weasel
Ictonyx striatus	Striped Polecat
Galerella sanguinea	Slender Mongoose
Atilax paludinosus	Water Mongoose
Ichneumia albicauda	White-tailed Mongoose
Cynictis penicillata	Yellow Mongoose
Genetta genetta	Small-spotted Genett
Genetta tigrina	Large-spotted Genett
Felis lybica	African Wild Cat
Procavia capensis	Rock Dassie (Hyrax)

APPENDIX 9

LIST OF RECORDED MAMMAL SPECIES

Common Name	Biological Name
Hottentot Golden Mole	*Amblysomus hottentotus*
Scrub Hare	*Lepus saxatilis*
Woodland Dormouse	*Graphiurus murinus*
Porcupine	*Hystrix africaeaustralis*
Striped Mouse	*Rhabdomys pumilio*
Vlei Rat	*Otomys irroratus*
Cape Clawless Otter	*Aonyx capensis*
Spotted-necked Otter	*Lutra maculicollis*
White-tailed Mongoose	*Ichneumia albicauda*
Yellow Mongoose	*Cynictis penicillata*

APPENDIX 10

LIST OF EXPECTED AMPHIBIAN SPECIES

Common Name	**Biological Name**
Common Platanna	*Xenopis laevis*
Bubblin Kassina	*Kassina senegalensis*
Giant Bullfrog	*Pyxicephalus adspersus*
Tremelo Sand Frog	*Tomopterna cryptotis*
Natal Sand Frog	*Tomopterna natalensis*
Raucous Toad	*Bufo rangeri*
Guttural Toad	*Bufo gutturalis*
Red Toad	*Schismaderma carens*
Striped River Frog	*Strongylopus fasciatus*
Common River Frog	*Afrana angolensis*
Common Caco	*Cacosternum boettgeri*
Snoring Puddle Frog	*Phrynobatrachus natalensis*

APPENDIX 11

LIST OF RECORDED AMPHIBIAN SPECIES

Common Name	**Biological Name**
Guttural Toad	*Bufo gutturalis*
Striped River Frog	*Strongylopus fasciatus*
Common River Frog	*Afrana angolensis*
Common Caco	*Cacosternum boettgeri*

APPENDIX 12

LIST OF EXPECTED REPTILE SPECIES

Common Name	**Biological Name**
Marsh Terrapin	*Pelomedusa subrufa*
Bibrons Blind Snake	*Typhlops bibronii*
Delalandes Blinde Snake	*Typhlops lalandei*
Cape Thread Snake	*Leptotyplops conjunctus*
Peters Thread Snake	*Leptotyplops scutifrons*
Common Brown Water Snake	*Lycodonomorphus rufulus*
Brown House Snake	*Lamprophis fuliginosus*
Aurora house Snake	*Lamprophis aurora*
Cape Wolf Snake	*Lycophidion capense*
Common Slug Eater	*Duberria lutrix*
Mole Snake	*Pseudaspis cana*
Rhombic Skaapsteker	*Psammophylaxrhombeatus*
Montane Grass Snake	*Psamorphis crucifer*
Cape Centipede Eater	*Aparallactus lunulatus*
Spotted Harlequin Snake	*Homoroselaps lecteus*
Striped Herlequin Snake	*Homoroselaps dorsalis*
Green Water Snake	*Philothanus hoplogaster*
Natal Green Snake	*Philothanus natalensis*
Rhombic Egg Eater	*Dasypeltis scabra*
Herald Snake	*Crotaphopeltis hotamboeia*
Sundevalls Garter Snake	*Elapsoidea sundevallii*
Rinkhals	*Hemachatus haemachatus*
Rhombic Night Adder	*Causus rhombeatus*
Puffadder	*Bitis arietans*
Cape Skink	*Mabuya capensis*
Striped Skink	*Mabuya striata*
Variable Skink	*Mabuya varia*
Yellow-throated Plate Lizard	*Gerrhosaurus flavigularis*
Transvaal Grass Lizard	*Chammaesaura aenea*
Transvaal Girdled Lizard	*Cordylus tropidosternum*
Rock Monitor	*Varanus exanthematicus*
Nile Monitor	*Varanus niloticus*
Rock Agama	*Agama aculeata*
Cape Gecko	*Pachydactylus capensis*

APPENDIX 13

LIST OF RECORDED REPTILE SPECIES

Common Name	Biological Name
Puffadder	*Bitis arietans*
Cape Skink	*Mabuya capensis*
Striped Skink	*Mabuya striata*
Rock Agama	*Agama aculeata*

APPENDIX 14

SERVICES SCORES FOR WETLAND UNITS

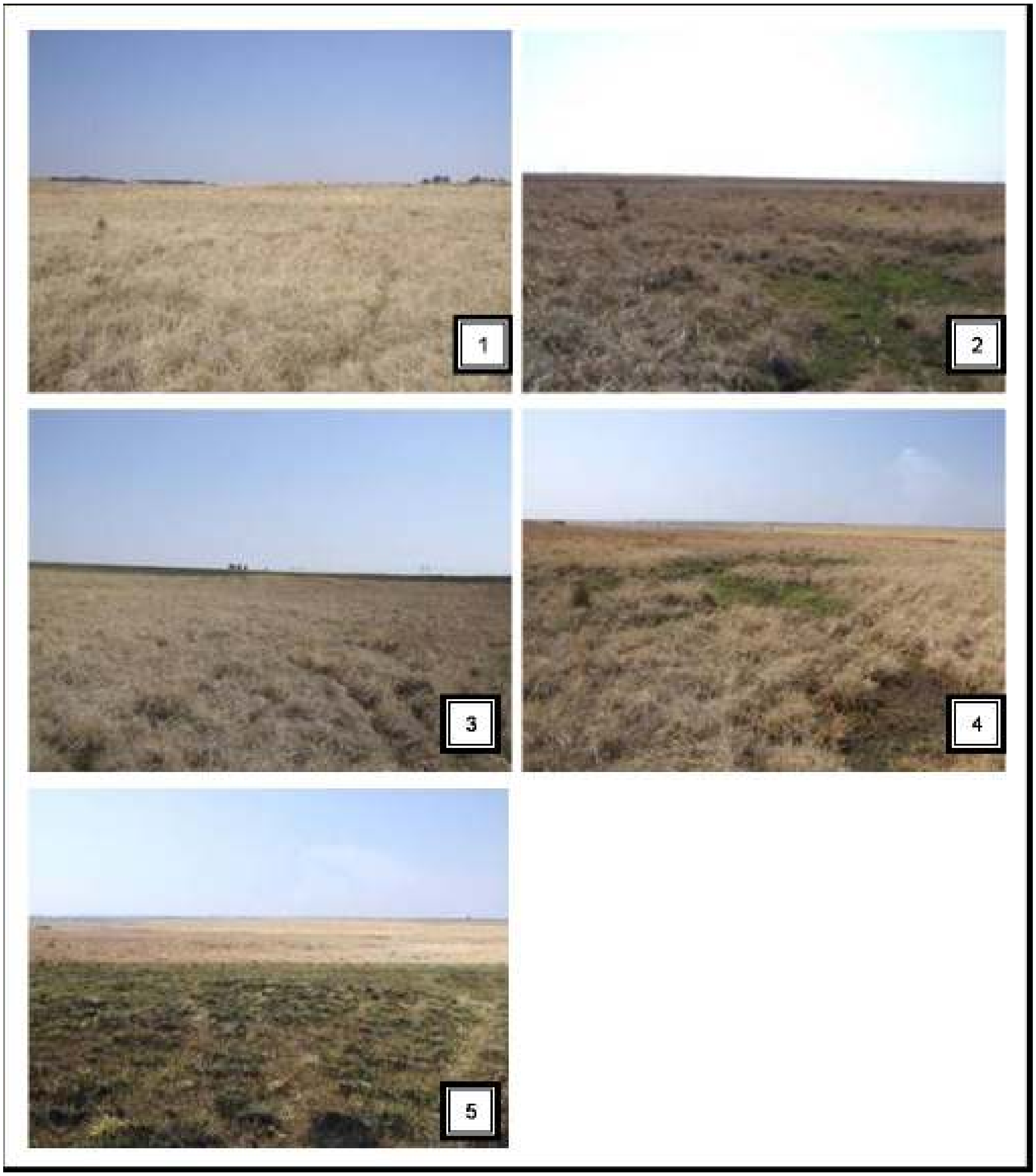
	YFP1		YVB1		YCHSW1		YVBC1		YVBC2		YHSW8	
Servives	Score	Confidence	**Score**	**Confidence**	**Score**	**Confidence**	**Score**	**Confidence**	**Score**	**Confidence**	**Score**	**Confidence**
Flood attenuation	1.8	2.8	1.4	2.7	1.8	2.7	2.1	2.9	1.8	2.9	1.4	3.0
Streamflow regulation	2.5	3.2	2.2	3.0	2.3	3.2	2.5	3.2	2.3	3.2	2.7	3.2
Sediment trapping	3.0	3.0	2.9	2.9	2.0	3.0	3.2	3.0	2.5	3.3	2.5	2.8
Phospahte trapping	2.2	2.5	2.2	3.1	2.3	3.0	2.9	3.2	3.0	3.4	2.7	2.9
Nitrate removal	1.7	2.5	2.8	2.3	2.5	3.0	1.7	3.2	2.8	3.2	3.5	3.0
Toxicant removal	2.1	2.9	2.3	2.7	2.0	3.0	2.4	3.2	2.7	3.2	2.9	2.9
Erosion control	2.2	2.7	2.5	2.4	2.1	2.7	2.1	3.1	2.0	3.0	2.1	2.9
Carbon storage	1.7	2.7	1.0	2.3	1.7	3.0	1.3	3.0	1.7	3.0	2.3	3.0
Maintenance of biodiversity	1.8	2.8	1.8	2.7	2.8	3.2	4.0	3.2	1.9	3.2	2.4	3.0
Water supply for human use	1.4	3.2	1.2	2.8	0.9	2.0	2.8	3.5	1.6	3.0	1.4	3.0
Natural resources	2.0	3.6	2.2	3.4	0.8	3.6	1.6	3.2	1.2	3.4	0.6	3.4
Cultivated foods	1.0	3.6	1.4	3.2	0.8	2.4	1.4	3.4	1.2	3.0	0.6	3.0
Cultural significance	0.0	3.0	0.0	3.0	0.0	3.0	0.0	3.8	0.0	3.3	0.0	3.0
Tourism and recreation	1.0	2.4	0.9	2.6	0.6	3.4	2.7	3.4	0.6	3.0	0.6	3.0
Education and research	1.5	3.3	1.5	3.3	1.0	3.0	2.0	3.5	1.5	3.3	1.3	3.3
Threats	3.0	3.0	3.0	2.0	3.0	3.0	3.0	4.0	3.0	3.0	3.0	3.0
Opportunities	2.0	3.0	1.0	2.0	0.0	3.0	3.0	4.0	2.0	3.0	2.0	3.0

	YHSW5		XD1		XVBC1		XHS1		XVB1		XVB2	
Servives	**Score**	**Confidence**	**Score**	**Confidence**	**Score**	**Confidence**	**Score**	**Confidence**	**Score**	**Confidence**	**Score**	**Confidence**
Flood attenuation	1.8	2.9	2.3	1.8	1.8	2.5	2.2	2.8	1.8	3.0	1.9	2.9
Streamflow regulation	2.5	3.2	2.0	3.0	2.2	3.2	2.0	3.0	2.7	3.2	2.0	3.0
Sediment trapping	2.2	2.8	2.2	2.8	2.8	3.0	3.2	2.9	2.9	3.0	2.2	3.0
Phospahte trapping	2.1	2.9	2.6	2.8	2.4	3.0	2.6	3.0	2.1	3.0	2.1	2.8

Nitrate removal	3.3	3.2	1.2	3.0	1.8	3.0	2.5	2.8	3.0	3.0	1.8	2.8
Toxicant removal	2.5	2.9	1.6	2.8	1.9	3.0	2.7	2.8	2.8	3.0	2.2	2.8
Erosion control	2.4	3.0	1.8	2.1	2.1	3.0	1.6	3.1	2.4	3.0	2.3	3.0
Carbon storage	2.7	3.0	0.0	3.0	1.0	3.0	0.7	3.0	2.3	3.0	1.3	2.7
Maintenance of biodiversity	3.5	3.0	1.3	3.0	1.3	3.0	0.5	3.1	2.2	3.0	1.6	3.0
Water supply for human use	1.6	3.0	0.3	3.0	2.0	3.0	2.0	3.2	1.4	3.0	1.0	2.8
Natural resources	0.6	3.0	0.6	3.0	1.4	3.0	0.8	3.8	0.8	3.0	0.4	2.8
Cultivated foods	0.0	3.0	0.2	3.0	1.2	3.0	1.4	3.0	0.8	3.2	1.0	3.0
Cultural significance	0.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0	0.0	3.0
Tourism and recreation	0.3	3.2	0.4	3.0	1.4	3.0	0.0	4.0	0.7	3.0	0.4	3.0
Education and research	1.0	3.0	0.0	3.0	0.8	3.0	0.3	3.5	1.0	3.0	1.0	3.0
Threats	3.0	3.0	3.0	3.0	4.0	3.0	4.0	4.0	3.0	3.0	3.0	3.0
Opportunities	1.0	3.0	1.0	3.0	3.0	3.0	0.0	4.0	3.0	3.0	1.0	3.0

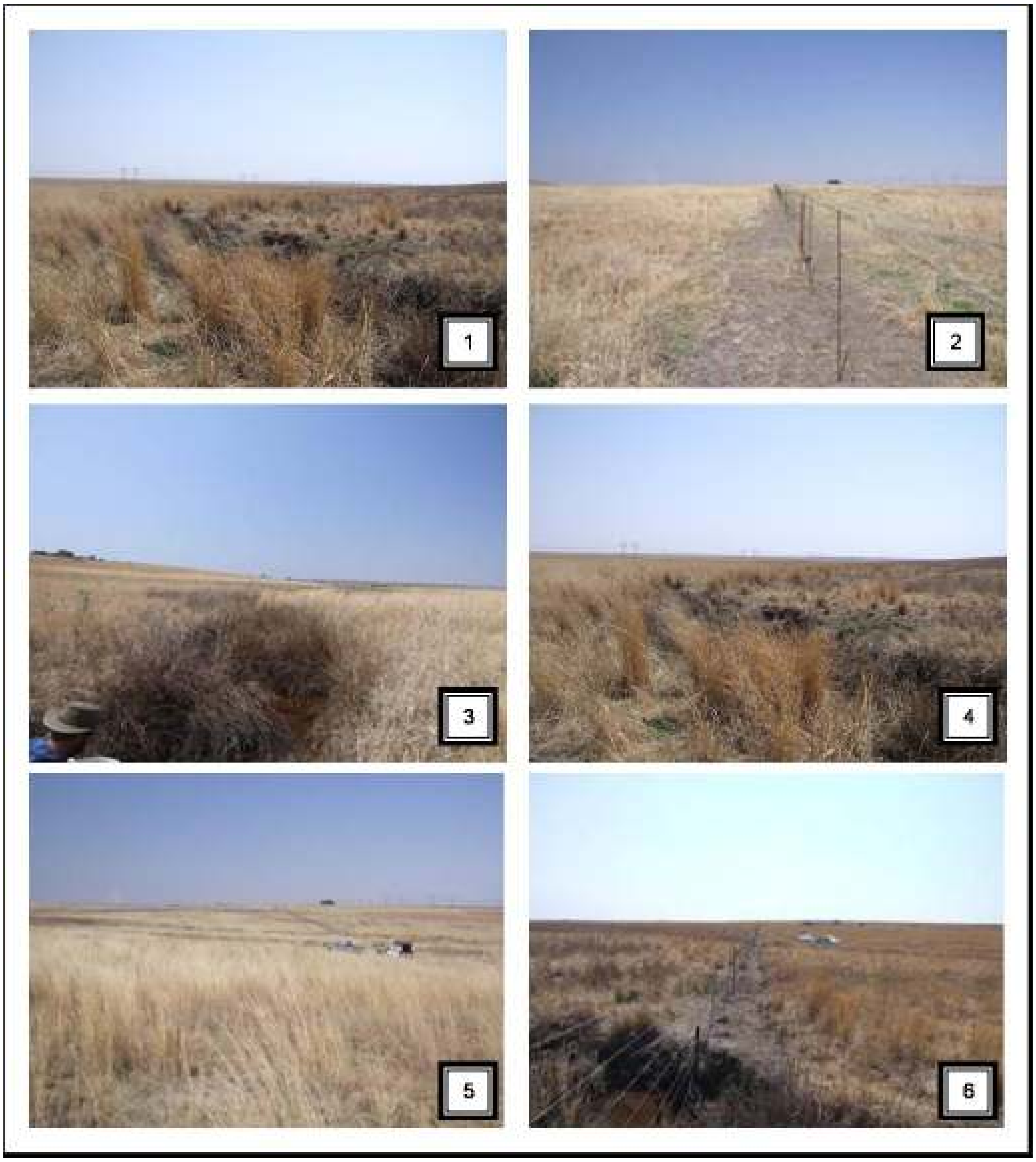
APPENDIX 15

SAMPLE SITE PHOTOGRAPHS



Site XHFSAD: 1) Left hand bank, 2) Right hand bank, 3) Upstream, 4) Downstream, 5) Valley.

Site XKFSDS: 1) Left hand bank, 2) Right hand bank, 3) Upstream, 4) Downstream.



Site XKFSCSAD: 1) Left hand bank, 2) Right hand bank, 3) Upstream, 4) Downstream, 5) Valley, 6) Transverse.

Site XPSPAN: 1) Left hand bank, 2) Right hand bank.

Site XKFSPS: 1) Upstream, 2) Downstream, 3) Valley, 4) Transverse.

Site XKSDS: 1) Left hand bank, 2) Right hand bank, 3) Upstream, 4) Downstream, 5) Valley,

Site YKSUS: 1) Left hand bank, 2) Right hand bank, 3) Upstream, 4) Downstream, 5) Valley, 6) Transverse,

Site YKWRDS: 1) Left hand bank, 2) Right hand bank, 3) Upstream, 4) Downstream, 5) Valley, 6) Transverse.

Site YWRUS: 1) Left hand bank, 2) Right hand bank, 3) Upstream, 4) Downstream.

APPENDIX 16

ESKOM KENDAL WETLAND DELINEATION SOIL SURVEY

VILJOEN & ASSOCIATES

Wetland Verification, Delineation & Impact Assessment for Kusile Ash Dump

For:

Tania Oosthuizen

Knight Piésold (Pty) Ltd

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Reference: 689/2011

APPROVAL

COMPILED BY:	CHECKED BY:	APPROVED BY:
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DATE: April 2011	DATE:	DATE:

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DATE	No.	DESCRIPTION OF REVISION OR AMENDMENT	INITIAL

DOCUMENT SUMMARY DATA

PROJECT:	**Wetland Delineation and Impact assessment, Kusile Ash Dump**
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INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and Wetland Consulting Services (Pty.) Ltd. and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to this investigation.

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1. BACKGROUND INFORMATION

Wetland Consulting Services (Pty) Ltd was appointed by Tania Oosthuizen from Knight Piésold to establish the extent of the wetlands and assess the potential impacts on these wetlands within the footprint of an ash dump associated with the Kusile Power Station. It is understood that the site selected for the Ash Dump was a conscious decision based on the limited impact that the ash dump would have on the environment. A wetland was identified within the footprint of the proposed ash dump, classified as a depression. It is a widely perceived belief that pans reflect contained systems with little to no drainage from them and thus would be considered as ideal systems to contain wastes.

The purpose of this document is to describe the wetlands found within the study area, to map, classify and assess the impact of the planned ash dump on the wetlands, all as a necessary requirement for inclusion in a Water Use License Application.

2. SCOPE OF WORK

The following task formed part of the agreed upon scope of work:

- ⇒ Confirmation/rejection of the presence of previously identified wetlands on site;
- ⇒ If present, delineation and mapping of the wetland extent; and
- ⇒ Establish the Present Ecological State and Ecological Importance and Sensitivity of the wetland
- ⇒ Assess the impact of the ash dump on the wetland
- ⇒ Identify and describe mitigation measures associated with the proposed activity.

3. LIMITATIONS

Due to the scale of the remote imagery used (1:10 000 ortho-photographs and Google Earth Imagery), as well as the accuracy of the handheld GPS unit used to delineate wetlands in the field, the delineated wetland boundaries cannot be guaranteed beyond an accuracy of about 20m on the ground. Should greater mapping accuracy be required, the wetlands would need to be pegged in the field and surveyed using conventional survey techniques.

4. STUDY AREA

4.1 Location

The study area is located south of the N4, and west of the Balmoral/ Kendall Road, the R545, in Mpumalanga. The location and extent of the property is illustrated in Figure 1. The study area was initially confined to the footprint of the actual ash dump, but after cursorily examining aerial photographs, areas outside of the original study area were included. The additional areas covered extended to the south and west of the footprint of the ash dump to include the areas identified for the dirty water dams and the soil stockpiles.

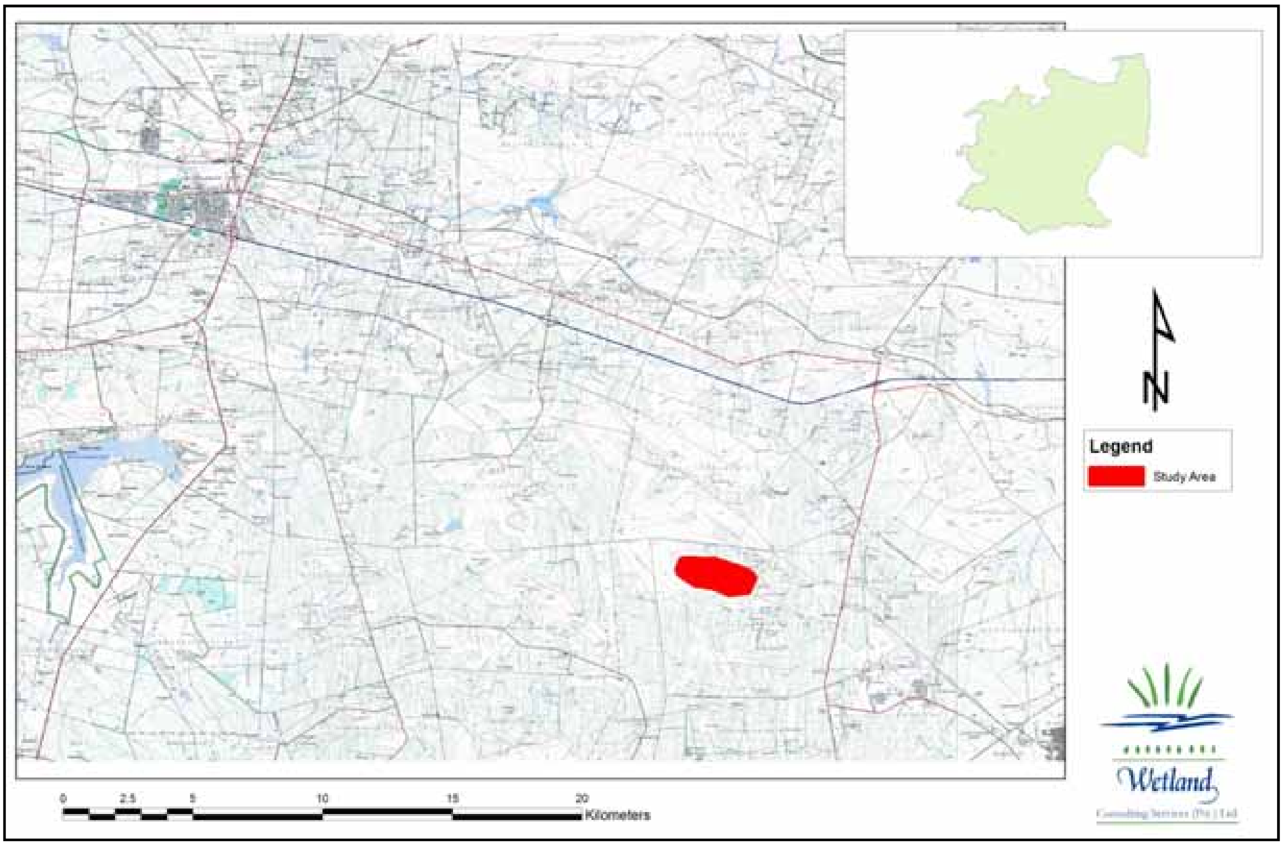

Figure 1. Map showing the location of the original defined study area.

