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the **dedet**

Department:  
Economic Development, Environment and Tourism  
MPUMALANGA PROVINCIAL GOVERNMENT

**Basic Assessment Report in terms of the  
Environmental Impact Assessment Regulations, 2010, promulgated in terms  
of the National Environmental Management Act, 1998(Act No. 107 of 1998),  
as amended.**

	(For applicant / EAP to complete)
<b>File Reference Number:</b>	<b>Reference: 17/2/3/E-7</b>
<b>Project Title:</b>	<b>DONORA FALLS HYDRO-PROJECT ON PORTION 5 OF THE FARM DOORNKRAAL 244, NEAR BRONDAL, MPUMALANGA PROVINCE.</b>
<b>Name of Responsible Official:</b>	<b>MR. MICHAEL NYIRENDA</b>

  

	(For official use only)
<b>NEAS Reference Number:</b>	
<b>Date Received:</b>	

**Kindly note that:**

1. Required information must be typed within the spaces provided in the form. The size of the spaces provided is not necessarily indicative of the amount of information to be provided. Tables can be extended as each space is filled with typing.
2. Where applicable **black out** the boxes that are not applicable in the form.
3. An incomplete report may be returned to the applicant for revision.
4. The use of "not applicable" in the report must be done with circumspection because if it is used in respect of material information that is required by the competent authority for assessing the application, it may result in the rejection of the application as provided for in the regulations.
5. All reports (draft and final) must be submitted to the Department at the address of the relevant **DISTRICT OFFICE** given below or by delivery thereof to the relevant **DISTRICT OFFICE**. Should the reports not be submitted at the relevant district office, they will not be considered.
6. No faxed or e-mailed reports will be accepted.
7. One copy of the draft version of this report must be submitted to the relevant district office. The case officer may request more than one copy in certain circumstances.
8. **Copies of the draft report must be submitted to the relevant State Departments / Organs of State for comment.** In order to give effect to Regulation 56(7), proof of submission/delivery of the draft documents to the State Departments / Organs of State must be attached to the draft version of this report.
9. Unless protected by law, all information in the report will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this report on request, during any stage of the application process.
10. All specialist reports must be appended to this document, and all specialists must complete a declaration of independence, which is obtainable from the Department.

## **SECTION A: BACKGROUND INFORMATION**

<b>Project Applicant:</b>	Donora Farm Hydro Pty. Ltd.		
<b>Trading Name (if any):</b>	Donora Farm Hydro Pty. Ltd.		
<b>Contact Person:</b>	Mr. J. E. van Merwe.		
<b>Physical Address:</b>	Nora Falls Farm, Brondal Area; District Nelspruit.		
<b>Postal Address:</b>	P. O. Box 1229, Nelspruit.		
<b>Postal Code:</b>	1200	<b>Cell:</b>	082 557 6199 or 082 829 7912
<b>Telephone:</b>	013 755 6168	<b>Fax:</b>	013 755 3162
<b>E-mail:</b>	alpine@lantic.net		
<b>Environmental Assessment Practitioner:</b>	Ralf Kalwa (Rhengu Environmental Services)		
<b>Contact Person:</b>	Ralf Kalwa		
<b>Postal Address:</b>	P. O. Box 1046, Malelane.		
<b>Postal Code:</b>	1320	<b>Cell:</b>	082 414 7088.
<b>Telephone:</b>	082 414 7088	<b>Fax:</b>	086 685 8003.
<b>E-mail:</b>	rhengu@mweb.co.za		
<b>Qualifications:</b>	BSc. Hons. Wildlife Management.		
<b>Professional affiliations:</b>	The South African Council for Natural Scientific Professions: Registration Number: No. 400046/08. The Southern African Institute of Ecologists and Environmental Scientists. The Grassland Society of Southern Africa. A Company Portfolio can be submitted on request.		

## **SECTION B: DETAILED DESCRIPTION OF THE PROPOSED ACTIVITY**

Describe the activity, which is being applied for, in detail. The description must include the size of the proposed activity (or in the case of linear activities, the length) and the size of the area that will be transformed by the activity.