4.2 Catchments

The study area is located within the Oliphant's River Catchment (Primary Catchment B), and more specifically within quaternary catchment B20F. The catchment drains into the Wilge River.

Information regarding catchment size, mean annual rainfall and runoff for the quaternary catchment is provided in the table below (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990). Figure 2 indicates the position of the study area in relation to the affected quaternary catchment.

Table 1. Table showing the mean annual precipitation, run-off and potential evaporation per quaternary catchment (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990).

Quaternary Catchment	Catchment Surface Area km^2	Mean Annual Rainfall (MAP) in mm	Mean Annual Run-off (MAR) in mm	MAR as a % of MAP
B20F	0.045443	666	33	5

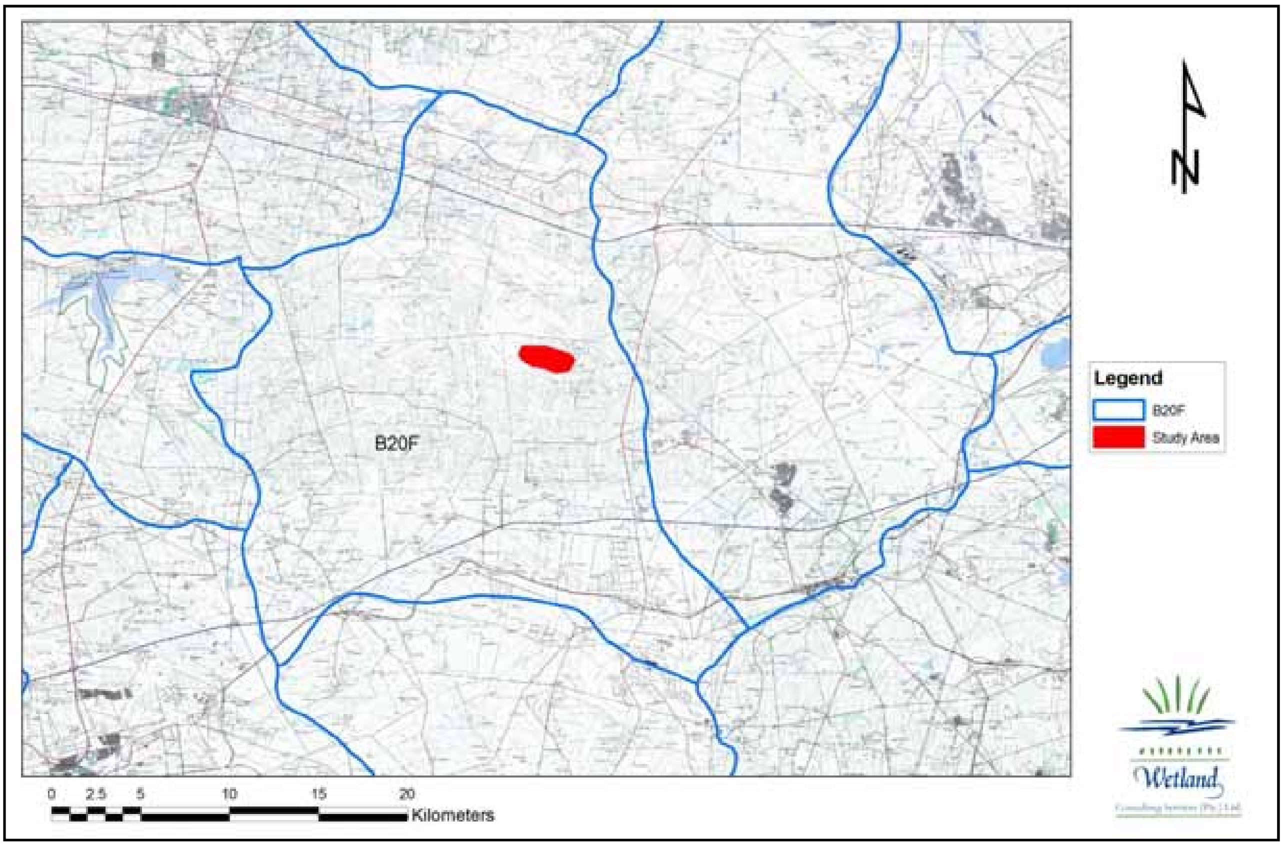

Figure 2. Map showing the study area in relation to the quaternary catchment.

4.3 Geology and Soils

According to the 1:250 000 Geological Map Series of South Africa 2528 East Rand, the study area is underlain by a diabase sill overlain by tillite and shales of the Dwyka formation of the Karoo system. Shales associated with the Strubenskop formation outcrop on the eastern section of the site, Figure 3.

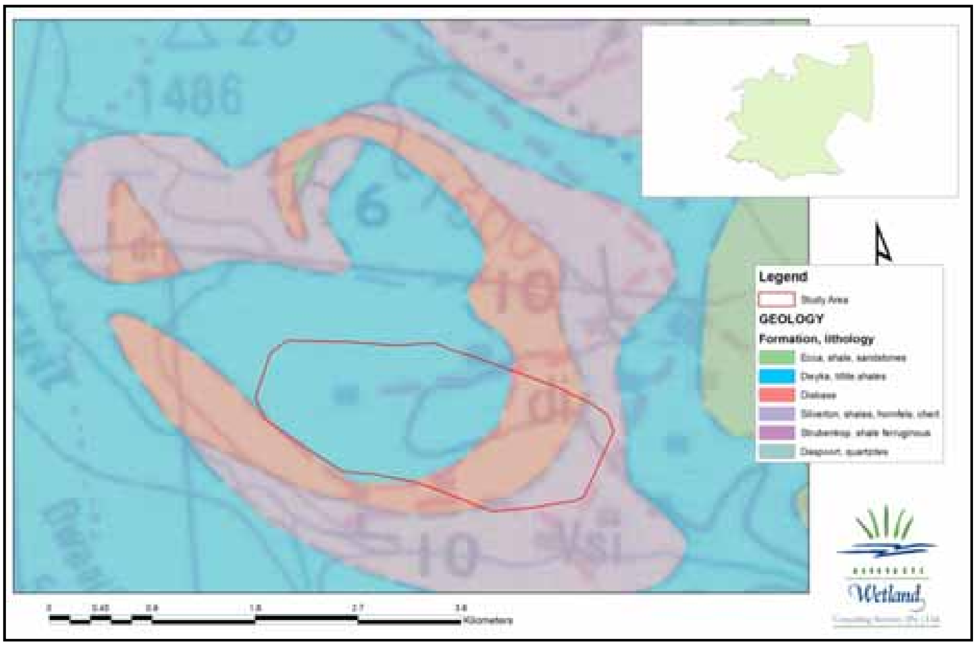

Figure 3. Simplified map indicating the dominant geology of the site. (source 1:250 000 2528 geology map)

The soils associated with this site range from moderately deep sandy soils , cultivated in the past to shallow soils, in some instances underlain by a well-developed ferricrete horizon, to rocky in places.

5. APPROACH

5.1 Wetland Delineation and Classification

Use was made of 1:50 000 topographical maps, 1:10 000 orthophotos and Google Earth Imagery to create digital base maps of the study area onto which the wetland boundaries could be delineated using ArcMap 9.0. A desktop delineation of suspected wetland areas was undertaken by identifying rivers and wetness signatures on the digital base maps. All identified areas suspected to be wetlands were then further investigated in the field.

Wetlands were identified and delineated according to the delineation procedure as set out by the "*A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas*" document, as described by DWAF (2005) and Kotze and Marneweck (1999). Using this procedure, wetlands were identified and delineated using the Terrain Unit Indicator, the Soil Form Indicator, the Soil Wetness Indicator and the Vegetation Indicator.

For the purposes of delineating the actual wetland boundaries use is made of indirect indicators of prolonged saturation, namely wetland plants (hydrophytes) and wetland soils (hydromorphic soils), with particular emphasis on hydromorphic soils. It is important to note that under normal conditions hydromorphic soils must display signs of wetness (mottling and gleying) within 50cm of the soil surface for an area to be classified as a wetland (*A practical field procedure for identification and delineation of wetlands and riparian areas*, DWAF).

The delineated wetlands were then classified using a hydro-geomorphic classification system based on the system proposed SANBI (2009).

6. FINDINGS

6.1 Wetland Delineation and Classification

The National Water Act, Act 36 of 1998, defines wetlands as follows:

> *"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

The presence of wetlands in the landscape can be linked to the presence of both surface water and perched groundwater. Wetland types are differentiated based on their hydro-geomorphic (HGM) characteristics; i.e. on the position of the wetland in the landscape, as well as the way in which water moves into, through and out of the wetland systems. A schematic diagram of how these wetland systems are positioned in the landscape is given in the figure below. The wetlands originally identified on the site in 2006, (Ecosun, 2006) comprised only the valley head pan and its associated seeps and a channelled valley bottom wetland.

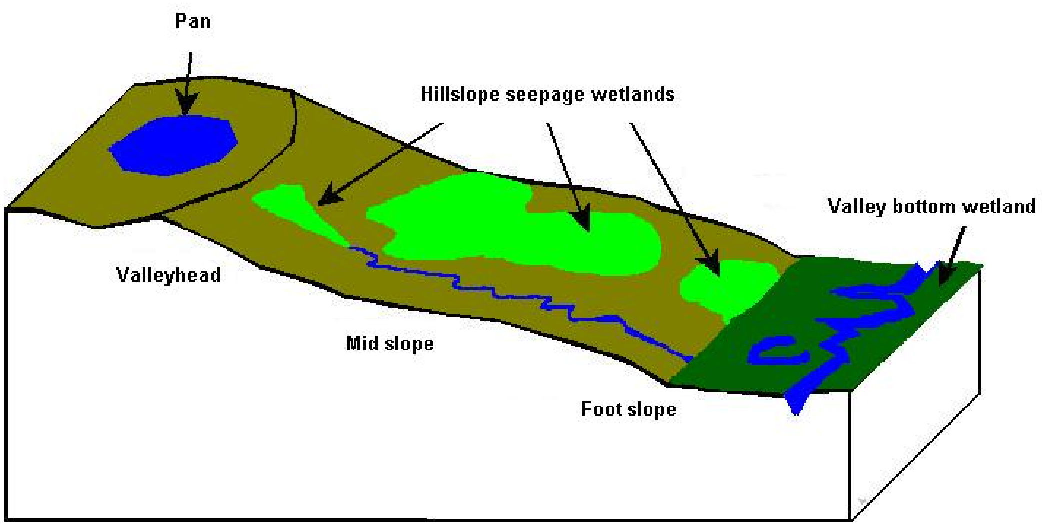

Figure 4. Diagram illustrating the position of the various wetland types within the landscape.

A site visit to the Kusile Ash dump study area was undertaken on 3 March and again on 7 March 2011. Two wetland types were identified on the site itself a depression or pan with associated seepage wetlands and contact seepage wetlands on the and south western slopes of the site. The extent of the identified delineated wetlands together with the valley bottom wetland are illustrated in the figure below, Figure 5, and their respective areas in Table 2. These identified wetlands occupy 8% of the catchment area of 207 ha, of which 98 ha of the catchment falls within the footprint of the proposed ash dump.

Table 2. Summary of the wetland types expressed as a percentage of the area of wetlands.

HGM Unit	HGM Type	Ha	% of wetlands
1	Isolated Hillslope seepage associated with pan	7.9	46
2	Depression (includes Pans)	2.3	13
3	Contact seepage wetlands	7.1	41
Total		**17.3**	**100**

Of these wetlands, the hillslope seepage wetlands associated with the depression and the depression itself were identified in a previous study conducted by ECOSUN in 2006, Report No: E457/06/B. The contact wetlands were not recorded.

The seepage wetlands on site were delineated based on the presence of hydromorphic features in the soil such as mottling and gleying on the deeper soils, while the presence of certain vegetation types was used for delineation in areas where the soil was shallow. These wetlands are generally seasonally to temporarily saturated, and are dependent on water derived from rainfall and its storage and slow release into the wetlands from adjacent upslope areas. Typical wetland indicator species observed in the seepage wetlands include *Aristida junciformis*, *Eragrostis gummiflua*, *Helictotrichon turgidulum*, *Hemarthria altissima*, *Leersia hexandra*, *Setaria* spp., *Cyperaceae* spp., *Fimbrostylis complanata*, *Fuirena pubescens*, *Kyllinga erecta*, *Chironia purpurascens*, *Haplocarpha scaposa*, *Helichrysum aureonitens*, *Pseudognaphalium luteo-album*, and *Wahlenbergia caledonica*.

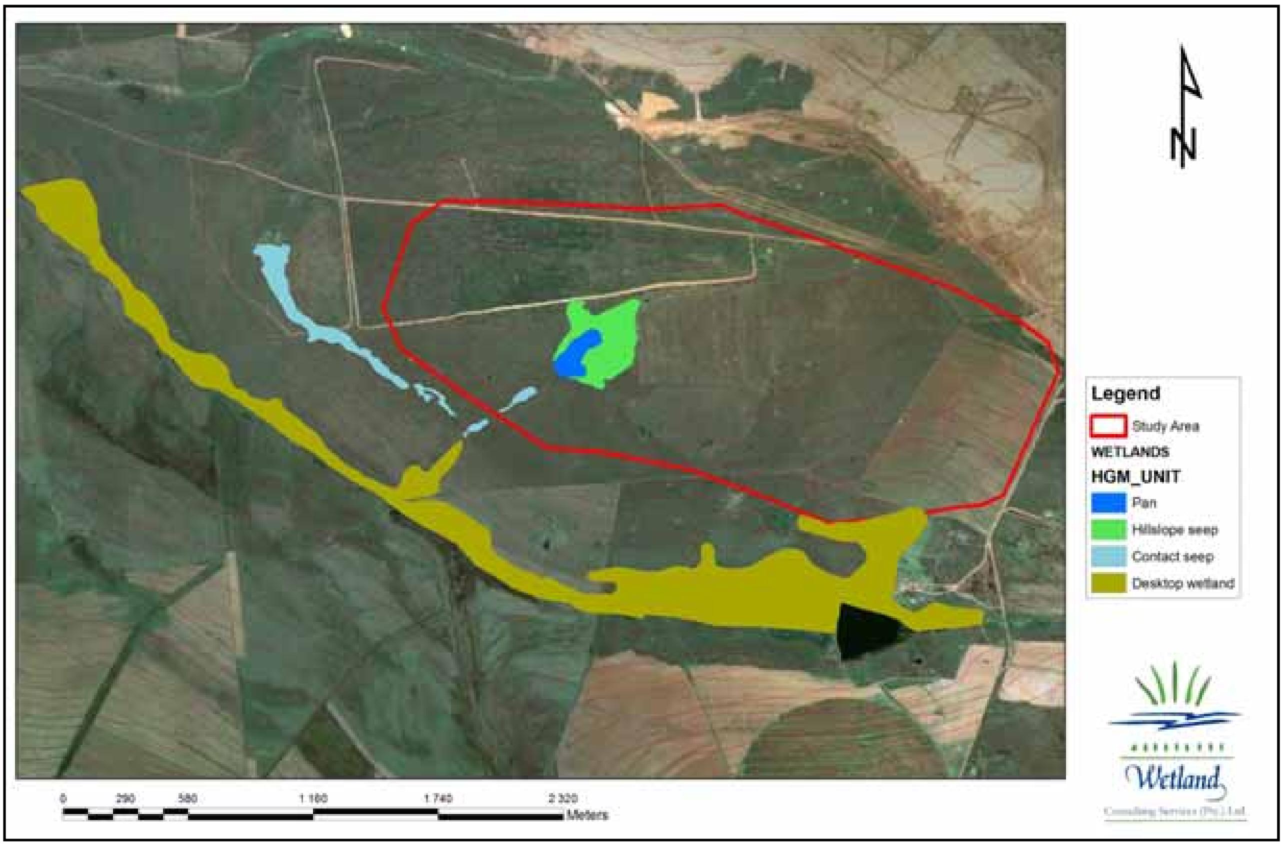

Figure 5. Map of the delineated wetlands on site.

The hillslope seepage wetlands to the east of the pan are on deep to moderately deep sandy soils while those to the north and west are associated with shallow rocky soils, underlain in places by a hard ferricrete horizon. There is a ferricrete sill in the south eastern section of the pan which appears to provide an impediment to flow although the seep immediately downslope of the depression would suggest that a connection exits between the pan the seepage wetland. The presence of a lineament identified by Partridge and Maud would explain this feature.

The sandy soil allows easy infiltration of rainwater into the soil. Infiltrated water thus starts slowly percolating laterally through the soil profile along the aquitard. Most of this water is likely lost to evapotranspiration over time (in the process supporting the vegetation growing on site), while some is discharged into the adjacent stream. The largest contribution of these seepage wetlands to stream flow probably occurs during high rainfall periods when the shallow soils of the seepage wetland become saturated faster than upslope terrestrial areas and encourage surface runoff into the stream (McCarthy, 2000).

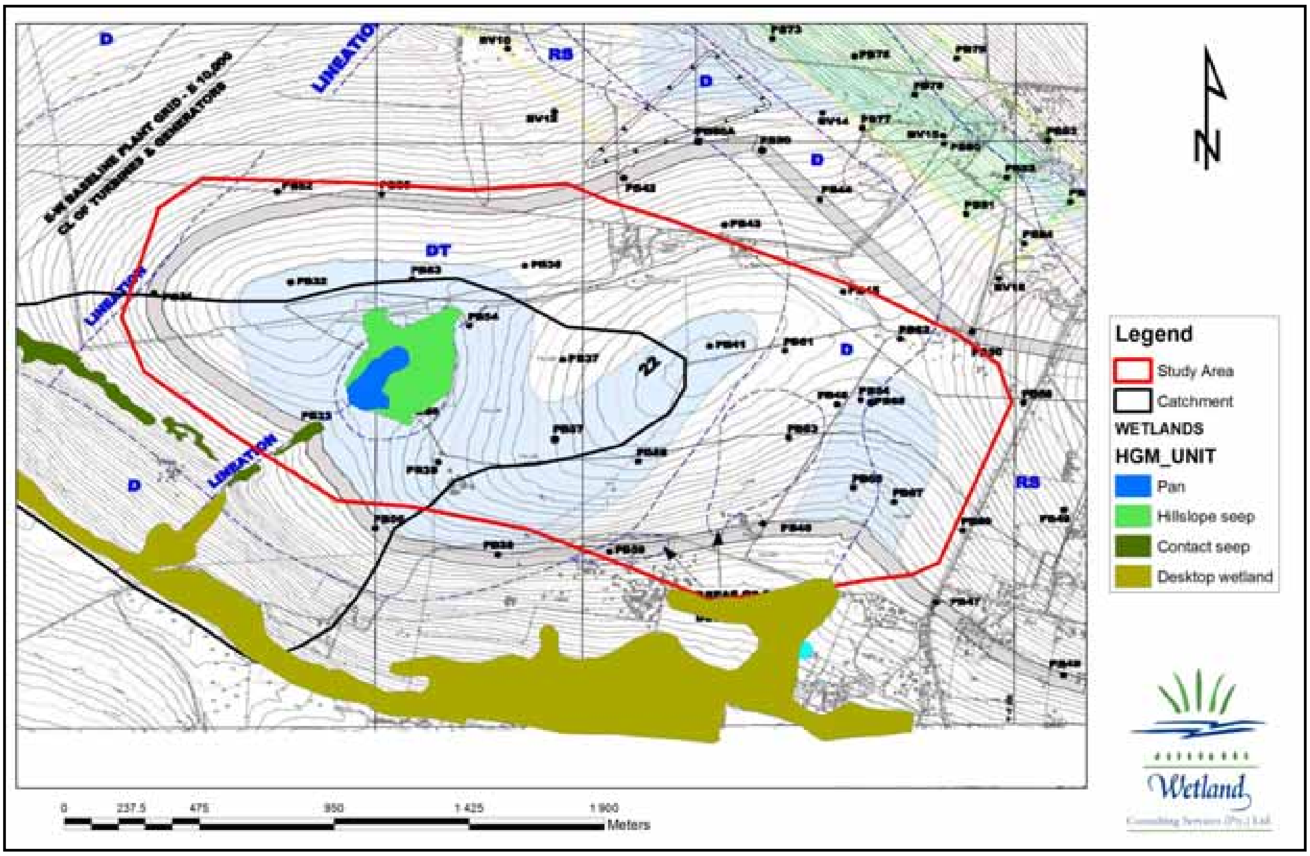

Figure 6. A map showing the relationship between the depression, the contact seep and the position of the lineation detected by Partridge and Maud.

Figure 7. Photographs of the hillslope seepage (left) and the pan, showing the differences in vegetation**.**

The soils within the pan basin have a well developed organic horizon and would likely be classified as a Katspruit soil.

Vegetation in the pan itself is dominated by *Agrostis lacnantha, Paspalum urvillei, Persicaria sp and Leersia hexandra, (Figure 6 left).*

In addition to the wetlands identified within the footprint of the ash dump, wetlands were detected and delineated outside of the footprint of the ash dump. These wetlands are associated with the contact between a diabase sill and the Dwyka formation. These are seasonal wetlands with their extent and expression directly proportional to the amount of antecedent rainfall, Figure 8. It is suspected that the water responsible for the expression of the contact seep is water derived from the catchment as a whole which is prevented from deep infiltration by the diabase sill. They are dominated by sedges, Figure 9.

The water emerging within these wetlands is mostly subsurface, but close enough to the surface to influence the vegetation.

Previous landowners have excavated into the side slope to expose the seepage front to provide access to water by livestock, Figure 9. The depth at which water was emerging from the soil profile is indicated by a white line.

In total, the wetlands occupy approximately 17 hectares of the expanded study area, excluding the valley bottom wetlands, which represents about 8% of the wetlands catchment. 93 ha (45%) of the catchment supporting the identified wetland falls directly within the foot print of the ash dump. The latter occupies an area of 278 Ha

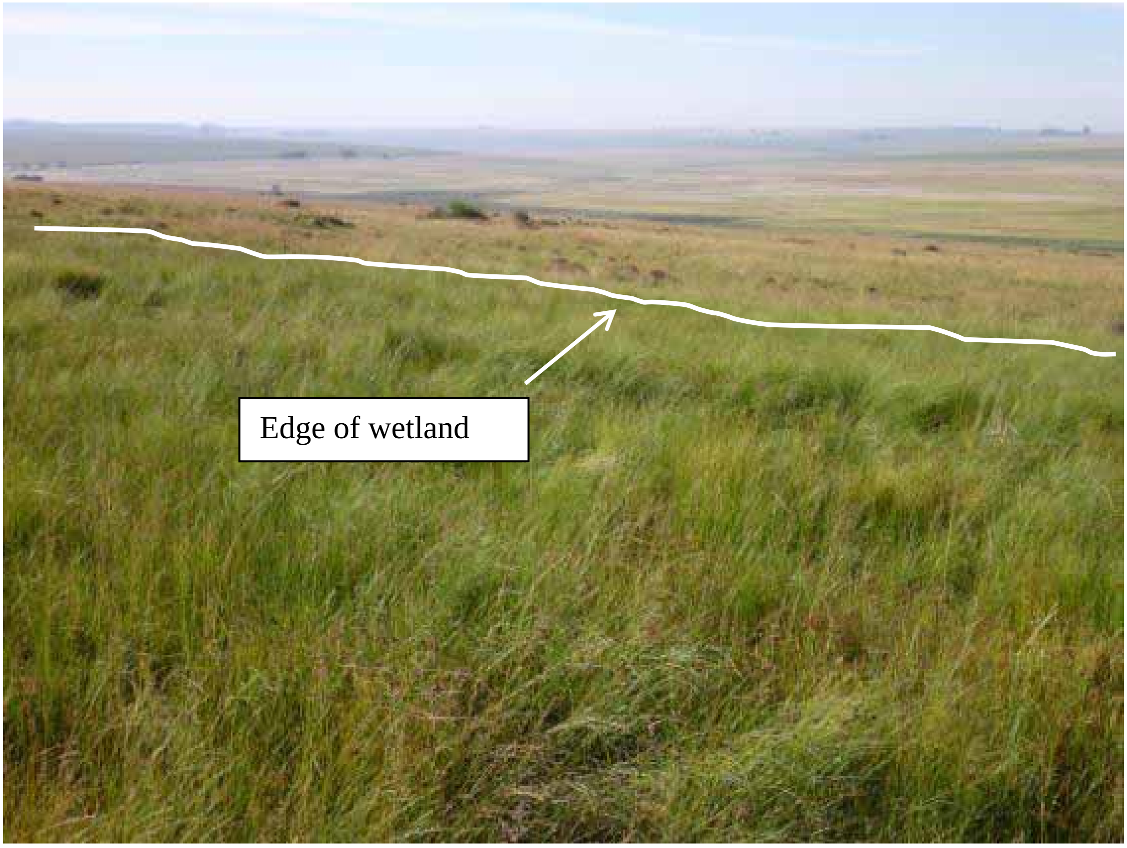

Figure 8. Hillslope seepage wetlands on the contact between the Dwyka and diabase.

Figure 9. Excavation into the seepage wetland to expose water to make it available to livestock.

Figure 10. A photograph of the vegetation associated with the contact seepage wetlands.

6.2 Present Ecological State (Health)

For the purpose of this study, the scoring system as described in the document "*Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems*" (DWAF, 1999) was applied for the determination of the PES and EISC. Two tools have been developed to facilitate the derivation of scores, namely the Index of Habitat Integrity (IHI) (DWAF, 2007), and Wet-Health, developed by Macfarlane et al., 2008. Both these tools have limitations in that they were developed primarily to assess conditions of floodplain and valley bottom wetlands and hillslope seepage wetlands linked to drainage lines. The former tool was developed to provide a rapid assessment of the PES specifically for application in reserve studies, while the latter tool was developed to support the Working for Wetlands program. The objective of the latter tool was to provide a semi quantitative assessment of the state of wetland prior to rehabilitation, and one post rehabilitation to demonstrate "improvement". The intention in defining the health category (PES) of a wetland is to provide an indication of the current "condition" of a wetland in order to inform a management class. The latter provides the guidelines against that inform water quality and quantity required to maintain or improve the quality of the water resource.

An attempt was made to apply the tool Wet-health to provide an indication of the departure of the wetlands from an unimpacted state.

Wet-Health comprises three modules, a hydrological, geomorphological and vegetation module, each one providing indicators that collectively contribute to determining the PES. A water quality component was added using the protocol in the tool, Index of Habitat Integrity for valley bottom and floodplain wetlands in DWAF, 2007.

6.2.1 Hydrology

There are no obvious indications of changes in the hydrology influencing the two wetland types, namely the hillslope seepage and depression or pan. It is possible that the conversion of the original grassland to cultivation within portions of the catchment may have influenced the rate and/or volume of water through and into the systems, as might have the small copse of wattles.
Based on site observations the changes in hydrology to both the systems is considered to be small, with an impact rating of between 0.5 for sections of the hillslope seepage wetlands and 1 for others. This translates to a total impact score 0.5 for the combined system, suggesting a health category of A, Table 3.

Table 3. Assessment of hydrological changes in to the wetlands on the site

HGM Unit	HGM Type	Impact Score	Health Category
1	Isolated Hillslope seepage associated with pan	0.7	A
2	Depression (includes Pans)	0.2	A
3	Contact seepage wetlands	0	A

Table 4. Summary of impact scores and health category associated with changes in hydrology

DESCRIPTION	IMPACT SCORE RANGE	HEALTH CATEGORY
No discernible modifications, or the modifications are of such a nature that they have no impact on the hydrological integrity.	0-0.9	A
Although identifiable, the impact of the modifications on the hydrological integrity are small.	1-1.9	B
The impact of the modifications on the hydrological integrity is clearly identifiable, but limited.	2-3.9	C
The impact of the modifications is clearly detrimental to the hydrological integrity. Approximately 50% of the hydrological integrity has been lost.	4-5.9	D
Modifications clearly have an adverse effect on the hydrological integrity. 51% to 79% of the hydrological integrity has been lost.	6-7.9	E
Modifications are so great that the hydrological functioning has been drastically altered. 80% or more of the hydrological integrity has been lost.	8 - 10	F

6.2.2 Geomorphology

There were no signs of erosion, deposition, head cuts or other signs of geomorphological changes in other than the intentionally excavated section of a contact seepage wetland.. The excavation into the hillslope seepage wetland reduces the "health" of this small section of seepage but this does not significantly influence the overall rating of the combined system. The combined system is thus considered as unimpacted, with an impact rating of 0.5, or in an A state, Table 3.

Table 5. Assessment of the changes in geomorphology associated with the various wetlands on the site

HGM Unit	HGM Type	Impact Score	Health Category
1	Isolated Hillslope seepage associated with pan	0	A
2	Depression (includes Pans)	0	A
3	Contact seepage wetlands	0.7	A

Table 6. Summary of impact scores and health category associated with changes in geomorphology

IMPACT SCORE	DESCRIPTION	PGS CATEGORY
0-0.9	Unmodified, natural.	A
1-1.9	Largely natural. A slight change in geomorphic processes is discernable but the system remains largely intact.	B
2-3.9	Moderately modified. A moderate change in geomorphic processes has taken place but the system remains	C
4-5.9	Largely modified. A large change in geomorphic processes has occurred and the system is appreciably altered.	D
6-7.9	Greatly modified. The change in geomorphic processes is great but some features are still recognizable.	E
8-10	Modifications have reached a critical level as geomorphic processes have been modified completely.	F

6.2.3 Vegetation

An assessment of the vegetation within the catchments and in the wetlands themselves suggest that some disturbance has taken place. Typically some cultivation and cattle grazing and trampling has occurred in some sections of, particularly the hillslope seepage wetlands on the perimeter of the depression. The occurrence of the small copse of wattles is also indicative of disturbance. However the extent of the changes was not assessed as being extensive or intensive resulting in an overall impact score of 1.5, equating to a PES of B, Table 4.

Table 7. Assessment of the changes in vegetation associated with the various wetlands on the site

HGM Unit	HGM Type	Impact Score	Health Category
1	Isolated Hillslope seepage associated with pan	2.1	C
2	Depression (includes Pans)	0	A
3	Contact seepage wetlands	0.1	A

Table 8. Summary of impact scores and health category associated with changes in vegetation.

Description	Overall Impact Score	Present Vegetation State Category
Vegetation composition appears natural.	0-0.9	A
A very minor change to vegetation composition is evident at the site.	1-1.9	B
Vegetation composition has been moderately altered but introduced; alien and/or increased ruderal species are still clearly less abundant than characteristic indigenous wetland species.	2-3.9	C
Vegetation composition has been largely altered and introduced; alien and/or increased ruderal species occur in approximately equal abundance to the characteristic indigenous wetland species.	4-5.9	D
Vegetation composition has been substantially altered but some characteristic species remain, although the vegetation consists mainly of introduced, alien and/or ruderal species.	6-7.9	E
Vegetation composition has been totally or almost totally altered, and if any characteristic species still remain, their extent is very low.	8 - 10	F

6.2.4 Water Quality

There is no way of establishing except by inference based on changes in land use, changes that might have occurred to the water quality contributing to the development and support of the wetlands. Given that a portion of the catchment in which the wetlands are located has been used for cultivation it is possible that there has been a change in the quality of water reaching the wetlands. There are however a number of processes that occur within the soil profile that are known to transform and or remove substances such as nitrogen and phosphates, making it difficult to assess whether the quality of water reaching the wetland has in fact changed. Thus the inferred PES of water quality associated with the various HGM units must be regarded as being speculative.

Table 9. Assessment of the changes in water quality associated with the various wetlands on the site

HGM Unit	HGM Type	Impact Score	Health Category
1	Isolated Hillslope seepage associated with pan	1.9	B
2	Depression (includes Pans)	0	A
3	Contact seepage wetlands	0	A

Table 10 Summary of impact scores and health category associated with changes in water quality

DESCRIPTION	IMPACT SCORE RANGE	HEALTH CATEGORY
No discernible changes in landuse, or the changes are of such a nature that they have no impact on the water quality	0-0.9	A
Although identifiable, the impact of the changes in landuse on water quality is small.	1-1.9	B
The impact of the changes in land use on water quality is clearly discernable, but limited.	2-3.9	C
The changes in landuse in the catchment are of such a nature that they clearly have a detrimental affect on water quality. Approximately 50% of the catchment has been modified.	4-5.9	D
The changes in landuse and their impact on water quality is clearly evident in the changes in the vegetation within the wetland.	6-7.9	E
Changes in landuse and the water quality associated with these changes is such that the wetland is dominated by pollution tolerant species or no vegetation at all.	8 - 10	F

6.2.5 Overall PES

The overall PES of the wetlands on the site given the relative contributions give a PES of A for the pan and A/B for the hillslope seepage, summarised in Figure 10, and Table 5., suggesting that most of the functions attributed to these have not been compromised . These are biodiversity and productivity support, flow regulation through the interception and storage and release of water from the catchment as a whole. The nature of the land use within the catchment is such that the quality of water reflected in the wetlands is high.

Table 11. Summarised PES categories of the wetlands on the site

	PES	
Hillslope seepage wetlands around the pan	B	Largely natural. A slight change in processes is discernable but the system are largely intact
Depression	A	Unmodified, natural.
Contact seepage wetlands	A	Unmodified, natural.

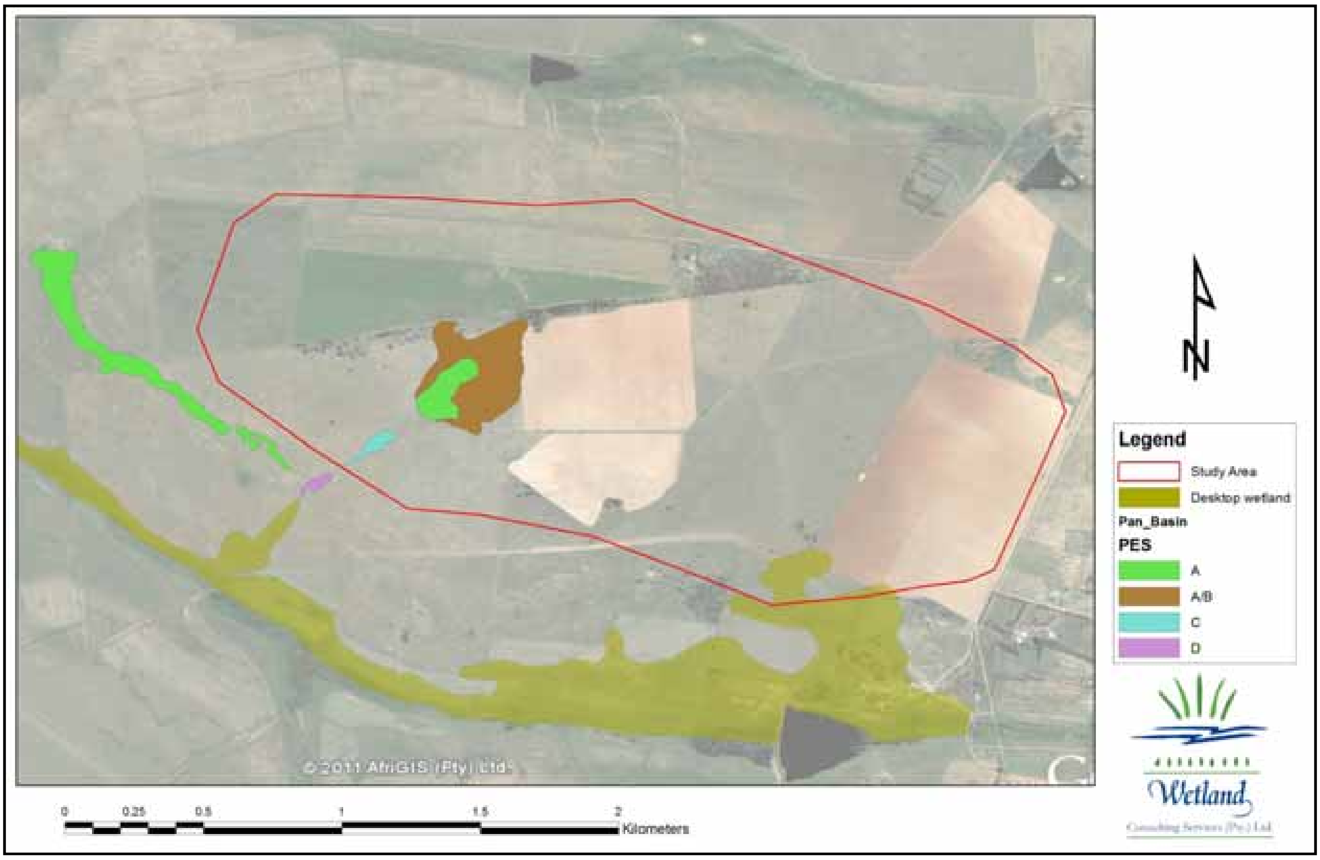

Figure 11. A map showing the wetlands and their associated PES scores

6.3 Ecological Importance & Sensitivity.

Wetlands are regarded as important components of the landscape in which they occur as they are associated with a number of functions that are of value to society. Typically these functions include water quality improvement, flood attenuation, biodiversity support as well as products. Critically it is difficult if not impossible at the level that these assessments are undertaken to separate at least the first two functions from the catchments in which the wetlands are located. It is thus difficult to determine their ecological importance and sensitivity without considering the wetlands in the broader catchment context. A summary of the functions expected to be performed by the hillslope seepage wetlands and the depression to which they are summarised in Figure 11.

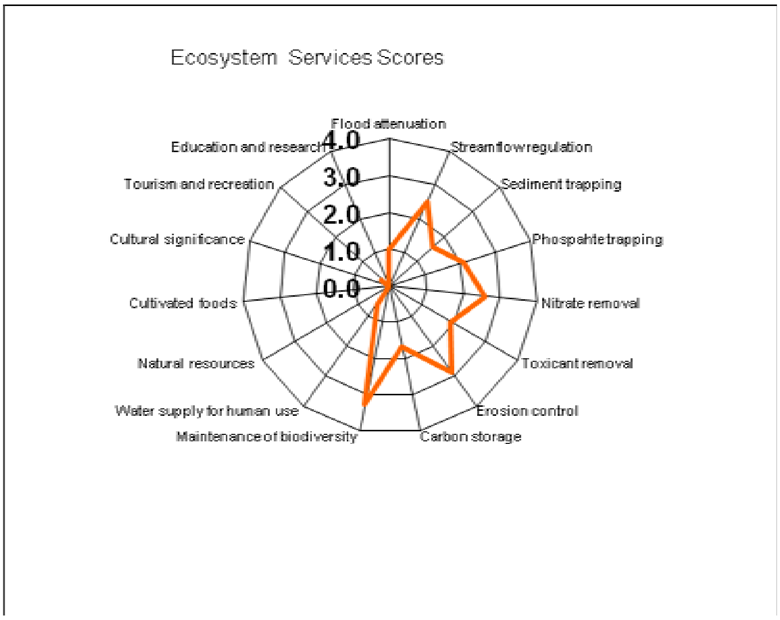

Figure 12. A radial plot indicating some of the functions associated with his wetland complex.

Not unexpectedly those functions associated with water movement, its role in creating a moisture mosaic, which in turn influences biodiversity and inferred nutrient transformation are important.

The water feeding these wetlands contributes to the maintenance of the what have been termed contact seepage wetlands and their associated biodiversity that occur on the western and south western slopes of the ridge on which the ash dump has been positioned.

On the negative side, from a water provisioning perspective, it is probable that much of the water associated with these hillslope seepage wetlands and depression is lost to evapotranspiration (Bullock, 1992).

The water emerging from the seepage wetlands on these slopes provides drinking water for livestock while the vegetation is grazed.

An indication of the ecological importance and sensitivity of the wetlands is portrayed in Figure 11, with an explanation of the categories associated with the derived EIS. The ecological importance and sensitivity was rated as an A based:

- on an assessment of the wetlands taken in isolation from surrounding land uses,
- the lack of biodiversity information which invoked the precautionary principle and
- the rate of transformation of the land use to open cast coal mining in the Upper Olifants and Wilge catchments in relation to their impact on water flow and wetlands.

However this score was down rated to a C for the following reasons:

- Kusile Power station and its supporting infrastructure is a strategically important project and has been approved, and has been granted a Water Use License
- The environmental impact associated with its positioning has been established and accepted by society
- The cost, in terms of time (delays to commissioning the power station), monetary and environmental associated with finding an alternative site.

.**Table 12.** Table explaining the scoring system used for the EIS assessment

Ecological Importance and Sensitivity categories	Range of Median	Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1 and <=2	C
Low/marginal Wetlands that is not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

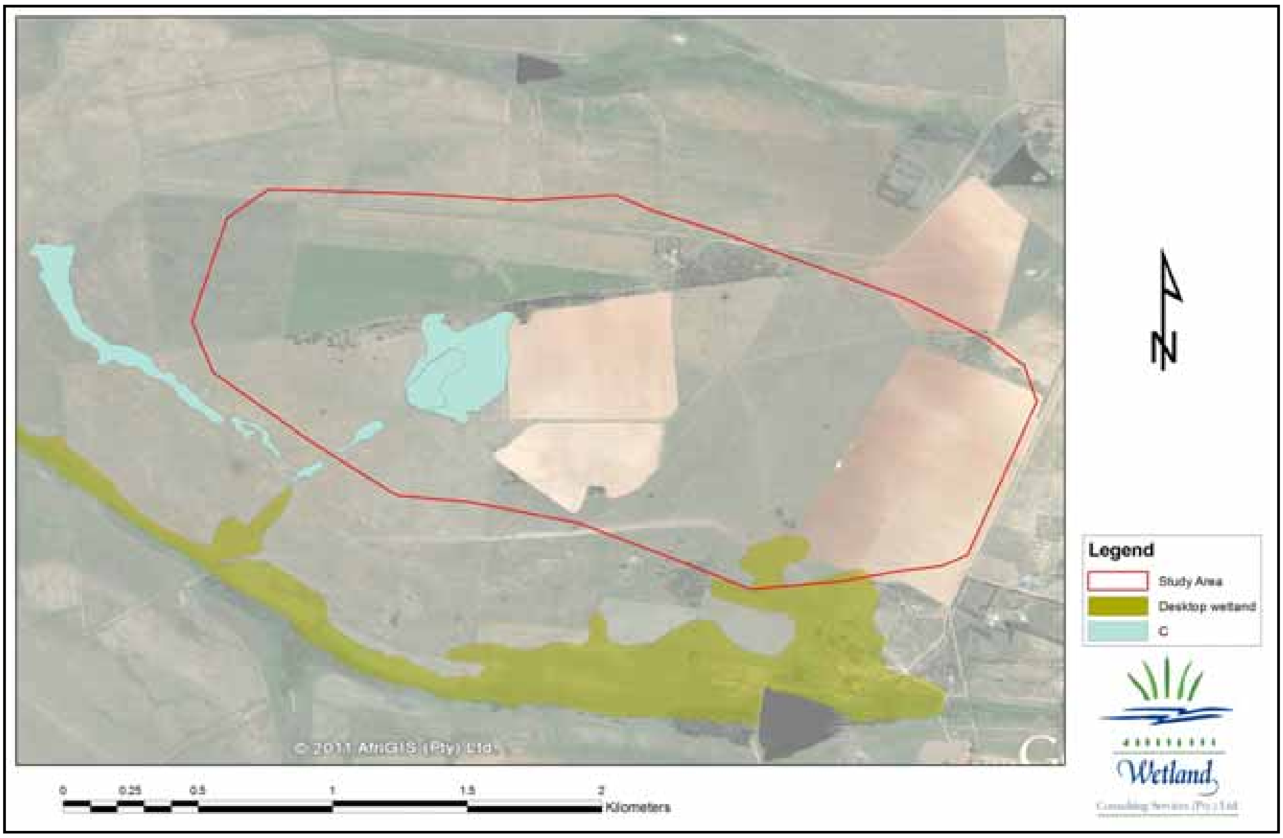

Figure 13. A map showing the wetlands and interpreted ecological importance and sensitivity

7. IMPACT ASSESSMENT

To ensure uniformity, the assessment of potential impacts was addressed in a standard manner to ensure comparable treatment over a wide range of impacts. A clearly defined rating scale was used (Appendix I) to assess the impacts on wetlands associated with the proposed development. Each impact identified was assessed in terms of probability (likelihood of occurring), extent (spatial scale), intensity (severity) and duration (temporal scale). To enable a scientific approach to the determination of the impact significance (importance), a numerical value was linked to each rating scale. The sum of the numerical values defined the significance. Details on the scoring system used in this impact rating procedure are provided in Appendix I.

The assessment of impacts will focus separately on the construction and operational phases of the proposed development, as well as addressing possible cumulative impacts to the wetlands.

7.1 The Project

An ash dump is proposed to be created on the site. The deposition of ash across the site is planned to take place over a period of 60 years. The design and operation of the ash dump is such that the area on which the ash is to be deposited has been designed to limit the amount of rainfall that will be intercepted and diverted off the site into a clean water system, while at the same time limiting the quantity of dirty water that will be collected off the ash itself. The design and operation of the ash dump makes provision for 40% of the footprint of the ash dump to be occupied in the first 5 years, with the remainder being covered slowly by flue gas deposits (gypsum) over the next 55 years. The gypsum is environmental cost associated with desulphurization of emissions.