- **Description of Proposed Activities:** Donora Hydro-Electrical Station will be constructed on the farm Doornkraal 244 Portion 5 on the western banks of the Nels River. The farm is located approximately 20km north west from Nelspruit on the road to Brondal/Lydenburg.
- The project will commence at the existing weir above the **Nora Falls**, diverting the water into the existing irrigation canal which delivers water to three farmers. The applicant's farm also sources water from the canal.
- The water will follow the canal on the contour for **1278 metres**. The water will be diverted back to the Nels River through a **600 meter** (1.2 meter diameter) pressure pipe with a fall of **76 meter** down to the turbine.
- At maximum capacity, the turbine and generator will generate electricity using the **3m<sup>3</sup>/second** water supply to generate **1.8 MWatt** of electricity at 22 kilovolts.
- The Hydro Station will operate for 24 hours per day throughout the year.
- Shutdowns will only occur for maintenance purposes.
- **Development Specifications:**
- Raise the weir on average by 500mm in **certain sections**. The objective is to ensure

that the weir is 1.5m in height over its entire length.

- Install measuring devices at **3 sites** (at the weir diversion; the sluice gate at the pipeline and at the hydro plant), to ensure that water quantity is measured in accordance with allocation restrictions and to ensure that minimum flows are maintained as required.
- Enlarge the existing canal to 2mx1.5m wide **where necessary** over a distance of 1278m to convey water at 3m<sup>3</sup>/second (10 800m<sup>3</sup>/hour = 259 200 m<sup>3</sup>/day).
- Install a sluice gate at the end of the canal development (at 1278m) to feed water to the rest of the canal and the farmers downstream as per their water allocation.
- Install a pressure pipe (1.2m in diameter) from the canal to the hydro station.
- Build the hydro station building near the Nels River (approximately 48sqm) with an outlet.
- Return the water out of the hydro plant back into the Nels River over a gabion mattress (300mm thick). This approach will dissipate water gradually and ensure that the potential impact of erosion is mitigated.
- Build a 22kV overhead power line to join up with the existing ESKOM network on the farm (400m in length).
- **Site Locations are as follows:**

Coordinates of Weir in Nels River

E 25°18'46.47" S 30°50'07.82"

Coordinates of Hydro Station

E 25°19'12.14" S 30°50'45.42"

Coordinates of Eskom Point: MB 136/22

E 25°19'19.25" S 30°50'30.43"

## **SECTION C: PROPERTY/SITE DESCRIPTION**

Provide a full description of the preferred site alternative (farm name and number, portion number, registration division, erf number etc.):

The site is fixed on Portion 5 of the Farm: Doornkraal 244. The weir and the canal have been in operation for many years and are functional in terms of diverting water into the irrigation system for use by farmers down-stream.

Alternative route options were considered in the evaluation process of the impacts and where possible options with the least or no impact were given preference. **See paragraph 7.6.1 and Appendix A for more detail in this regard.**

Indicate the position of the activity using the latitude and longitude of the centre point of the preferred site alternative. The co-ordinates should be in degrees and decimal minutes. The minutes should have at least three decimals to ensure adequate accuracy. The projection that must be used in all cases is the WGS84 spheroid in a national or local projection. The position of alternative sites must be indicated in Section B of this document.

### **Site Locations are as follows:**

Coordinates of Weir in Nels River

E 25°18'46.47" S 30°50'07.82"

Coordinates of Hydro Station

E 25°19'12.14" S 30°50'45.42"

Coordinates of Eskom Point: MB 136/22

E 25°19'19.25" S 30°50'30.43"

**In the case of linear activities:**

	Latitude (S):	Longitude (E):
• Starting point of the activity	E 25°18'46.47"	S 30°50'07.82"
• Middle point of the activity	E 25°19'19.25"	S 30°50'30.43
• End point of the activity	E 25°19'12.14"	S 30°50'45.42"