Provision has also been made in the design to intercept runoff from the dump and to divert this into lined dirty water storage dams for subsequent use in dust suppression and irrigation of the rehabilitated surfaces of the ash dump..

Details of how this is to be achieved is contained in the ash dump design report.

In addition considerable thought has been put into the design and operation of the system with a view to minimising the quantities of both clean and dirty water that need to be managed.

The relationship of the extent of the ash dump and its associated dirty water return dam is depicted in Figure 7.

It can be seen from this figure that the footprint of the ash dump covers the extent of the seepage wetlands and the depression.In addition the dirty water dumps occupy contact seepage wetlands that exist at the contact of the dwyka and the diabase sill as well as topsoil stockpiles.

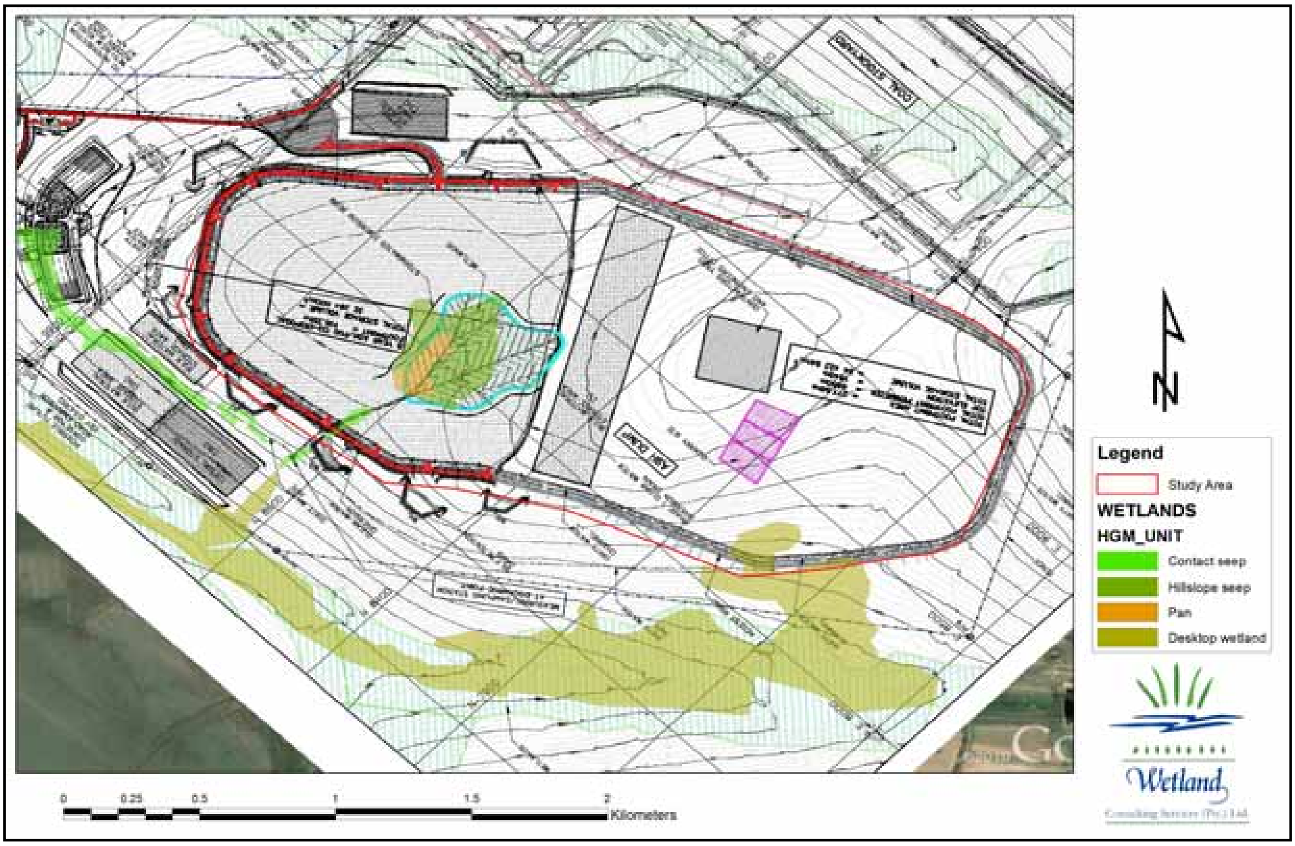

Figure 14. A map showing the position of the planned ash dump and associated support structures in relation to the wetlands on the site.

7.2 Identification of Potential Impacts

Construction:

- → Loss of Wetlands
- → *Erosion and Sedimentation*
- → *Surface Water Pollution*
- → *Loss of Biodiversity*

Operation:

- → Surface Water Pollution
- → Erosion and Sedimentation

7.3 Description of Potential Impacts and Mitigation Recommendations – Construction Phase

7.3.1 Loss of Wetlands

It is inevitable that the placement of the ash dump on the current site will result in the e loss, of both the hillslope seepage as well as the depression wetlands as these occur within the footprint of the ash dump.

The dirty water dirty water dams will directly impact the contact seepage wetlands as will access roads and general construction related activities associated with the initial preparation of the site.

While the soil stockpiles can be relocated so as to avoid impacting the wetlands, their future is jeopardised by the ash dump itself as this will result in the displacement of water responsible for their existence. Much of the water that makes to this catchment will be intercepted and will either contribute to the dirty or clean water systems that form part of the overall water management strategy for the ash dump. As a consequence they will be deprived of water the flows that support them

This impact is considered to be Negative and of High significance.

Mitigation Measures

Unless the ash dump is relocated the impacts associated with the loss of wetlands and their function is unavoidable. Off-site mitigation could be considered to compensate for the loss of biodiversity. Water falling on the site will from an overall water quantity perspective still be available to support the main streams that drain the site.

In terms of compensating for the loss of biodiversity, a source of water capable of supporting wetlands, as well as a suitable locality, preferably already disturbed so as to avoid altering another ecosystem, would need to be identified. Consideration could be given to using treated domestic effluent for this purpose. This has the potential advantages from an environmental perspective for example:

- Providing the opportunity for further treatment and nutrient removal
- If appropriately designed affords a ranges of habitats that would encourage biodiversity
- Afford a buffer between the treatment works and the receiving environment in the event of operational mishaps.

The feasibility of this recommendation both from a cost and environmental perspective should be investigated as it may not be practical in the overall context of the Kusile Project.

7.3.2 Erosion and sedimentation

Construction activities will require the clearing of large areas of vegetation, thereby leaving the soil exposed to erosion during rainfall events. Eroded sediment will likely make its way into the wetlands and the channel and contribute to sedimentation in the valley bottom wetland down slope of the planned activities. This would not only reduce the geomorphological condition of the wetland, but would also affect the water quality by increasing the load of suspended sediments in the water column. This impact is considered to be Negative and of Low to Moderate significance.

Mitigation Measures

In order to reduce the risks of sediment loss:

- the extent of exposed soils at any one time should be limited
- the construction footprint should be minimised to avoid unnecessarily exposing soils to erosion
- low level berms and the placement of sediment traps in obvious low points will contain the extent of erosion and deposition reducing the scale of the impacts to the site itself.

The design report contains details of the mitigation measures that have been considered and provided for during the design and construction of the ash dump.

7.3.3 Water pollution.

The close proximity of the valley bottom wetlands to the proposed ash dump makes the wetlands and water resource it represents susceptible to pollution during construction. Dust generated by construction activities, eroded sediments, leaked hydrocarbons from construction vehicles, litter, and small amounts of construction materials can all find their way into the valley bottom wetland below the site, potentially negatively affecting water quality.

This impact is considered to be Negative and of Low to Moderate significance.

Mitigation Measures
Mitigation measures suggested to curb erosion and sedimentation will also mitigate against some forms of water pollution. All toxic products or possible pollutants such as hydrocarbons must be stored offsite or in sealed areas on site to prevent surface water pollution. Vehicles should be parked on impermeable surfaces, to prevent the absorption of leaked hydrocarbons in to the soil profile, and stormwater from these areas channelled away from the wetlands. Litter should be disposed of in appropriate waste disposal bins. Spill kits and drip trays will be provided at all times. All contaminated materials will be disposed off at permitted waste disposal facilities.

7.3.4 Loss of biodiversity

Wetlands support a unique biodiversity not usually encountered in adjacent terrestrial habitats and also provide an important resource for both terrestrial and aquatic species. Development of the ash dump will lead to the loss of all the wetlands and any populations or communities of species associated with, or dependant on, them.

This impact is considered to be Negative and of High significance.

Mitigation Measures
If areas of wetland are lost, it is unavoidable that the biodiversity supported within these wetlands will also be lost. However, it is possible to prevent unnecessary disturbance to the remaining wetland fauna and flora by preventing thoroughfare, by people and vehicles, through the wetlands as well as adjacent grasslands. Cognisance should be taken of the fact that wetlands lie downstream of their water supply hence any activities that influence the flow of water are likely to influence wetlands. Travelling through grasslands above wetlands and through wetlands and grasslands outside of immediate construction areas should be avoided.

Off-site mitigation could be considered, see Section 7.3.1 .

A summary of the impacts on the wetlands associated with construction related activities is listed in Table 13.

With the exception of the loss of the wetlands themselves, reflected in their structure and biodiversity, some of the functions associated with the wetlands for example regulated release of clean water can be successfully mitigated. A summary of the predicted impacts and their significance before and after implementation of mitigation measures arising during the construction phase are summarised in Table 13.

Table 13. Summary of potential impacts to the wetlands during construction

Expected Impact	Probability	Extent	Duration	Intensity	Significance of Impact pre mitigation	Significance of Impact post mitigation
Loss of Wetlands	Definite	local	Permanent	Very high	***HIGH***	***HIGH***
Erosion and Sedimentation	Probable	Local	Medium	Medium	***MODERATE***	***MODERATE to LOW***
Surface Water Pollution	Probable	Local	medium	Low	***MODERATE***	***LOW***
Loss of Biodiversity	Definite	local	Permanent	Very high	***HIGH***	***HIGH***

7.4 Description of Potential Impacts and Mitigation Recommendations – Operational Phase

The impacts identified as being possible during the construction phase will, because of the design and operation of the ash dump, are likely to continue through the operational phase.

Mitigation Measures

From a water and sediment management perspective, the design of the ash dump makes provision for the separation of dirty and clean water, with clean water being designed to be discharged into the environment. Dirty wall will be recovered and used for dust suppression

7.4.1 Increased volumes of clean water discharged to the environment

An additional impact that is likely to arise is as a consequence of the interception and transfer of rainwater on areas of the rehabilitated portions of the ash dump that will enter the clean water system and be discharged via sedimentation traps equipped with controlled release systems. It is probable that the losses to evaporation and evapotranspiration will be reduced thus increasing the volume making to the local streams. Opportunities to dispose of this excess water to irrigation or for dust suppression are possibly limited as they are likely to coincide with already saturated conditions associated with rainfall events.

These additional flows could cause changes in the receiving streams where from :

- An overall quantity perspective the impact might be perceived as beneficial
- An environmental perspective at the wetland level, possibly negative to neutral.

Mitigation Measures

Whether mitigation is desirable and/or necessary would depend on the differences in volumes and discharge rates and the resource quality and management objectives of the receiving stream and its associated wetland.

7.4.2 Increased velocities of clean water discharged to the environment

It is possible that the velocities associated with the discharges from the individual clean water sediment traps at their point of discharge into the environment will be higher than the pre-developed situation despite the designed mitigation measures. As a consequence there is an increased risk of erosion if the discharges occur on the side slopes.

The impact is expected to be NEGATIVE and of moderate to high significance

<u>Mitigation Measures</u>

Discharge velocities should be reduced by ensuring that the discharge are distributed across a wide footprint and/or alternatively the discharge points should be at the lowest point in the landscape, ie the valley bottom systems where the slopes are shallow rather than on the hillsides themselves or a combination of both. Appropriate energy dissipation structures should be created at the points of discharge to limit the impact of the discharges to the immediate area.

Table 14. Summary of impacts expected during the operational phase of the Ash dump. These are the same as expected during the construction phase due to the progressive nature of ash storage. Pink indicates negative impact, blue indicates ambivalent.

Expected Impact	Probability	Extent	Duration	Intensity	Significance of Impact pre mitigation	Significance of Impact post mitigation
Loss of Wetlands	Definite	local	Permanent	Very high	***HIGH***	***HIGH***
Erosion and Sedimentation	Probable	Local	Medium	Medium	***MODERATE***	***LOW***
Surface Water Pollution	Probable	Local	medium	Low	***MODERATE***	***LOW***
Loss of Biodiversity	Definite	local	Permanent	Very high	***HIGH***	***HIGH***
Increase volumes of discharge	Probable	Local to regional	Long term	Low to medium	**MODERATE**	***LOW***
Increase velocity	Probable	Local	Long term	Medium	**MODERATE to HIGH**	***LOW***

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8. CONCLUSION

The presence of wetlands was verified on site, and two hydrogeomorphic wetland types were identified, namely hillslope seepage wetlands and a depression. Together, these wetlands cover approximately 17 ha of the overall site.

The wetlands on site although showing some signs of disturbance have a PES of either an A or B state.

The nature of the proposed activity is such that the wetlands beneath the footprint of the ash dump and their supporting hydrology will be lost. Associated with the ash dump are dirty water dams and soil stockpiles. The positioning of these conflicts with seepage wetlands that were not identified in the previous survey, Ecosun, 2006. While the soil stockpiles can be relocated so as to avoid impacting the wetlands, the future of these contact wetlands is jeopardised by the ash dump itself. There is strong but circumstantial evidence that the water responsible for their existence is derived from the upstream catchment. In the event that the ash dump is constructed much of the water that makes to this catchment will be intercepted and will either contribute to the dirty or clean water systems that form part of the overall water management strategy for the ash dump.

However the Water Act recognises the right of existence of water resources, including wetlands, and requires that they receive an allocation of water, in terms of both flow and quality to maintain them in a predefined state. ***The quantity and quality of water required to maintain this resource is a legal requirement known as the ecological reserve and needs to be provided irrespective of possible changes in land use. The reserve also includes an allocation of water for direct human use.***

In this particular instance the nature of the proposed changes in land use are such that there is little likelihood of the wetlands existing in the future, given that the current site has been approved from an Environmental perspective. As a consequence of the proposed project the interception and flow of water through the catchment will change, determined by the surface water management plan. It is likely that more water will be available to the downstream users and the water will be clean. Thus from a water management perspective the placement of the ash dump on this particular site will have an impact on the wetlands, directly, and their associated biodiversity, but other functions linked to wetlands will not be affected. Of particular importance from a water management perspective, are:

- The regulated release of water
- The quality of the water that will be discharged.

Finally there is a requirement to provide an ash dump to deal with ash and gypsum associated with the generation of electricity from the Kusile Power Station. In the event that consideration is given to recommending the relocation of the ash dump to a new position in the landscape that doesn't impact wetlands directly, the impacts associated with the ash dump will remain, with instead of wetlands being affected that sensitive and threatened grasslands will be affected. These support a higher biodiversity than wetlands, the principle issue of concern that cannot be effectively mitigated. Thus from an environmental and water management perspective, and given the design considerations that have been incorporated in the overall project that the existing locality, despite the presence of wetlands, is considered suitable for purpose.

It is important to point out that any activity which is contemplated and which will impact on the wetlands within the study area is subject to authorisation under Section 21 of the National Water Act (Act 36, 1998). As such, all activities that impact wetlands will require a Water Use License.

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APPENDIX I: IMPACT RATING SCALE

Table 1. Probability

Category	Rating	Description
Definite	3	More than 90 per cent sure of a particular fact or of the likelihood of that impact occurring
Probable	2	70 to 90 per cent sure of a particular fact or of the likelihood of that impact occurring
Possible	1	40 to 70 per cent sure of a particular fact or of the likelihood of that impact occurring
Improbable	0	Less than 40 per cent sure of a particular fact or of the likelihood of that impact occurring

Table 2. Extent

Category	Rating	Description
Site	1	Immediate project site
Local	2	Up to 5 km from the project site
Regional	3	20 km radius from the project site
Provincial	4	Provincial
National	5	South African
International	6	Neighbouring countries/overseas

Table 3. Duration

Category	Rating	Description
Very short-term	1	Less than 1 year
Short-term	2	1 to 5 years
Medium-term	3	5 to 10 years
Long-term	4	10 to 15 years
Very long-term	5	Greater than 15 years
Permanent	6	Permanent

Table 4. Intensity

Category	Rating	Description
Very low	0	Where the impact affects the environment in such a way that natural, cultural and social functions are not affected

Category	Rating	Description
Low	1	Where the impact affects the environment in such a way that natural, cultural and social functions are only marginally affected
Medium	2	Where the affected environment is altered but natural, cultural and social function and processes continue albeit in a modified way
High	3	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily cease
Very high	4	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease

Table 5. Significance Rating

Score	Significance Rating
2 – 4	Low
5 – 7	Low to Moderate
8 – 10	Moderate
11 - 13	Moderate to High
14 – 16	High
17 – 19	Very High

Appendix D

Construction Method Statements

Appendix D

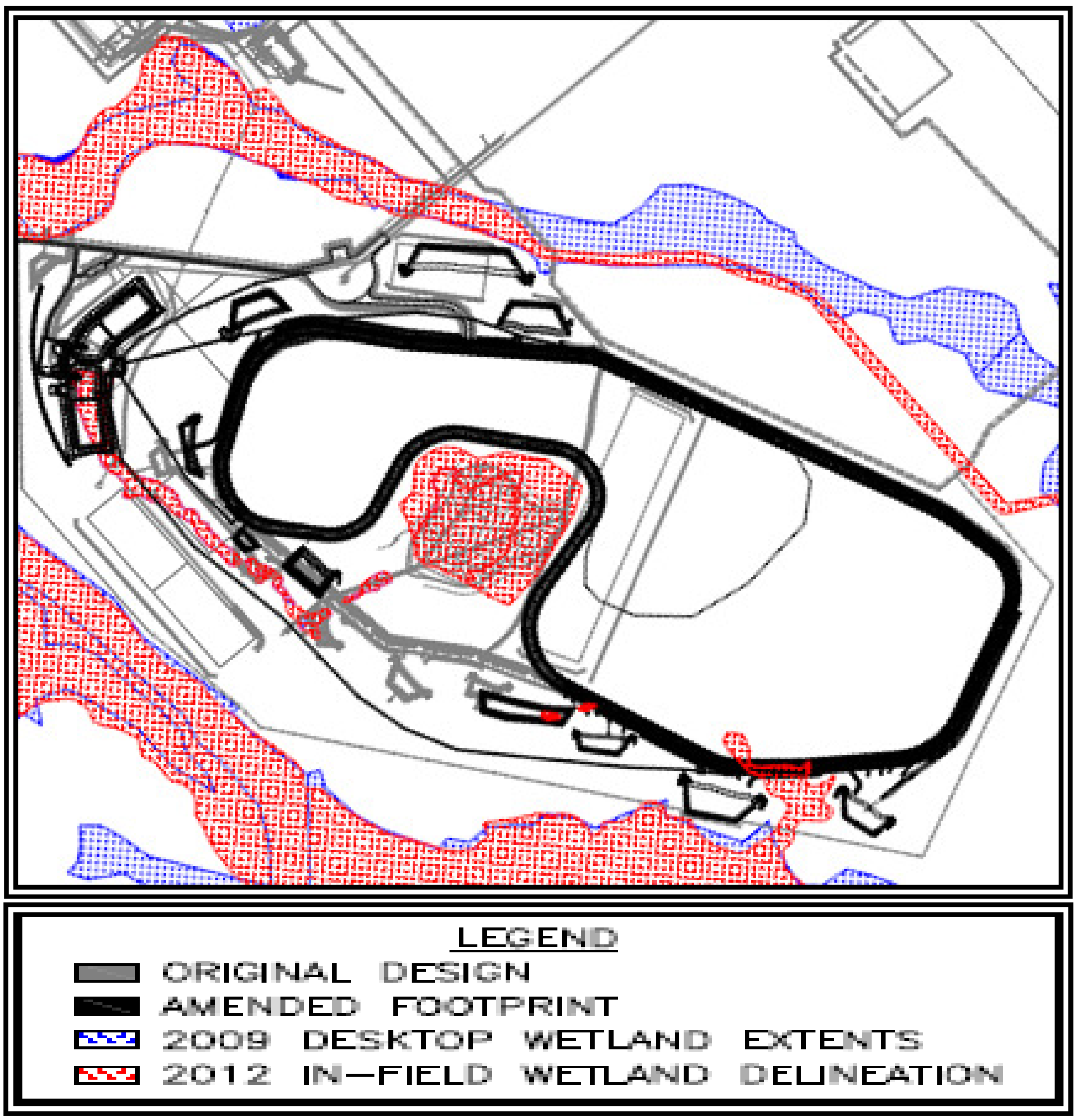
Wetlands Construction Method Statement

Kusile Power Station – Combustion Waste Terrace

I. Scope

The Construction Method Statement supports the Site Specific Construction Environmental Management Programme for the River Crossings and Wetlands and Construction within Rivers and Wetlands at the Kusile Power Station Combustion Waste Terrace (DEA reference 14/12/16/3/3/1/700). Figure 1 indicates a general site layout with structures relative to the wetlands from the CEMP (2007) and the ground truth wetland delineation (2012).

Figure 1



II. Design Responsibility

The design of the Combustion Waste Terrace is rather complex with various Consultants and Sub-Consultants involved as shown in Figure 2. The linear services activities described below are examined in detail later.

Material Handling equipment in the ARMCO culvert and Radial Stacker areas form part of Bateman Africa scope.

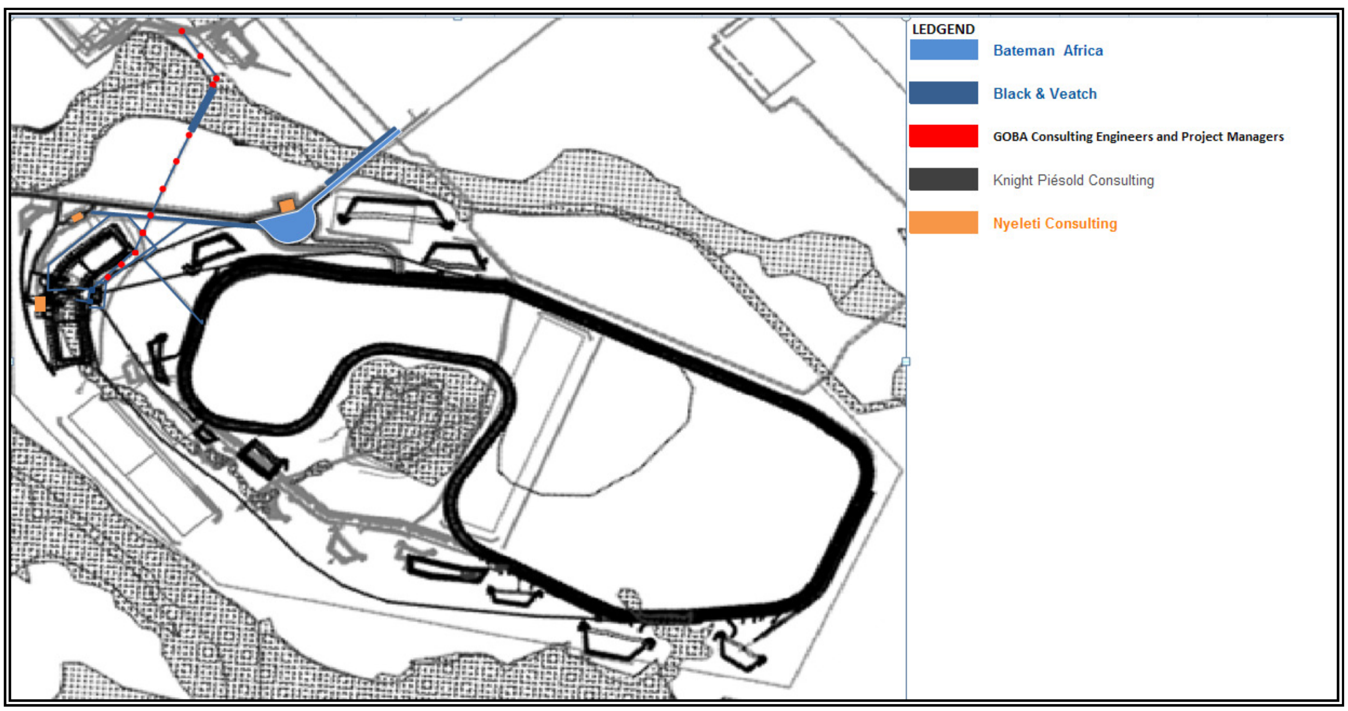
Black & Veatch designed road 1 and 2 (over ARMCO culvert) and other linear services; 525 pipe (ADDD to SDD) including above ground crossing of the wetland, 110/160 diameter pipes (Workshop Terrace to the Power Block), 315 diameter pipe (Ash Dump Dirty Dam to Power Block) and electrical cable routes (Pump Station to Power Block).

Goba Consulting Engineering and Project Managers designed Junction Boxes JB949 to JB965.

Nyaleti Consulting designed the Sub-Station, Workshop and Pump Station buildings.

All remainder design work done by Knight Piésold Consulting.

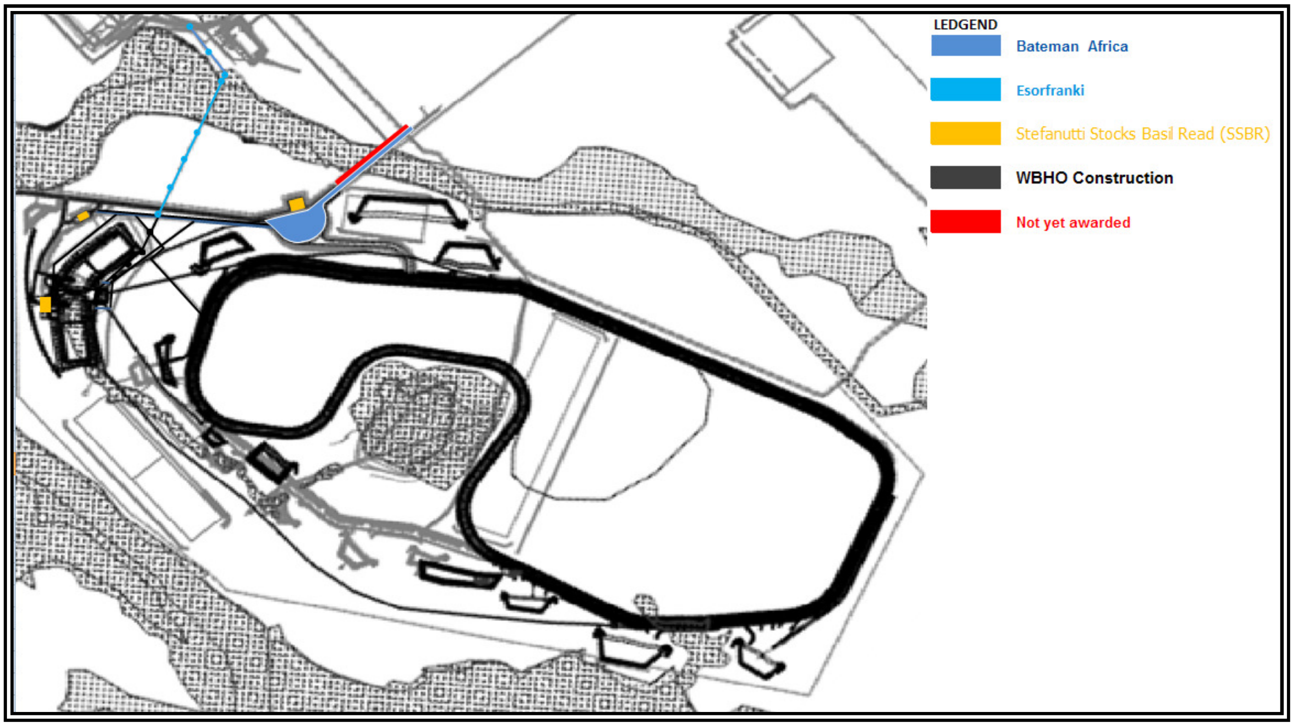
Figure 2 – Design Responsibilities



III. Construction Contractor Responsibility

The current Construction Contractor package split is shown in Figure 3.

Figure 3- Current Package Scope

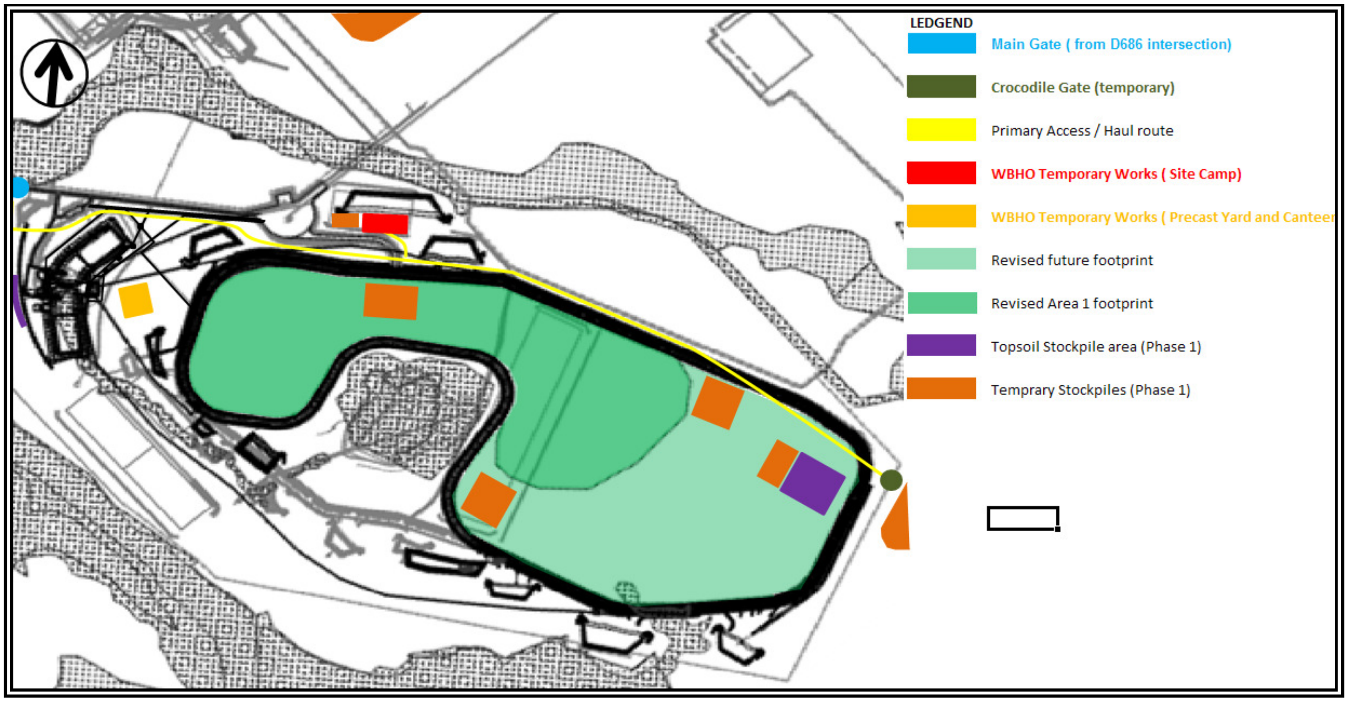


Package 26 Constructing Contractor's the only contractor within the current scope split specializing in piling activities and therefore retains the scope of work outside the Combustion Waste Terrace permanent fence.

IV. Access Control

It is imperative to construct the permanent fence as soon as possible along the perimeter of the 10 year Combustion Waste Terrace to control unauthorized access to site in response to condition item 7.1 (Appendix III) in the Water Use License 04/B20F/CGI/1836 dated 20/06/2012. The package 23A Constructing Contractor, WBHO Construction, control access to the site until Take Over when control reverts to the Project. Access to site (for authorized employees and their contractors) can be obtained through access gates subject to compliance to access requirements.

Figure 4- Temporary Works and Access to site



V. Regulated activities within a wetland

1. Ash Dump Dirty Dam (ADDD) and settling tanks

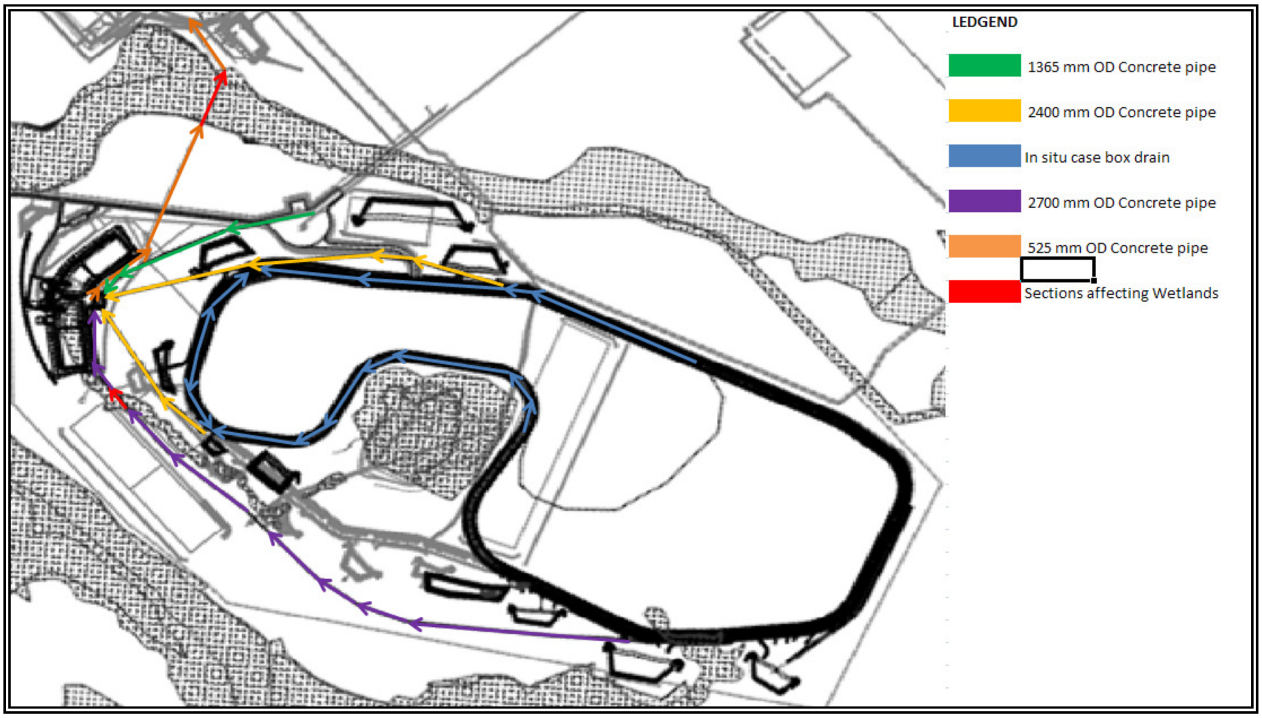
1.1. Applicable regulation

- Activity 11 of GN 544 for the construction of the ash dump dirty dam (ADDD) and settling dams within a wetland
- Activity 18 of GN 544 for the removal of soil located in a wetland for the construction of the ADDD.

1.2. Design

Various Dirty Water Drain pipe systems to and from the ADDD had to be considered in positioning the ADDD as can be seen in Figure 1.2.1. The overflow system (525 OD pipe between the ADDD and the Station Dirty Dam (SDD) in section 5 also refer.

Figure 1.2.1- Dirty Water Systems



1.3. Programme

Activities within the watercourse are listed in Table 1.21, 1.2.2 and 1.2.3 below. Months of seasonal low flows (September/ October months) have been taken into consideration in the schedule. Due to the complexity and duration of activities, activities could also not be confined to the months of seasonal low flow.

Construction timeframes are shown in table 1.2.1 below based on the receiving a positive Environmental Authorization on 1 May 2013 for each of the listed activities

Table 1.2.1

Wetland/ River Crossing Number	**Description**	**GPS location**		**Start Date**	**Finish Date**
		South	**East**		
10	removal of soil located in a wetland for the construction of the ADDD	25º56'4.61"	28º53'51.75"	2013/05/01	2013/08/29
1	Construction of the ash dump dirty dam (ADDD) within a wetland	25º56'4.61"	28º53'51.75"	2013/05/01	2014/11/26

A positive Environmental Authorization on 1 June 2013 for each of the listed activities will result in the following impacts to the schedule. Allowance of 20 days for the 2014 Builders Break allowed for in the Completion of the ADDD. A summary of the activities are shown in Table 1.2.2

Table 1.2.2

Wetland/ River Crossing Number	Description	GPS location		Start Date	Finish Date
		South	East		
10	removal of soil located in a wetland for the construction of the ADDD	25º56'4.61"	28º53'51.75"	2013/06/01	2013/09/29
1	Construction of the ash dump dirty dam (ADDD) within a wetland	25º56'4.61"	28º53'51.75"	2013/06/01	2015/01/16

A positive Environmental Authorization on 1 July 2013 for each of the listed activities will result in the following impacts to the schedule. Allowance of 30 days for re-mobilization, induction and training allowed for in both start dates. Allowance of 20 days for the 2014 Builders Break allowed for in the Completion of the ADDD. A summary of the activities are shown in Table 1.2.3.

Table 1.2.3

Wetland/ River Crossing Number	Description	GPS location		Start Date	Finish Date
		South	East		
10	removal of soil located in a wetland for the construction of the ADDD	25º56'4.61"	28º53'51.75"	2013/07/30	2013/11/29
1	Construction of the ash dump dirty dam (ADDD) within a wetland	25º56'4.61"	28º53'51.75"	2013/07/30	2015/03/16

1.4. Methodology

<table>
<tr><th>Process</th><th>Materials and Equipment</th><th>On / Off site Transport</th><th>Movement of Materials on site</th><th>Method and Storage of Material</th></tr>
<tr><td>Excavation of a cut off trench South side</td><td>360° Excavator, Tipper trucks</td><td rowspan="4">Equipment will access the site from the North of the hillside seep (not traverse through the wetland from the South). Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers)</td><td rowspan="2">360° Excavator will excavate from East to West. Excavated material will be trucked away by tipper trucks along haul roads (refer to figure 4)</td><td rowspan="2">Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project (refer to figure 4)</td></tr>
<tr><td>Excavate Compartment 1,2 JB05 and pump station terrace</td><td>360° Excavator, Tipper trucks</td></tr>
<tr><td>Construct Drain under liner</td><td>Geotextile, Pioneer, Fill,360° Excavator, Tipper trucks, Flatbed truck, Compactor/ Rollers</td><td>Compact selected layer.TLB or telescopic handler will off load the geotextile and using a spreader bar, spread the geotextile. 19 mm washed stone placed in the geotextile and geotextile closed on top</td><td rowspan="2">Only sufficient material, to be used during that day, will be temporary stockpiled on site within servitude.</td></tr>
<tr><td>Install Liner System incl cuspated sheet</td><td>Geotextile, HDPE Liner, Cuspated sheet Fill,360° Excavator, Tipper trucks, Flatbed truck, Compactor/ Rollers</td><td>TLB or telescopic handler will off load the material and using a spreader bar, spread the sheets and then welded in situ by skilled workers</td></tr>
<tr><td rowspan="3">Construct Concrete liner and Energy Discipators/ Junction Boxes</td><td>Formwork (wood or steel shutters)</td><td rowspan="3">Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers/ water pumps)</td><td>Manual installation by skilled workers / may be assisted by crane</td><td>Stacked and stored within the site</td></tr>
<tr><td>Steel Reinforcing (Mesh & dowels)</td><td>Manual installation by skilled workers</td><td>Stacked and stored within the site</td></tr>
<tr><td>Ready-mix Concrete, Mixer truck, floats</td><td>Direct Discharge/ chute/ Pump or Crane and bucket dependant on reach</td><td>Off Site</td></tr>
</table>

2. Silt Retention Ponds

2.1. Applicable regulation

Activity 11 of GN 544 for the construction of settling dams within a wetland.

2.2. Design

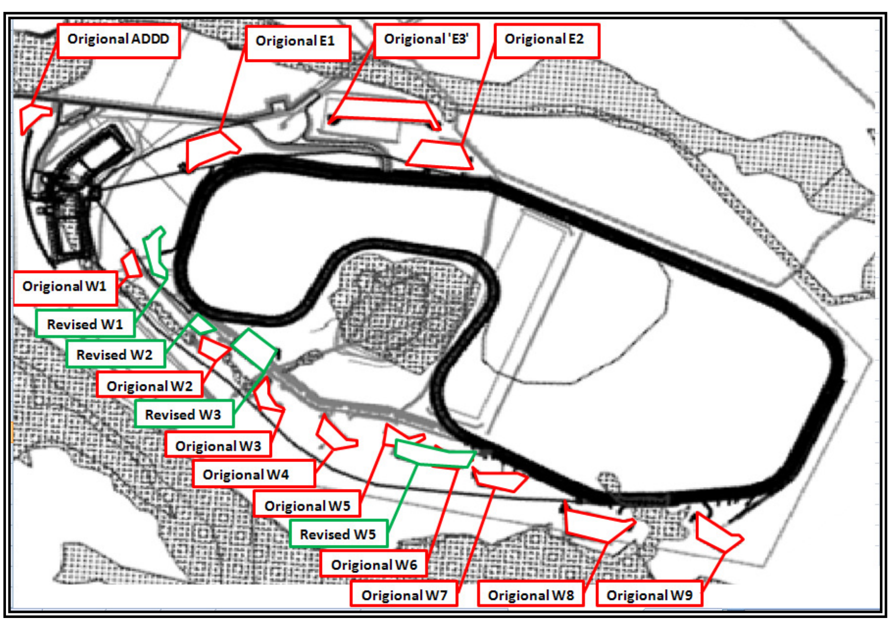
Construction phase and operation phase storm water management include the construction of a number of Silt Retention Ponds (SRP). The location of these SRP can be seen in Figure 2.2.1.

The Engineer revised the SRP W1, W2, W3 and W5 in mitigation of impacts to wetlands based on the latest (2012) specialist wetlands study and the revised Combustion Waste Terrace footprint.

A series of temporary and permanent drainage v-drains channel storm water to the various strategically placed SRPs. Permanent v-drains are lined with topsoil and grassed. Channel slopes are targeted to be less than 2 % based on the existing contour map.

The locations of SRP's are therefore not only determined by the size of the catchment and the rate of runoff but also the location of the v-drains. The existing contours at the location of each SRP also influence the height of the dam's wall. W5 remains with a small residual impact to the wetlands.

Figure 2.2.1- SRP locations



2.3. Programme

Table 2.3.1

Wetland/ River Crossing Number	Description	GPS location		Start Date	Finish Date
		South	East		
2	Construction of settling dams within a wetland (W5)	25º56’32.92”	28º54’51.87”	2014/03/30	2014/7/30

2.4. Methodology

<table>
<tr><th>Process</th><th>Materials and Equipment</th><th>On / Off site Transport</th><th>Movement of Materials on site</th><th>Method and Storage of Material</th></tr>
<tr><td>Excavation of SRP including dam wall key and outlet pipe</td><td>360° Excavator, Tipper trucks</td><td rowspan="3">Equipment will access the site from the North (not traverse through the wetland from the South). Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers)</td><td>360° Excavator will excavate and material will be trucked away by tipper trucks</td><td>Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project</td></tr>
<tr><td>Installation of Pipe</td><td rowspan="2">360° Excavator, Tipper trucks, Hi-ab Flatbed truck, Compactor/ Rollers. HDPE pipe</td><td rowspan="2">Suitable material will be imported from elsewhere on site, pipe bedding installed and on completion of pipe installation backfilled with suitable material from elsewhere on site</td><td rowspan="2">Only sufficient material, to be used during that day, will be temporary stockpiled on site within servitude</td></tr>
<tr><td>Backfilling of permanent works</td></tr>
</table>

3. Dirty Water Drain (toe drains)

3.1. Applicable regulation

Activity 11 of GN 544 for the construction of Dirty Water Drains (toe drains) within a wetland.

3.2. Programme

The section of Dirty Water Drain do not form part of the current Constructing Contractor scope of work, the impacted area being close to SRP W8. The Project Strategy is that this will be constructed by Eskom Generation at a later date. Eskom Generation will notify the Department (s) prior to commencement of the activity.

3.3. Methodology

Methodology used elsewhere on site for the same activity.

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Excavation of box cut trench	360° Excavator, Tipper trucks	Equipment will access the site from the North of the hillside seep (not traverse through the wetland from the South). Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers)	360° Excavator will excavate. Excavated material will be trucked away by tipper trucks along haul roads to stockpile areas (refer to figure 4)	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project (refer to figure 4)
Construct Dirty Water Drain	Formwork (wood or steel shutters)	Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Cranes/ pumps)	Crane or telescopic handler will off load the material and assembled and installed a by skilled workers	
	Steel Reinforcing		Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the site
	Ready-mix Concrete,		Direct Discharge/ chute/ Pump or	Off Site

	Mixer truck, floats		Crane and bucket dependant on reach	

4. Ash Dump Access Embankment and ARMCO culvert

4.1. Applicable regulation

- Activity 11 of GN 544 for the construction of the ash dump access embankment (with culvert) within a wetland.
- Activity 18 of GN 544 for the infilling of soil and rock into a wetland for the construction of the ash dump access embankment (with culvert).

4.2. Programme

Activities within the watercourse are listed in Table 4.21 below. Months of seasonal low flows (September/ October months) have been taken into consideration in the schedule. Due to the complexity and duration of activities, activities could also not be confined to the months of seasonal low flow.

Construction timeframes are shown in table 4.2.1 below based on the receiving a positive Environmental Authorization on 1 May 2013 for each of the listed activities. Sub activities include, construction of the diversion berm and temporary stream diversion (40 days), founding level (50 days), installation of the 3 x 5 meter diameter ARMCO pipe culverts (90 days), and backfilling of the 215 000 cubic meter embankment (overall height 10 meters from invert level).