**GPS Positions of the Entire Preferred Route: See Map in Appendix A:**

	Site	Description	South	East	Elevation m/asl
1.	Weir	Fish way and water sluice.	25°18'45.49"	30°50'08.24"	953
2.	Weir	Inlet sluice to canal.	25°18'46.72"	30°50'08.22"	953
3.	Canal	Cross over gravel road.	25°18'57.15"	30°50'16.52"	950
4.	Canal	Below house: Gravel road cross.	25°18'56.68"	30°50'29.69"	943
5.	Canal	Pressure Pipe Start.	25°19'06.06"	30°50'26.02"	940
6.	Pipe	Halfway down the slope.	25°19'08.17"	30°50'33.26"	916
7.	Pipe	Right turn to Hydro Plant.	25°19'08.15"	30°50'40.11"	895
8.	Hydro Plant	End of pressure pipe. Hydro plant.	25°19'12.24"	30°50'45.15"	875
9.	Eskom Pole	Eskom Pole.	25°19'19.64"	30°50'31.15"	907

**SITE OR ROUTE PLAN: APPENDIX A: Preferred Route. Also Appendix D:  
Specialist Study: Dr. Andrew Deacon.**

A detailed site or route plan(s) must be prepared for each alternative site or alternative activity. It must be attached as an appendix to this document.

The site or route plans must be at least A3 and must include the following:

- 6.1 a reference no / layout plan no., date, and a legend / land use table
- 6.2 the scale of the plan which must be at least a scale of 1:2000;
- 6.3 the current land use as well as the land use zoning of each of the properties adjoining the site or sites;
- 6.4 the exact position of each element of the application as well as any other structures on the site;
- 6.5 the position of services, including electricity supply cables (indicate above or underground), water supply pipelines, boreholes, street lights, sewage pipelines, storm water infrastructure and telecommunication infrastructure;
- 6.6 all indigenous trees taller than 1.8 metres and all vegetation of conservation concern (protected, endemic and/or red data species);
- 6.8 servitudes indicating the purpose of the servitude;
- 6.9 sensitive environmental elements within 100 metres of the site or sites including (but not limited thereto):
  - watercourses and wetlands;
  - the 1:100 year flood line;
  - ridges;
  - cultural and historical features;
- 6.9 10 metre contour intervals

**SITE PHOTOGRAPHS: APPENDIX B**

Colour photographs from the centre of the site must be taken in at least the eight major compass directions with a description of each photograph. Photographs must be attached as an appendix to this form.

**FACILITY ILLUSTRATION: APPENDIX C and Appendix B: Figure 9**

A detailed illustration of the activity must be provided at a scale of 1:200 as an appendix for activities that include structures. The illustrations must be to scale and must represent a realistic image of the planned activity. The illustration must give a representative view of the activity.

## SECTION D: BASIC ASSESSMENT REPORT

Prepare a basic assessment report that complies with Regulation 22 of the Environmental Impact Assessment Regulations, 2010. The basic assessment report must be attached to this form and must contain all the information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 25, and must include:

	(Checklist for official use only)
1. A description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.	
2. An identification of all legislation and guidelines that have been considered in the preparation of the basic assessment report.	
3. Details of the public participation process conducted in terms of Regulation 21(2)(a) in connection with the application, including – (i) the steps that were taken to notify potentially interested and affected parties of the proposed application; (ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given; (iii) a list of all persons, organisations and organs of state that were registered in terms of regulation 55 as interested and affected parties in relation to the application; and (iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	
4. A description of the need and desirability of the proposed activity;	
5. A description of any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity;	
6. A description and assessment of the significance of any environmental impacts, including— (i) cumulative impacts, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the activity; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated;	
7. Any environmental management and mitigation measures proposed by the EAP;	
8. Any inputs and recommendations made by specialists to the extent that may be necessary;	
9. A draft environmental management programme containing the aspects contemplated in regulation 33;	
10. A description of any assumptions, uncertainties and gaps in knowledge;	
11. A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	
12. Any representations, and comments received in connection with the application or the basic assessment report;	
13. The minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants;	
14. Any responses by the EAP to those representations, comments and views;	
15. Any specific information required by the competent authority; and	
16. Any other matters required in terms of sections 24(4)(a) and (b) of the Act.	