Table 4.2.1

Wetland/ River Crossing Number	**Description**	**GPS location**		**Start Date**	**Finish Date**
		South	**East**		
9	infilling of soil and rock into a wetland for the construction of the ash dump access embankment(with culvert)	25º55'31.89"	28º 54'31.61"	2013/05/01	2014/11/26
4	Construction of the ash dump access embankment (with culvert) within a wetland	25º55'31.89"	28º54'31.61"	2013/05/01	2014/11/26

4.3. Methodology

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Deviation of stream - Excavation	360° Excavator, Tipper trucks	Equipment will access the site from the North of the stream (not traverse through the stream from the South). Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers)	360° Excavator will excavate from West to East (Downstream to Upstream), Excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Deviation of stream - Installation of Pipe	360° Excavator, Tipper trucks, Hi-ab Flatbed truck, Compactor/ Rollers		Suitable material will be imported from elsewhere on site, pipe bedding installed and on completion of pipe installation backfilled with suitable material from elsewhere on site	Only sufficient material, to be used during that day, will be temporary stockpiled on site within servitude
Deviation of stream - Deviation of Stream	360° Excavator, Tipper trucks		360° Excavator will excavate from West to East (Downstream to Upstream), Excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Temporary Embankment - Excavation		Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers/ water pumps)	360° Excavator can excavate North to South or South to North. Excavated material will be trucked away by tipper trucks	
Temporary Embankment - Filling	Dumprock, Pioneer, Fill,360° Excavator, Tipper trucks, Compactor/ Rollers		Dumprock/ Pioneer (as and when required) will be imported and fill sources from elsewhere on site.	Only sufficient material, to be used during that day, will be temporary stockpiled on site.
Excavation of permanent works	360° Excavator, Tipper trucks		360° Excavator will excavate and excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Installation of Subsoil drain	360° Excavator, Tipper trucks, water pump		Pioneer (as and when required) will be imported and fill sources from elsewhere on site. Water will be returned to the steam (downstream) through a siltnet	Only sufficient material, to be used during that day, will be temporary stockpiled on site within servitude.

Backfilling of permanent works	Dumprock, Pioneer, Fill,360° Excavator, Tipper trucks, Compactor/ Rollers		Dumprock/ Pioneer (as and when required) will be imported and fill sources from elsewhere on site.	
Installation of a temporary crane pad (as and when required if unsuitable founding conditions encountered)				
Installation of ARMCO Culvert	Crane/ Hi-ab Flatbed truck		Installation will be done in sections from East to West and level or below original stream invert level to prevent upstream damming	Material will be stored within reach of the crane within servitude
Construct Wing wall Bases	Formwork (wood or steel shutters)	Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers/ water pumps)	Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete		Direct Discharge / chute	Off Site
Construct Wing wall Walls	Formwork (wood or steel shutters)		Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, truck, crane or pump		Crane & bucket / piped	Off Site
Construct ARMCO Liner	Formwork (wood or steel shutters)		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, truck, crane or pump		Crane & bucket / piped	Off Site
Redirect FLOW THROUGH CULVERT	360° Excavator, Tipper trucks		360° Excavator will block temp pipe entrance with soil	N/A
Removal of Temporary Works			360° Excavator will excavate temp embankment and then from Downstream to Upstream, Excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Backfilling of permanent works	Dumprock, Pioneer, Fill,360° Excavator, Tipper trucks,		Dumprock/ Pioneer (as and when required) will be imported and fill sources from elsewhere on site.	Only sufficient material, to be used during that day, will be temporary stockpiled on site till work progressed above

	Compactor/ Rollers			1:100 year floodline.
Stabilization of Subbase	Cement ,Motor Grader Recycler(optional), rollers, Watercarts		Grader/ Recycler mix cement into layerworks Watercarts provide moisture during processing and curing period	Only sufficient material, to be used during that day, may be temporary stockpiled on site within servitude
Base Coarse	Base coarse, Motor Grader , rollers, Watercarts		Grader process layerworks Watercarts provide moisture during processing	On Site
Prime/ Wearing Coarse	Prime, Bearcat, Handpump / Apshalt, paver, tippers, rollers		Bearcat spray Base at required applied rate/ Handpump spreading for small areas, Paver spreads asphalt and rollers compact	Off Site

5. Spillage Mitigation pipeline between ADDD and SDD

5.1. Applicable regulation

Activity 11 of GN 544 for the crossing of wetlands by pipeline between the ADDD and Station Dirty Dam (SDD).

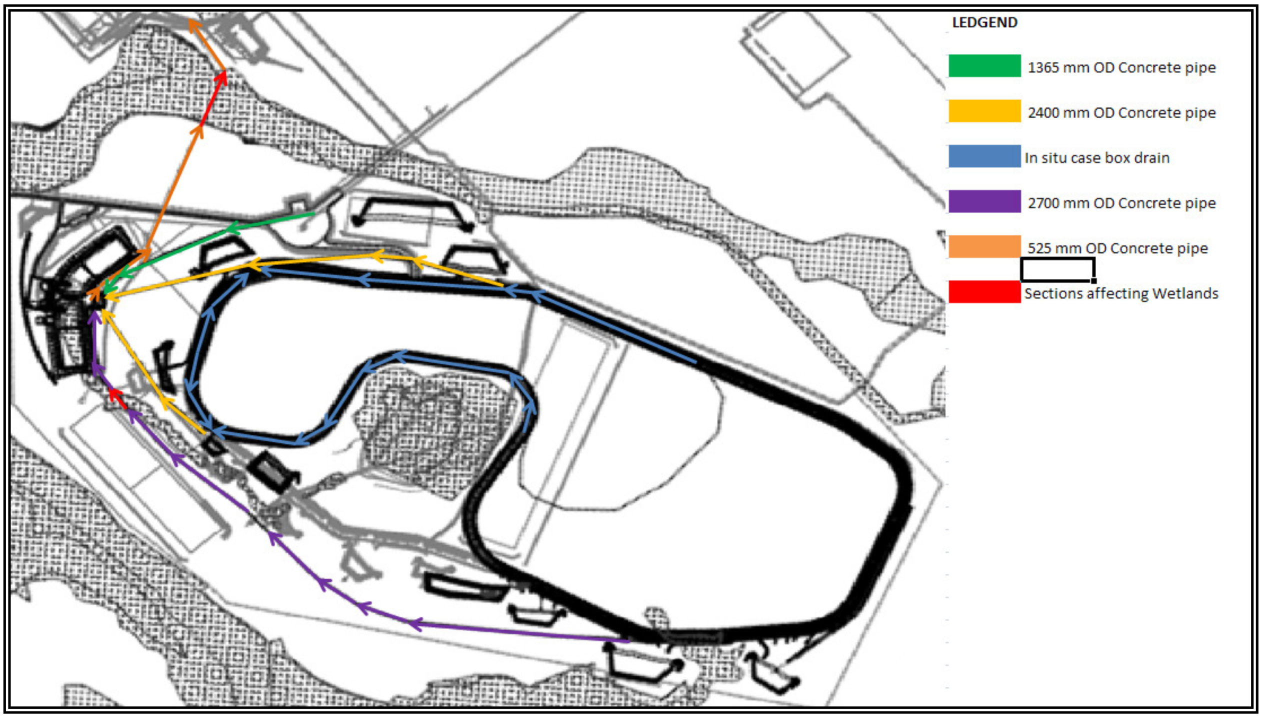
5.2. Design

The 525 mm OD pipeline system has been conceptually designed to mitigate the risk of ADDD overflow being spilled within the wetland. Dirty Water collected through the various pipe systems is retained at the ADDD and reused on the CWT dust suppression system during normal operations. The emergency system has been designed above ground level within the wetland in line with the recommendations of the EMP (2007) in mitigation of the risk of forming a preferential flow path along the pipe bedding.

The optimum route selection, based on the smallest possible impact, is shown in Figure 5.2.1 after considering the alternatives of crossing at the ARMCO culvert (next to the Raw Water pipeline from Kendal crossing) and crossing at the Access Road (D686). These alternatives are not feasible due to an elevation constraint; only a 0,6% slope available on the selected route.

The Project assumed that the foundation structures to be small as the pipe system is rather small (in design terms) and requires access to the wetland to do the geotechnical investigation in order to complete the detail design for the above ground section (wetlands section).

Figure 5.2.1- Dirty Water Systems



5.3. Programme

Only the wetlands section referred to below.

Wetland/ River Crossing Number	Description	GPS location		Start Date	Finish Date
		South	East		
5a	Crossing of wetlands by pipeline between the ADDD and station dirty dam (Geotech Investigation);	25º55'25.92"	28º54'7.95"	2013-07-31	2013-09-29
5b	Crossing of wetlands by pipeline between the ADDD and station dirty dam (Construction);	25º55'25.92"	28º54'7.95"	2014-02-25	2014-10-30

5.4. Methodology

The Project requires access to the wetland to do the geotechnical investigation in order to complete the detail design for the above ground section.

<table>
<tr><th>Process</th><th>Materials and Equipment</th><th>On / Off site Transport</th><th>Movement of Materials on site</th><th>Method and Storage of Material</th></tr>
<tr><td>Piling excavation</td><td>Bobcat /mini excavator/ Rig with auger</td><td rowspan="8">Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (tractors etc.) and at least 100 m away from wetlands (excavator, water pumps)</td><td>Pile borings will be sidecast, picked up on a daily basis and spoiled outside the 100 meter buffer zone trucked away by tipper trucks</td><td>Materials will not be stockpiled overnight and will be spoiled at approved dumping sites of the Project</td></tr>
<tr><td rowspan="2">Piling</td><td>Steel Reinforcing</td><td>Manual installation by skilled workers</td><td>Stacked and stored within the servitude</td></tr>
<tr><td>Ready-mix Concrete, bobcat (or similar light equipment)</td><td>Direct Discharge / chute</td><td>Off Site</td></tr>
<tr><td rowspan="3">Construct Pile caps / Foundations</td><td>Formwork (wood or steel shutters)</td><td>Manual installation by skilled workers / may be assisted by crane</td><td>Stacked and stored within the servitude</td></tr>
<tr><td>Steel Reinforcing</td><td>Manual installation by skilled workers</td><td>Stacked and stored within the servitude</td></tr>
<tr><td>Ready-mix Concrete, bobcat (or similar light equipment)</td><td>Direct Discharge / chute</td><td>Off Site</td></tr>
<tr><td>Rehabilitation</td><td>Tractor with disc harrow or plough</td><td>Disc or plough with contours to loosen soil compacted through plant movement and reinstate wetland banks</td><td>N/A</td></tr>
<tr><td>Rehabilitation</td><td>Seeds, seed spreader</td><td>Disc or plough with contours to loosen soil compacted through plant movement correcting preferential flow paths along equipment tracks and reinstate wetland banks</td><td>Harvest seeds in this area in current/ store in a cool dry place for use in next season</td></tr>
</table>

The remainder of the pipe system (below ground) as follows;

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Excavation of pipe trench	360° Excavator, Tipper trucks	Equipment will access the site from the downstream end Equipment will use predetermined haul route. Equipment wil be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator)	360° Excavator will excavate in sections from direction South (Southern leg) or visa versa. Excavated material will be sidecast outside the 100 meter buffer zone or trucked away by tipper trucks	Materials will be stockpiled on site (sidecast) on the upstream side of the trench and excess can be spoiled at approved dumping sites of the Project
Pipe Bedding	Bedding material, 360° Excavator, Tipper trucks		360° Excavator will place material in sections from direction South (Southern leg) or visa versa. Stockpiled material will be placed downstream outside the 100 meter buffer zone	Materials will be stockpiled on site (sidecast) on the upstream side of the trench and excess can be spoiled at approved dumping sites of the Project
Pipe installation	Concrete pipes,360° Excavator or mobile crane, Flatbed trucks		Pipes will be delivered to site by supplier and stockpiled downstream of the trench.	Pipes will be delivered to site by supplier and stockpiled downstream of the trench.
Construct Junction Boxes walls	Formwork (wood or steel shutters)		Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete		Direct Discharge / chute	Off Site
Construct Junction Boxes and walls	Formwork (wood or steel shutters)		Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, truck, crane or pump		Crane & bucket / piped	Off Site
Backfilling of permanent works	Fill ex excavation,360 ° Excavator, Tipper trucks, Compactor/ Rollers		fill sources from sidecast on site.	fill sources from sidecast next to trench. Excess spoiled at approved dump site

6. Dirty Water Pipeline between Ash Dump and ADDD

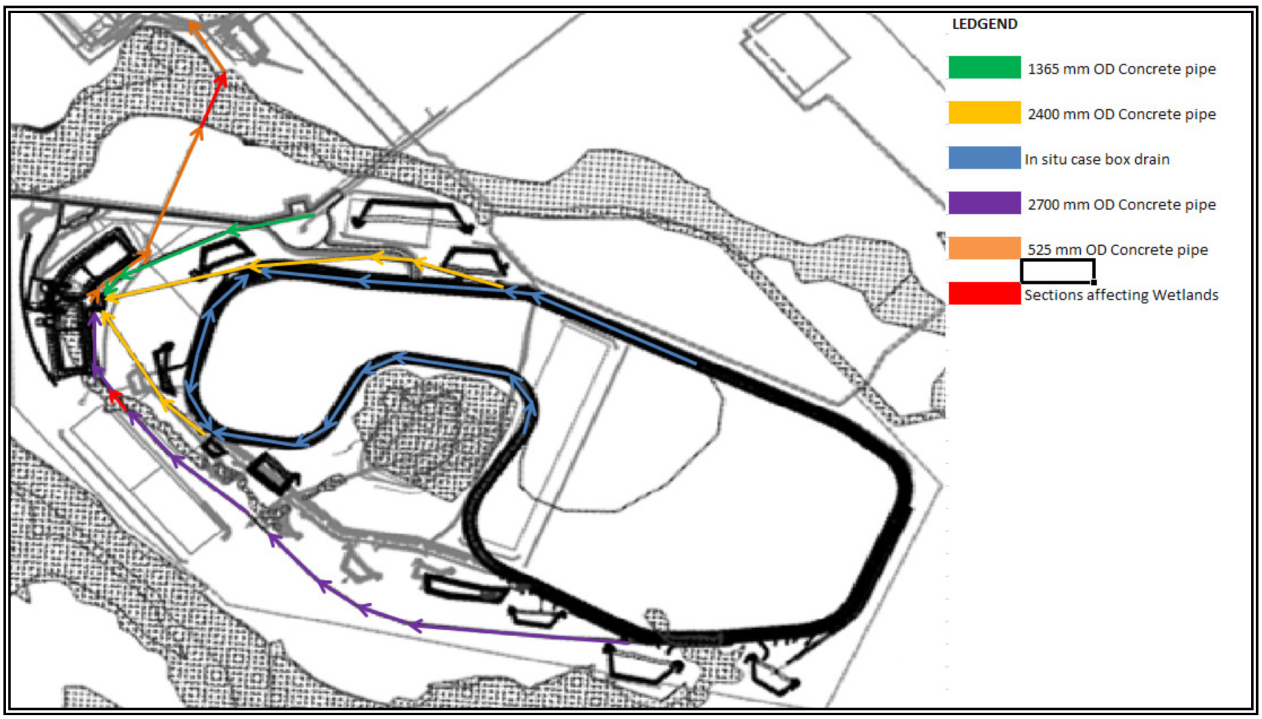
6.1. Applicable regulation

Activity 11 of GN 544 for the crossing of the wetland by a dirty water pipeline between the Ash Dump and the ADDD.

6.2. Design

The affected area can be seen along the 2700 mm OD pipeline highlighted in red – Figure 6.2.1.

Figure 6.2.1- Dirty Water Systems



6.3. Programme

The section of Dirty Water Drain do not form part of the current Constructing Contractor scope of work, the impacted area being close to SRP W8. The Project Strategy is that this will be constructed by Eskom Generation at a later date. Eskom Generation will notify the Department (s) prior to commencement of the activity.

6.4. Methodology

<table>
<tr><th>Process</th><th>Materials and Equipment</th><th>On / Off site Transport</th><th>Movement of Materials on site</th><th>Method and Storage of Material</th></tr>
<tr><td>Excavation of pipe trench</td><td>360° Excavator, Tipper trucks</td><td rowspan="10">Equipment will access the site from the downstream end Equipment will use predetermined haul route. Equipment wil be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator)</td><td>360° Excavator will excavate in sections from direction South (Southern leg) or visa versa. Excavated material will be sidecast outside the 100 meter buffer zone or trucked away by tipper trucks</td><td>Materials will be stockpiled on site (sidecast) on the upstream side of the trench and excess can be spoiled at approved dumping sites of the Project</td></tr>
<tr><td>Pipe Bedding</td><td>Bedding material, 360° Excavator, Tipper trucks</td><td>360° Excavator will place material in sections from direction South (Southern leg) or visa versa. Stockpiled material will be placed downstream outside the 100 meter buffer zone</td><td>Materials will be stockpiled on site (sidecast) on the upstream side of the trench and excess can be spoiled at approved dumping sites of the Project</td></tr>
<tr><td>Pipe installation</td><td>Concrete pipes,360° Excavator or mobile crane, Flatbed trucks</td><td>Pipes will be delivered to site by supplier and stockpiled downstream of the trench.</td><td>Pipes will be delivered to site by supplier and stockpiled downstream of the trench.</td></tr>
<tr><td rowspan="3">Construct Junction Boxes walls</td><td>Formwork (wood or steel shutters)</td><td>Manual installation by skilled workers / may be assisted by crane</td><td>Stacked and stored within the servitude</td></tr>
<tr><td>Steel Reinforcing</td><td>Manual installation by skilled workers</td><td>Stacked and stored within the servitude</td></tr>
<tr><td>Ready-mix Concrete</td><td>Direct Discharge / chute</td><td>Off Site</td></tr>
<tr><td rowspan="3">Construct Junction Boxes and walls</td><td>Formwork (wood or steel shutters)</td><td>Manual installation by skilled workers / may be assisted by crane</td><td>Stacked and stored within the servitude</td></tr>
<tr><td>Steel Reinforcing</td><td>Manual installation by skilled workers</td><td>Stacked and stored within the servitude</td></tr>
<tr><td>Ready-mix Concrete, truck, crane or pump</td><td>Crane & bucket / piped</td><td>Off Site</td></tr>
<tr><td>Backfilling of permanent works</td><td>Fill ex excavation,360 ° Excavator, Tipper trucks, Compactor/ Rollers</td><td>fill sources from sidecast on site.</td><td>fill sources from sidecast next to trench. Excess spoiled at approved dump site</td></tr>
</table>

8. Perimeter fencing

8.1. Applicable regulation

Activity 11 of GN 544 for the crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station.

8.2. Design

Three different design solutions are applicable. In area 7 (Coal Stock Yard) a fence bridge over the concrete structure has been provided, in area 4 (ARMCO culvert) the perimeter fence will cross the wetlands at the culvert embankment and in area 8 the perimeter fence cross the wetlands with a buried 300 mm section of bonnox wire mesh imbedded along the fence route as shown.

8.3. Programme

Wetland/ River Crossing Number	Description	GPS location		Start Date	Finish Date
		South	East		
4	Construction of the ash dump access embankment (with culvert) within a wetland	25º 55’31.89”	28º54’31.61”	2014-08-01	2014-11-26
7	Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station.	25º 55’48.71”	28º55’50.71”	2014/07/25	2014/10/25
8	Crossing of wetlands by the fence-lines around the Kusile ash dump and the Kusile Power Station.	25º 56’42.78”	28º55’23.01”	2014/07/25	2014/10/25

8.4. Methodology

Only at location 8 craft workers will work in "contact" with the wetland

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Hand Excavation of fence post holes and anchor trench	Spades, picks , wheel barrows and shovels	Care should be taken not to create preferential flow paths along fence route	material sidecast and re-used later as backfill	Excess material will be removed
installation of fence	Concrete, wheel barrows, fence material, backfill ex sidecast		the use of vehicles and plant to deliver materials within the wetlands prohibited to prevent vehicle tracks forming preferential flow paths	No pouring of concrete in standing/ running water allowed, excess concrete to be contained within a plastic lined bund till set. Waste containers to be provided >100 meter from the wetland for disposal of waste.
Backfilling of permanent works				Level backfilled material to simulate as close as possible the existing grade

Wetlands Method Statement

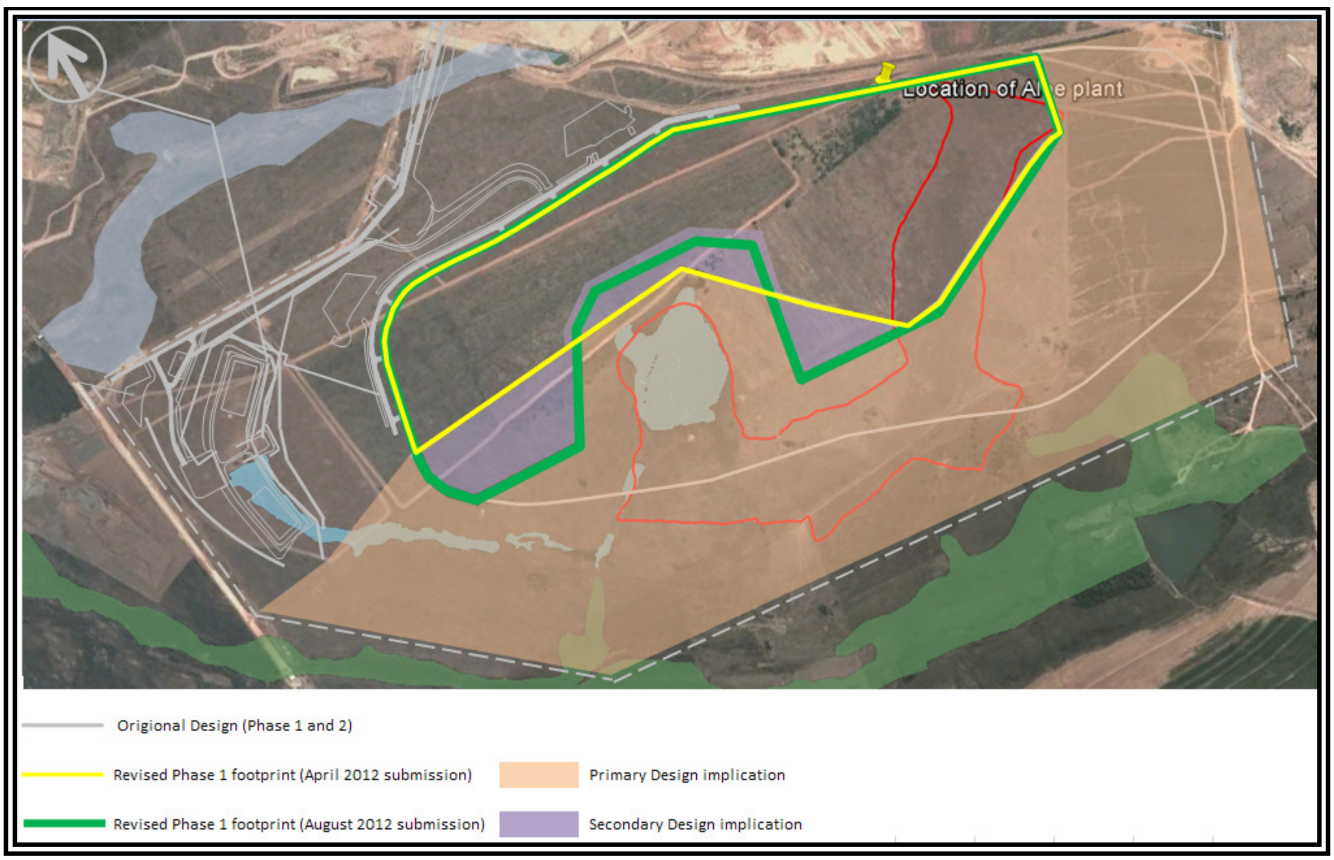
Kusile Power Station – Combustion Waste Terrace

I. Scope

This Construction Method Statement's scope has been limited to activities of which the design remained the same in all the various proposals to date.

Subsequent supplementary submissions that have design implications are explicitly excluded from this Method Statement. Design, drawings and method statements for the areas defined as "Primary design implication" and "Secondary design implication" will therefore have to be agreed at a later date with the Regional Chief Director: Mpumalanga, Department of Water Affairs, Private Bag X11259, Nelspruit, 1200 hereafter referred to as "The Regional Head". The impacted areas are shown in Figure 1.

Figure 1



II. Design Responsibility

The design of the Combustion Waste Terrace is rather complex with various Consultants and Sub-Consultants involved as shown in Figure 2. The linear services activities described below are examined in detail later.

Material Handling equipment in the ARMCO culvert and Radial Stacker areas (Bateman Africa scope) is excluded herein and will be agreed with The Regional Head separately.

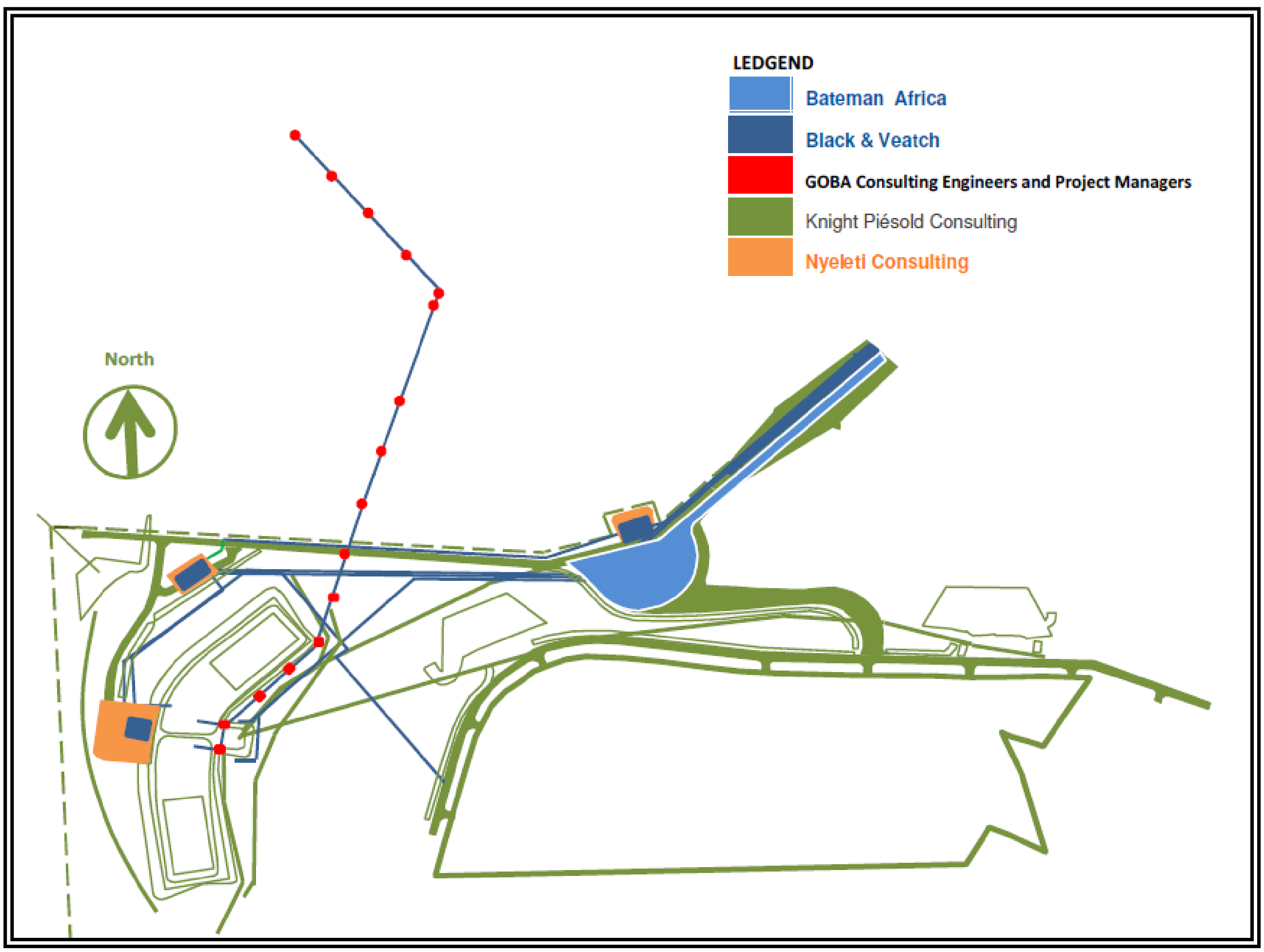
Black & Veatch designed road 1 (over ARMCO culvert) and other linear services; 525 pipe with Junction Boxes 949/ 950 (ADDD to SDD), 110/160 diameter pipes(Workshop Terrace to the Power Block), 315 diameter pipe (Ash Dump Dirty Dam to Power Block) and electrical cable routes (Pump Station to Power Block).

Goba Consulting Engineering and Project Managers designed Junction Boxes JB951 to JB965.

Nyaleti Consulting designed the Sub-Station, Workshop and Pump Station buildings.

All remainder design work done by Knight Piésold Consulting.

Figure 2 – Design Responsibilities



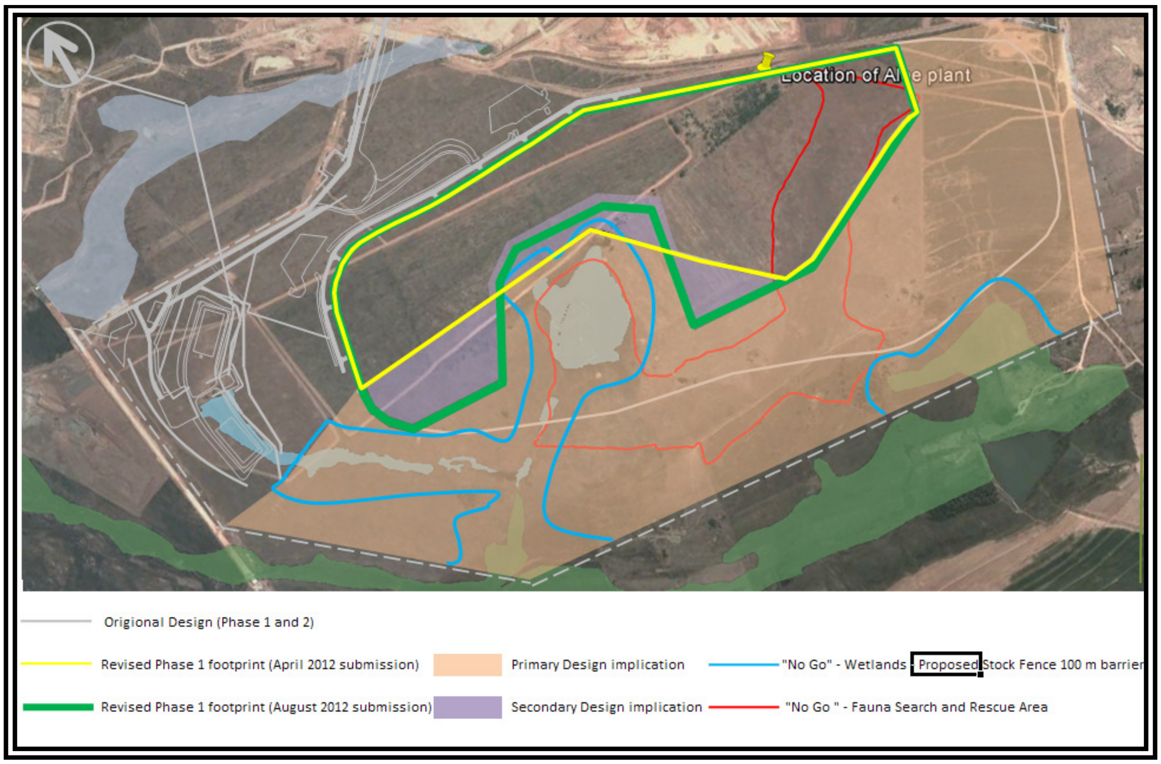
III. Specialist Studies

Various Environmental Specialist activities were undertaken within the area.

Zitholele Consulting and their associate Golder Associates performed a flora “Search and Rescue” survey within the site. They identified and mapped a number of plants to be rescued within the wetlands and the area demarcated in red (refer Figure 3) below. The identified plants can only be relocated to the Kusile nursery during the spring/ early summer.

In addition to communicating the conditions of the authorization to all employees, sub-consultants, contractors etc, the Project secure the Wetland “no-go” area, in a “belts and braces” approach, with the installation of a 1,2 meter high stock fence along the 100 meter barrier line around the defined wetlands as shown in the sketch below. This action will prevent indiscriminate driving through wetlands while still allowing the migration of natural flora and small fauna.

Figure 3



Zitholele Consulting also performs the onsite water monitoring regime.

Subsequent to the receipt of the 21 (c), (g) and (i) licence Wetland Consulting Services conducted a wetland study within the pan area. A drawing incorporating the recommendations of said report has been included.

IV. Construction Contractor Responsibility

The current Construction Contractor package split (shown in Figure 5) is in the process of being modified to simplify central point of accountability as shown in Figure 6.

Figure 5- Current Package Scope

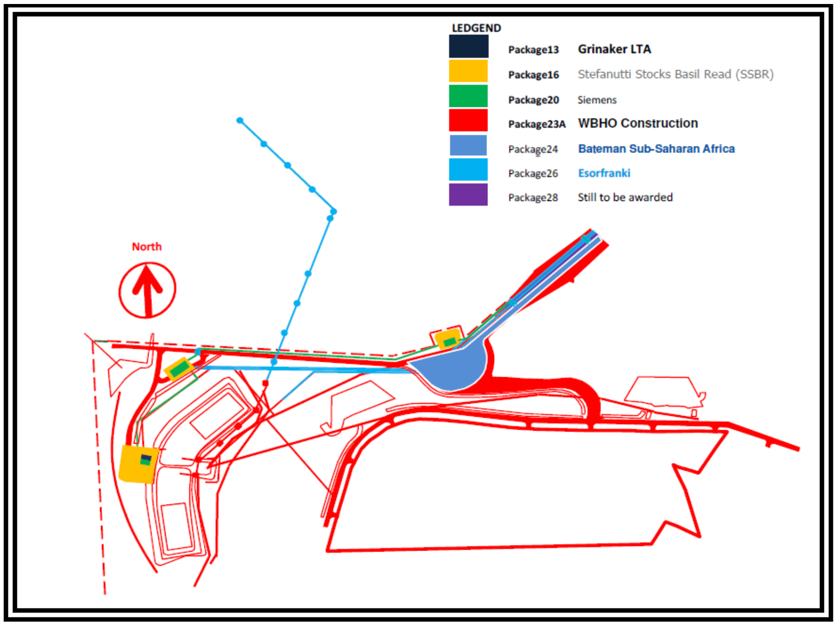
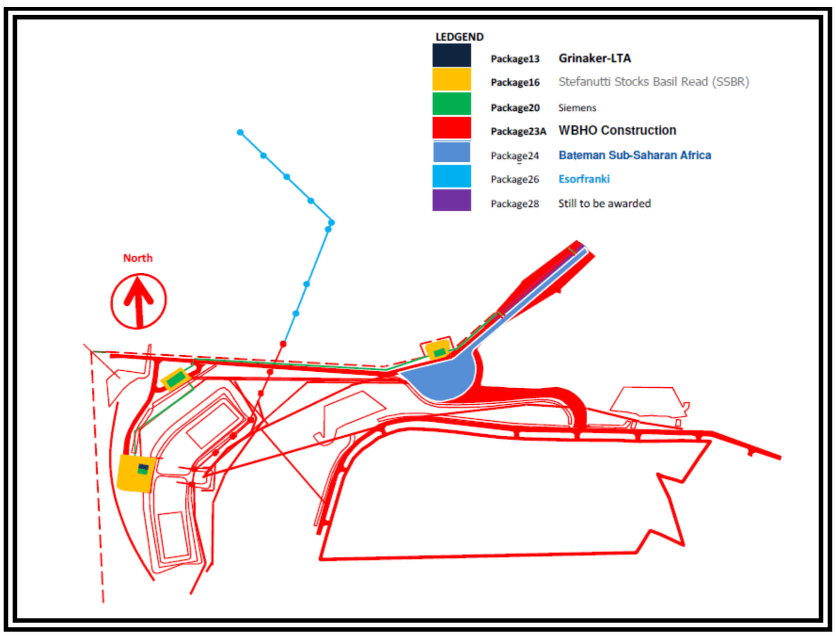


Figure 6 – Proposed Package Scope



Package 26 Constructing Contractor's the only contractor within the current scope split specializing in piling activities and therefore retains the scope of work outside the permanent fence.

V. Access Control

It is imperative to construct the permanent fence as soon as possible along the perimeter of the 10 year Combustion Waste Terrace to control unauthorized access to site. The package 23A Constructing Contractor, WBHO Construction, control access to the site until Take Over when control reverts to the Project. Access to site (for authorized employees and their contractors) can be obtained through access gates subject to compliance to access requirements.

VI. Programme

Activities within a watercourse are listed in Table 2 and depicted in Figure 4 below. Months of seasonal low flows (September/ October months) have been taken into consideration in the schedule. The Project also took into consideration the removal of protected flora hence the planned start date of some activities delayed till 2 November 2012. Due to the complexity and duration of activities, activities could also not be confined to the months of seasonal low flow.

Figure 4 – Wetlands

Table 2 - Programme

Description	Start		End		Programme	
	Co-ordinate (S)	Co-ordinate (E)	Co-ordinate (S)	Co-ordinate (E)	Start	Finish
WC Road 5	25.92516111	28.90941111	25.92607500	28.90856389	02-Nov-12	30-May-14
WC ADDD	25.93525556	28.89856389	25.93213056	28.89731667	02-Nov-12	30-May-14
WC SDD ADDD	25.92313611	28.90218889	25.92478056	28.90147778	26-Apr-13	06-Nov-13
WC PAN	25.93450000	28.90995278	25.93443611	28.91273056	No activity	No activity
WC F1	25.94204444	28.90268333	25.94370000	28.90594722	02-Nov-12	02-Feb-13
WC F2	25.94504444	28.92217500	25.94531111	28.92513889	02-Nov-12	02-Feb-13

VII. Limits of Disturbance

Limit of disturbance are defined as shown in Table 3 below for package 23A and extended to the North for package 26 as shown in Table 4.

Table 3

Description	Co-ordinate (S)	Co-ordinate (E)
Armco'	25.924225	28.90934167
JB 956'	25.92724722	28.90069167
ADDD HDPE'	25.92733333	28.89430556
PF2'	25.92772222	28.89433333
PF1'	25.93622222	28.89522222
PF10'	25.94334722	28.90403056
PF9'	25.94613889	28.92783333
PF8'	25.93677778	28.93161111

Table 4

Description	Co-ordinate (S)	Co-ordinate (E)
JB 956'	25.92724722	28.90069167
JB 960'	25.92296111	28.90250000
LD SDD'	25.92066944	28.89942500

VIII. ACTIVITIES

Activities were assessed for the following impacts after consulting the drawings listed in each sub-section;

Alteration of flow regimes

Deterioration of water quality

Disturbance of riparian or instream habitat

A. ROAD 5 – ARMCO

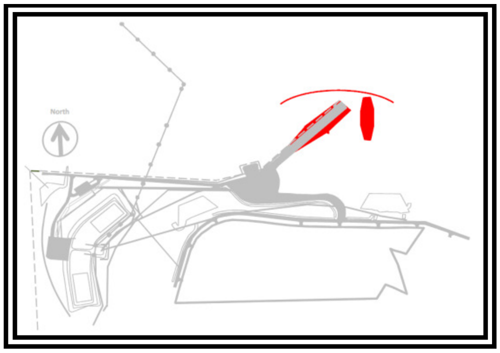


Table 5 – ARMCO drawings

Description	Drawing number
Ash Dump Access Embankment Culvert: General Arrangement	K5406-036
Ash Dump Access Embankment Culvert: Concrete layout and Details 1/2	K5406-094
Ash Dump Access Embankment Culvert: Concrete layout and Details 2/2	K5406-095
Coal stock Yard Stream Diversion Surface Channel to Ash Dump Culvert Layout	K5406-102

Methodology

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Deviation of stream - Excavation	360° Excavator, Tipper trucks	Equipment will access the site from the North of the stream (not traverse through the stream from the South). Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least	360° Excavator will excavate from West to East (Downstream to Upstream), Excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Deviation of stream - Installation of Pipe	360° Excavator, Tipper trucks, Hi-ab Flatbed truck, Compactor/ Rollers		Suitable material will be imported from elsewhere on site, pipe bedding installed and on completion of pipe installation backfilled with suitable material from elsewhere on site	Only sufficient material, to be used during that day, will be temporary stockpiled on site within servitude
Deviation of stream - Deviation of Stream	360° Excavator, Tipper trucks		360° Excavator will excavate from West to East (Downstream to Upstream), Excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project

		100 m away from wetlands (Excavator/ rollers)		
Temporary Embankment - Excavation			360° Excavator can excavate North to South or South to North. Excavated material will be trucked away by tipper trucks	
Temporary Embankment - Filling	Dumprock, Pioneer, Fill,360° Excavator, Tipper trucks, Compactor/ Rollers	Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers/ water pumps)	Dumprock/ Pioneer (as and when required) will be imported and fill sources from elsewhere on site.	Only sufficient material, to be used during that day, will be temporary stockpiled on site.
Excavation of permanent works	360° Excavator, Tipper trucks		360° Excavator will excavate and excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Installation of Subsoil drain	360° Excavator, Tipper trucks, water pump		Pioneer (as and when required) will be imported and fill sources from elsewhere on site. Water will be returned to the steam (downstream) through a siltnet	Only sufficient material, to be used during that day, will be temporary stockpiled on site within servitude.
Backfilling of permanent works	Dumprock, Pioneer, Fill,360° Excavator, Tipper trucks, Compactor/ Rollers		Dumprock/ Pioneer (as and when required) will be imported and fill sources from elsewhere on site.	
Installation of a temporary crane pad (as and when required if unsuitable founding conditions encountered)				
Installation of ARMCO Culvert	Crane/ Hi-ab Flatbed truck		Installation will be done in sections from East to West and level or below original stream invert level to prevent upstream damming	Material will be stored within reach of the crane within servitude
Construct Wing wall Bases	Formwork (wood or steel shutters)	Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at	Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete		Direct Discharge / chute	Off Site

Construct Wing wall Walls	Formwork (wood or steel shutters)	least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers/ water pumps)	Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, truck, crane or pump		Crane & bucket / piped	Off Site
Construct ARMCO Liner	Formwork (wood or steel shutters)		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, truck, crane or pump		Crane & bucket / piped	Off Site
Redirect FLOW THROUGH CULVERT	360° Excavator, Tipper trucks		360° Excavator will block temp pipe entrance with soil	N/A
Removal of Temporary Works			360° Excavator will excavate temp embankment and then from West to East (Downstream to Upstream), Excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Backfilling of permanent works	Dumprock, Pioneer, Fill,360° Excavator, Tipper trucks, Compactor/ Rollers		Dumprock/ Pioneer (as and when required) will be imported and fill sources from elsewhere on site.	Only sufficient material, to be used during that day, will be temporary stockpiled on site till work progressed above 1:100 year floodline.
Stabilization of Subbase	Cement ,Motor Grader Recycler(optional), rollers, Watercarts		Grader/ Recycler mix cement into layerworks Watercarts provide moisture during processing and curing period	Only sufficient material, to be used during that day, may be temporary stockpiled on site within servitude
Base Coarse	Base coarse, Motor Grader , rollers, Watercarts		Grader process layerworks Watercarts provide moisture during processing	On Site
Prime/ Wearing Coarse	Prime, Bearcat, Handpump / Apshalt, paver, tippers, rollers		Bearcat spray Base at required applied rate/ Handpump spreading for small areas, Paver spreads asphalt and rollers compact	Off Site
Prime	Prime, Bearcat, Handpump		Bearcat spray Base at required applied rate/ Handpump spreading for small areas	Off Site

B. Ash Dump Dirty Dam (ADDD)

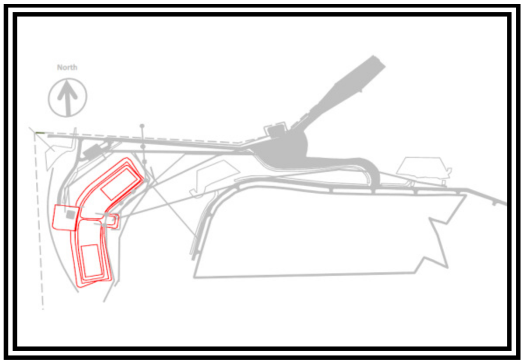


Table 6 – ADDD drawings

Description	Drawing number
Ash Dump No 1 Dirty dam Setting out Drawing for Dam	K30300098/06-280
Ash Dump No 1 Dirty dam Typical Sections	K30300098/06-281
Ash Dump No 1 Dirty dam Typical Sections	K30300098/06-282
Ash Dump No 1 Dirty dam Compartment 1 Inlet General Arrangement	K30300098/06-283
Ash Dump No 1 Dirty dam Compartment 1 Outlet General Arrangement	K30300098/06-284
Ash Dump Dirty dam Spilway 1 Outlet GA and Typical details	K30300098/06-285
Ash Dump Dirty dam Spilway 2 Outlet GA and Typical details	K30300098/06-286
Ash Dump Dirty dam Compartment no 1 Energy Dissipator No 1 General Arrangement & Details	K30300098/06-287
Ash Dump Dirty dam Leakage detection sump General Arrangement & Details	K30300098/06-288
Ash Dump No 1 Dirty dam Compartment 2 Inlet General Arrangement	K30300098/06-289
Ash Dump No 1 Dirty dam Compartment 2 Outlet General Arrangement	K30300098/06-290
Ash Dump Dirty dam Setting Out of Drains	K30300098/06-291
Ash Dump Dirty dam Compartment 1 Basin Division Walls & Details	K30300098/06-295
Ash Dump Dirty dam Compartment 2 Basin Division Walls & Details	K30300098/06-296
Ash Dump Dirty dam Compartment 1 GA - Floor slab and Joint layout	K30300098/06-297
Ash Dump Dirty dam Compartment 2 GA - Floor slab and Joint layout	K30300098/06-298
Ash Dump Dirty dam Compartment no 1 Energy Dissipator No 3 General Arrangement & Details	K30300098/06-400
Ash Dump Dirty dam Compartment no 2 Energy Dissipator No 4 General Arrangement & Details	K30300098/06-402
Ash Dump Dirty dam Compartment no 2 Energy Dissipator No 2 General Arrangement & Details	K30300098/06-404
Ash Dump No 1 Pump Station Terrace Retaining Wall Plan and Details	K30300098/06-405
Ash Dump No 1 Dirty Dam to Pump Station pipe longsections & Setting out	K30300098/06-406
Safety Rope Detail	K30300098/06-472

Methodology

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Excavation of a cut off trench South side	360° Excavator, Tipper trucks	Equipment will access the site from the North of the hillside seep (not traverse through the wetland from the South). Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers)	360° Excavator will excavate from South to North. Excavated material will be trucked away by tipper trucks	Materials will not be stockpiled on site (Sidecast) and will be spoiled at approved dumping sites of the Project
Excavate Compartment 1,2 JB05 and pump station terrace	360° Excavator, Tipper trucks			
Construct Drain under liner	Geotextile, Pioneer, Fill,360° Excavator, Tipper trucks, Flatbed truck, Compactor/ Rollers		Compact selected layer.TLB or telescopic handler will off load the geotextile and using a spreader bar, spread the geotextile. 19 mm washed stone placed in the geotextile and geotextile closed on top	Only sufficient material, to be used during that day, will be temporary stockpiled on site within servitude.
Install Liner System incl cuspated sheet	Geotextile, HDPE Liner, Cuspated sheet Fill,360° Excavator, Tipper trucks, Flatbed truck, Compactor/ Rollers		TLB or telescopic handler will off load the material and using a spreader bar, spread the sheets and then welded in situ by skilled workers	
Construct Concrete liner and Energy Discipators/ Junction Boxes	Formwork (wood or steel shutters)	Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator/ rollers/ water pumps)	Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the site
	Steel Reinforcing (Mesh & dowels)		Manual installation by skilled workers	Stacked and stored within the site
	Ready-mix Concrete, Mixer truck, floats		Direct Discharge/ chute/ Pump or Crane and bucket dependant on reach	Off Site

C. Drain pipe from ADDD to SDD

The designers considered the option of crossing at the ARMCO Culvert and Access Road. Neither alternative proved to be feasible due to elevation constraints between structures. The slope along invert of the 525 mm diameter pipe is only, on average, only a minimal 0.6 % basically because the SDD is fixed and the ADDD can't be moved due to other consideration of other gravity lines upstream.

This linear service has the potential to form a preferential flow path along the pipe invert/ bedding material because the service direction is perpendicular to the contour line. The risk of a preferential flow path is further mitigated by 17 manholes of either 1500mm x 1500 mm in situ placed concrete or 1800 diameter manhole precast rings spaced along the route forming barriers around the pipe.

Surface slope along the Southern leg's around 1,5 % and the Northern leg < 1,0%. The solid blue lines depict sidecast stockpiled material upstream of the excavation. The arrows indicate direction of surface flow.

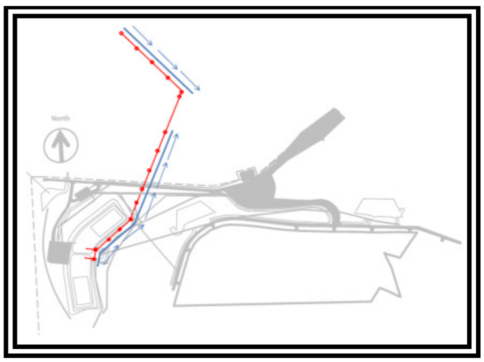


Table 7 – 525 Diameter pipe ADDD to SDD drawings

Description	Drawing number
Terrace Underground Facilities - Site Plan - Area 87	146838-OUXC-S3387
Terrace Underground Facilities - Site Plan - Area 86	146838-OUXC-S3386
Terrace Underground Facilities - Site Plan - Area 85	146838-OUXC-S3385
Terrace Underground Facilities - Site Plan - Area 91	146838-OUXC-S3391

Methodology

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Excavation of pipe trench	360° Excavator, Tipper trucks	Equipment will access the site from the downstream end Equipment will use predetermined haul route. Equipment wil be stored overnight at camps or at least > 100 meter away from	360° Excavator will excavate in sections from direction South (Southern leg) or visa versa. Excavated material will be sidecast outside the 100 meter buffer zone or trucked away by tipper trucks	Materials will be stockpiled on site (sidecast) on the upstream side of the trench and excess can be spoiled at approved dumping sites of the Project

Pipe Bedding	Bedding material, 360° Excavator, Tipper trucks	wetlands. Equipment will be refuelled at filling depot (trucks etc.) and at least 100 m away from wetlands (Excavator)	360° Excavator will place material in sections from direction South (Southern leg) or visa versa. Stockpiled material will be placed downstream outside the 100 meter buffer zone	Materials will be stockpiled on site (sidecast) on the upstream side of the trench and excess can be spoiled at approved dumping sites of the Project
Pipe installation	Concrete pipes,360° Excavator or mobile crane, Flatbed trucks		Pipes will be delivered to site by supplier and stockpiled downstream of the trench.	Pipes will be delivered to site by supplier and stockpiled downstream of the trench.
Construct Junction Boxes walls	Formwork (wood or steel shutters)		Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete		Direct Discharge / chute	Off Site
Construct Junction Boxes and walls	Formwork (wood or steel shutters)		Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, truck, crane or pump		Crane & bucket / piped	Off Site
Backfilling of permanent works	Fill ex excavation,360° Excavator, Tipper trucks, Compactor/ Rollers		fill sources from sidecast on site.	fill sources from sidecast next to trench. Excess spoiled at approved dump site

The design includes the wetland crossing above grade. The foundation design currently calls for 40 piles. The loading on the piles is extremely small (in construction terms). The project also crossed this wetland twice before and reasonably expect to find suitable founding conditions relatively near the surface /shallow. The Project expects that this can be done with light equipment and will conduct trail pit excavations to confirm basically following the same method described below (excluding constructing the pile).

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Piling excavation	Bobcat /mini excavator/ Tractor with auger	Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100	Pile borings will be sidecast , picked up on a daily basis and spoiled outside the 100 meter buffer zone trucked away by	Materials will not be stockpiled overnight and will be spoiled at approved dumping sites of the Project

		meter away from wetlands. Equipment will be refuelled at filling depot (tractors etc.) and at least 100 m away from wetlands (excavator, water pumps)	tipper trucks	
Piling	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, bobcat (or simmilar light equipment)		Direct Discharge / chute	Off Site
Construct Pile caps / Foundations	Formwork (wood or steel shutters)		Manual installation by skilled workers / may be assisted by crane	Stacked and stored within the servitude
	Steel Reinforcing		Manual installation by skilled workers	Stacked and stored within the servitude
	Ready-mix Concrete, bobcat (or similar light equipment)		Direct Discharge / chute	Off Site
Rehabilitation	Tractor with disc harrow or plough		Disc or plough with contours to loosen soil compacted through plant movement and reinstate wetland banks	N/A
Rehabilitation	Seeds, seed spreader		Disc or plough with contours to loosen soil compacted through plant movement correcting preferential flow paths along equipment tracks and reinstate wetland banks	Harvest seeds in this area in 2012/ store in a cool dry place for use in 2013 season

D. Fencing F1 and F2

Description	Drawing number
Ash Dump No 1 General Arrangement Plan	K30300098/06-201
SECURITY FENCE DOUBLE SWING ACCESS GATE	0UYX-S3916
SECURITY FENCE POST CONCRETE BASES AND	0UYX-S3916A
SECURITY FENCE ACCESS GATE POSTS	0UYX-S3916B
SECURITY FENCE DETAILS OF POSTS AND STRUTS	0UYX-S3916C
SECURITY FENCE WELDMESH TERMINATION AND	0UYX-S3916D
SECURITY FENCE ACCESS GATE	0UYX-S3916E
SECURITY FENCE OVERHANG BRACKETS	0UYX-S3916F
SECURITY FENCE SINGLE SWING ACCESS GATE	0UYX-S3916G
SECURITY FENCE GATE POST FOUNDATIONS	0UYX-S3916H
SECURITY FENCE SINGLE SWING GATE KEEP DETAILS	0UYX-S3916J

Methodology

Process	Materials and Equipment	On / Off site Transport	Movement of Materials on site	Method and Storage of Material
Auger excavation	Bobcat /mini excavator/ Tractor with auger	Equipment will use predetermined haul route. Equipment will be stored overnight at camps or at least > 100 meter away from wetlands. Equipment will be refuelled at filling depot (tractors etc.) and at least 100 m away from wetlands (excavator, water pumps)	Pile borings will be sidecast , picked up on a daily basis and spoiled outside the 100 meter buffer zone trucked away by tipper trucks	Materials will not be stockpiled overnight and will be spoiled at approved dumping sites of the Project
Concrete to Straining posts	Ready-mix Concrete, bobcat (or similar light equipment)		Direct Discharge / chute	Off Site
Rehabilitation	Tractor with disc harrow or plough		Disc or plough with contours to loosen soil compacted through plant movement and reinstate wetland banks	N/A
Rehabilitation	Seeds, seed spreader		Disc or plough with contours to loosen soil compacted through plant movement correcting preferential flow paths along equipment tracks and reinstate wetland banks	Harvest seeds in this area in 2012/ store in a cool dry place for use in 2013 season

E. Linear Services- ADDD Downstream Collection Drain

Concentrated flows occur typically along Linear Services. Stormwater contamination (mainly turbidity) can also occur.

ADDD Downstream v-drain collect stormwater from the ADDD work area and channel the water to the silt retention pond where the flow's attenuated and debris collected in the silt retention dam as shown. SO1 to SO2 slopes at 4.4 % and 1.2 % between SO2 and SO3. The drain's to be grassed once shaped.

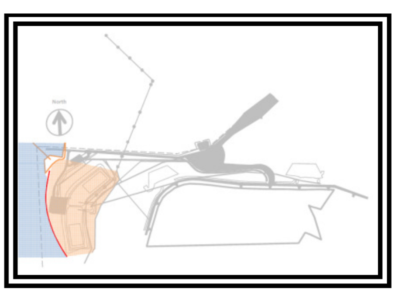


Table 8 – ADDD Downstream Storm Water Control

Description	Drawing number
Ash Dump No 1 Dirty Dam Setting out of Drains	K30300098/06-291
Ash Dump No 1 Stormwater Diversion /Collection Channels Typ sections and details (Cross section R)	K30300098/06-219
Ash Dump Dirty dam Construction Stormwater Management G.A.	K30300098/06-215

F. Linear Services- Workshop/ Pumpstation Collection Drain

This is supplemented by the Workshop v-drain; “CD-EF” slopes at 0.68% and “XW-P15” at 0.40% This drain’s to be grassed once shaped.

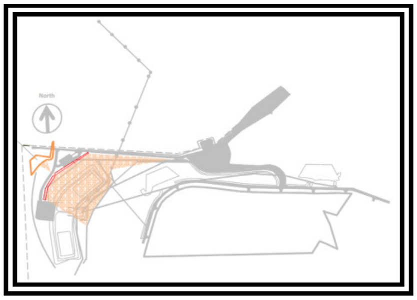


Table 9 – Workshop/ Pump Station Storm Water Control

Description	Drawing number
Ash Dump No 1 Workshop Terrace General Arrangement & Typ details	K30300098/06-217
Ash Dump No 1 Pumpstation General Arrangement & Typ details	K30300098/06-218
Ash Dump No 1 Stormwater Diversion /Collection Channels Typ sections and details (Cross section B)	K30300098/06-219

G. Linear Services- Temporary Drain

1a1/ 1a2 temporary v-drain collect stormwater from the 1a1/ 1a2 work area and channel the water to the silt retention pond E1 where the flow’s attenuated and debris collected as shown. The design includes gabion trench breakers at 50 meter centres and erosion blankets. In the approximately 1460 meter checked only 5 points may exceed the 2% slope; chainage 740m / 2.4%, 840m / 2.7%, 868m/ 2.08 %, 884/ 2.06% and 1200m 2.08%. This will be verified in the field and additional berms provided where required.

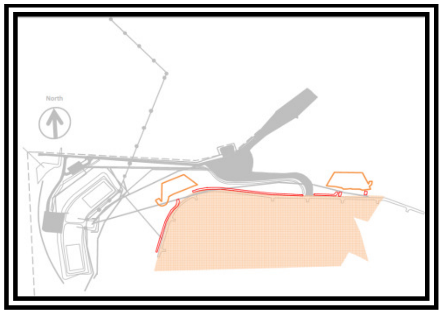


Table 10 – Area 1a1 Temporary Storm Water Control

Description	Drawing number
Dirty Water Drains Plan and profile Sheet 1	K30300098/06-235
Dirty Water Drains Plan and profile Sheet 2	K30300098/06-236
Ash Dump No 1 Construction Phase Stormwater management GA and Details	K30300098/06-216

H. Linear Services- Radial Stacker Access Road Drain

RSAR v-drain collect stormwater from the area South of the access road mainly to manage water not to run down the Redial stacker embankment. The v-drain slopes on average at about 4 %.

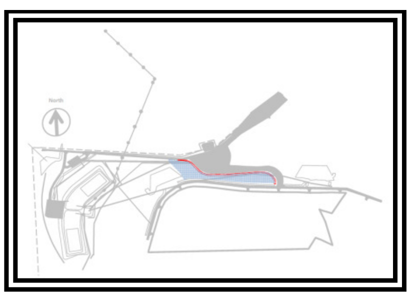


Table 11 – RS Storm Water Drain

Description	Drawing number
Ash Dump No1 Perimeter Access Road - Access from Radial Stacker	K30300098/06-349

I. Linear Services- ADDD Upstream Drain

ADDD Upstream v-drain divert stormwater away from the ADDD Only the first 50 meter and the last 50 meter slope at 4.25 % the average over the length of the v-drain is 0.5%. Drain to be grassed once shaped.

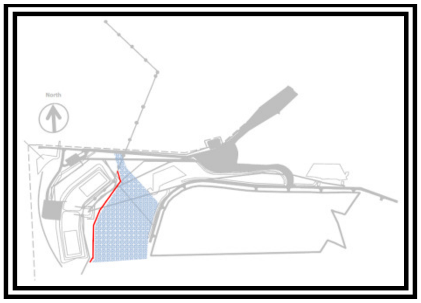


Table 12 – ADDD Upstream Storm Water Drain

Description	Drawing number
Ash Dump No 1 Dirty Dam Setting out of Drains	K30300098/06-291
Ash Dump No 1 Dirty Dam Typical sections (Cross section E)	K30300098/06-218

J. Linear Services- Dirty Water Pipe from Radial Stacker

Linear Services other than Stormwater Drainage structures include

The 1365 Concrete pipe slope at 0.42 % towards the ADDD in a closed system. Construction methodology will be similar to the 525 diameter pipe described earlier.

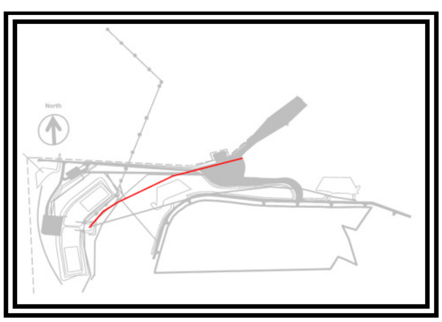


Table 13– 1365 mm Diameter drain line between RS and ADDD

Description	Drawing number
Ash Dump No1 Dirty Water Pipes Plan and Profile Sheet 3	K30300098/06-252

K. Linear Services- Dirty Water Drain from 1a1/1a2

The 2400 Concrete pipe slope at 0.42 % towards the ADDD in a closed system. Construction will be similar to the 525 diameter pipe described earlier.

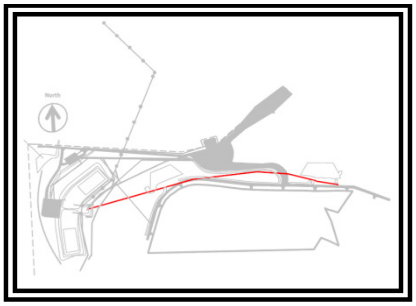


Table 14 – 2400 mm Diameter drain line between AD and ADDD

Description	Drawing number
Ash Dump No1 Dirty Water Pipes Plan and Profile Sheet 2	K30300098/06-251

L. Linear Services- 315 uPVC Pipeline

Shallow services form part of the scope. Construction concerns are similar to the deep dirty drains from an Environmental perspective. Shallow services include

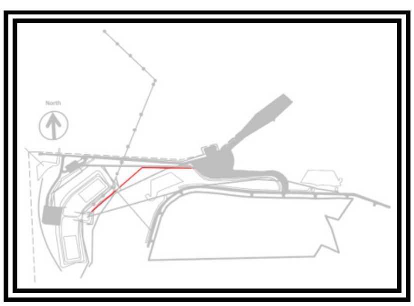


Table 15 – 315 uPVC pipeline

Description	Drawing number
Terrace Underground Facilities - Site Plan - Area 87	146838-OUXC-S3387
Terrace Underground Facilities - Site Plan - Area 86	146838-OUXC-S3386
Terrace Underground Facilities - Site Plan - Area 85	146838-OUXC-S3385
Terrace Underground Facilities - Site Plan - Area 83	146838-OUXC-S3383

M. Linear Services- Irrigation Pipeline

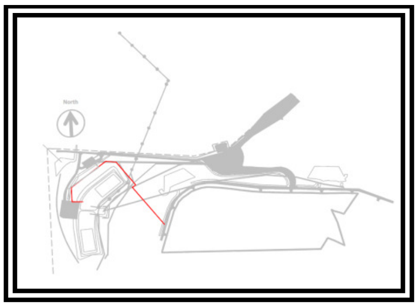


Table 16 – Irrigation pipeline.

Manifold at the dam omitted for clarity

Description	Drawing number
Terrace Underground Facilities - Site Plan - Area 87	146838-OUXC-S3387
Terrace Underground Facilities - Site Plan - Area 86	146838-OUXC-S3386
Terrace Underground Facilities - Site Plan - Area 84	146838-OUXC-S3384

N. Linear Services- 110 and 160 mm uPVC Pipelines

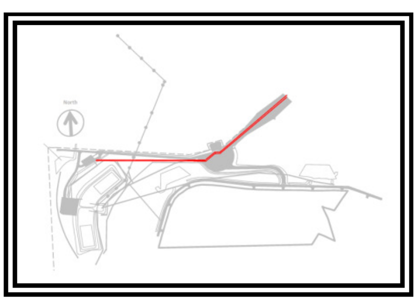


Table 17 - 110 / 160 diameters uPVC pipeline.

Description	Drawing number
Terrace Underground Facilities - Site Plan - Area 88	146838-OUXC-S3388
Terrace Underground Facilities - Site Plan - Area 86	146838-OUXC-S3386
Terrace Underground Facilities - Site Plan - Area 85	146838-OUXC-S3385
Terrace Underground Facilities - Site Plan - Area 83	146838-OUXC-S3383
Terrace Underground Facilities - Site Plan - Area 82	146838-OUXC-S3382

O. Linear Services- Cable Route

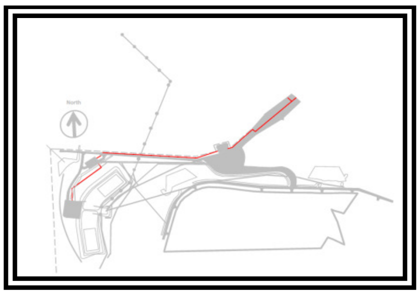


Table18 - . Electric Cable route.

Description	Drawing number
Terrace Underground Facilities - Site Plan - Area 87	146838-OUXC-S3387
Terrace Underground Facilities - Site Plan - Area 86	146838-OUXC-S3386
Terrace Underground Facilities - Site Plan - Area 84	146838-OUXC-S3384

IX. Environmental Management Strategy

A. Environmental Impact Management

The impacts relevant to the construction of the crossings are:

- Alteration of flow regimes, including but not limited to:
  - ~ Concentrated flows
  - ~ Temporary river diversions
- Deterioration of water quality (mainly turbidity), including but not limited to:
  - ~ Sedimentation
  - ~ Accidental spills (hydrocarbons, other hazardous chemicals)
  - ~ Contamination via stormwater runoff

- Disturbance of riparian an instream habitat (i.e. changes to the physical structure of the watercourses as well as vegetation), including but not limited to:
  - ~ Erosion
  - ~ Soil compaction
  - ~ Damage to vegetation
  - ~ Alien species establishment (operational phase?)

Measures to manage these impacts will be implemented as set out in Table 4.

Table 18: Mitigation Measures

Aspects and Measures	Report Reference	Page
Environmental awareness training for contractors		
Delineating and sign posting of maximum impact footprints and work areas		
Location of construction camps	Environmental Management Plan for the Eskom Kusile Power Station Project	P12
Washing and maintenance of equipment (away from watercourses)		
Waste management		
Storage of material (outside watercourses)		
Emergency preparedness plans for accidental spills	Environmental Management Plan for the Eskom Kusile Power Station Project	P15
Erosion and sediment management and containment ~ Berms	Environmental Management Plan for the Eskom Kusile Power Station Project	P7, 19

Aspects and Measures	Report Reference	Page
~ Sediment traps ~ Use of machinery		
Stormwater runoff management ~ Prevention of concentrated flows and maintenance of diffuse flows (diversion of stormwater into vegetated buffer zones before entering watercourses) ~ Trench breakers	Environmental Management Plan for the Eskom Kusile Power Station Project	P7
Maintaining downstream flows during construction of crossings ~ Location and management of instream diversions	Environmental Management Plan for the Eskom Kusile Power Station Project	P7, 13
Rehabilitation of work areas ~ Timing ~ Indigenous seed mixes ~ Soil compaction ~ Alien vegetation control	Environmental Management Plan for the Eskom Kusile Power Station Project	P13, 14, 15

B. Monitoring and Review Strategy

Monitoring and reporting will be undertaken as set out in the reports listed in Table 4. Specific provisions are set out in Table 5 below.

Table 19: Monitoring and Review Measures

Measures	Report Reference	Page
Monitoring of and reporting on compliance		
Steps for non-compliance with specifications (specifically environmental damage)		
Reporting of incidents (refer Section 19 and 20 of the National Water Act)		

X. Declarations

A. Design Engineer (KPC)

The work described in this Work Method Statement, if carried out according to the methodology described, is satisfactorily mitigated to prevent avoidable environmental harm.

Signed

Print Name

Date

B. Site Manager (23A)

I understand the contents of the Work Method Statement and the scope of works required from me.

Signed

Print Name

Date

C. Environmental Officer (23A)

The works described in this Work Method Statement are approved.

Signed

Print Name

Date

XI. Declarations

A. Design Engineer (B&V)

The work described in this Work Method Statement, if carried out according to the methodology described, is satisfactorily mitigated to prevent avoidable environmental harm.

Signed

Print Name

Date

B. Site Manager (26)

I understand the contents of the Work Method Statement and the scope of works required from me.

Signed

Print Name

Date

C. Environmental Officer (26)

The works described in this Work Method Statement are approved.

Signed

Print Name

Date

XII. Reference Documents

Reference documents excluding the drawings listed in each section above, attached to the submission;

Description	Reference Number	Date
Water Use Licence (Included under tab 0)	B01533	20 June 2012
Ecohydrological Assessment of the Wetland Catchment within the Proposed Eskom Kusile Ash Dump Facility (included under tab PQ)	689-2011	July 2012
Ecohydrological Assessment of the Wetland Catchment within the Proposed Eskom Kusile Ash Dump Facility Summary Report (included under tab R)	689-2011	July 2012
EMP amendment of section 6.3.5 and 6.2.2 of the Standard Environmental Specification for the Construction Environmental management Plan (EMP): Project Bravo	12/12/20/807	7 May 2009