**The basic assessment report must take into account --**

- (a) any relevant guidelines; and
- (b) any departmental policies, environmental management instruments and other decision making instruments that have been developed or adopted by the competent authority in respect of the kind of activity which is the subject of the application.

\* In terms of Regulation 22(4), the EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in subregulation 22(2)(h), exist.

Have reasonable and feasible alternatives been identified, described and assessed?	YES X	NO
If NO, the motivation and investigation required in terms of Regulation 22(4) must be attached as an Appendix to this document.		



## **SECTION E: CONSULTATION WITH OTHER STATE DEPARTMENTS**

Provide a list of all State Departments / Organs of State that have been consulted and registered as interested and affected parties, and to whom draft reports have been submitted for comment. **Proof of submission / delivery of the draft report to all State Department / Organs of State must be attached to this document.**

<b>Department:</b>	Department of Water Affairs: Nelspruit Office		
<b>Contact person:</b>	Ms. Lufuno Rambau Ms. Mpho Sebola Ms. Prudence Dzambukeri Mr. Sampie Shabangu		
<b>Postal address:</b>	Private Bag X 11259, Nelspruit.		
<b>Postal code:</b>	1200	<b>Cell:</b>	082 611 6938
<b>Telephone:</b>	013 759 7419	<b>Fax:</b>	013 759 7460
<b>E-mail:</b>	RambauL@dwa.gov.za		
<b>Department:</b>	South African Heritage Resources Agency		
<b>Contact person:</b>	Mr. Phillip Hine		
<b>Postal address:</b>	P. O. Box 4637, Cape Town.		
<b>Postal code:</b>	8000	<b>Cell:</b>	Not available.
<b>Telephone:</b>	021 462 4502	<b>Fax:</b>	021 462 4509
<b>E-mail:</b>	phine@sahra.org.za		

<b>Department:</b>	Mpumalanga Tourism and Parks Agency (MTPA).		
<b>Contact person:</b>	Dr. Hannes Botha		
<b>Postal address:</b>	Private Bag X 11338, Nelspruit.		
<b>Postal code:</b>	1200	<b>Cell:</b>	Not available.
<b>Telephone:</b>	013 262 4844	<b>Fax:</b>	013 262 4858
<b>E-mail:</b>	nilecrocs@mweb.co.za		

**NOTE: THE DRAFT REPORT OF THE BAR WAS ALSO SUBMITTED TO THE THABA CHEWU LOCAL MUNICIPALITY.**

## **SECTION F: APPENDICES**

The following appendices must be attached to the basic assessment report as appropriate:

Site plan(s)

Photographs

Facility illustration(s)

Specialist reports

Comments and responses report

Other information

## **1. EXECUTIVE SUMMARY**

This initial phase of the **Environmental Investigation Process** was conducted over a period of 8 months in the Brondal Area. The proposed establishment of a hydro power station on this portion of the Nels River will provide power for the National Grid equivalent to the energy needs of 200 households.

The public participation process was advertised locally and regionally in the printed media, on site and amongst the neighbours and Government Departments. The immediate neighbours of the property were contacted specifically and engaged in two **Focus Group Meetings**. The **Mpumalanga Parks and Tourism Association (MTPA)**, the **South African Heritage Resource Agency (SAHRA)** and the **Thaba Chewu Local Municipality** were also informed of the outcome of the assessment and requested to participate.

The **Draft Basic Assessment Report** has been made available for comment at the **Nelspruit Public Library, the offices of developer on site** and to all individuals and departments that registered. We await comments on this report.

The **Specialist Report by Dr. Andrew Deacon** on the ecology of the site (aquatic and terrestrial) and the implications of the development on these ecosystems was made available to all Interested and Affected Parties for a period of 6 weeks. The MTPA, through their specialist, Dr. H. Botha, supported the project and submitted some useful mitigation suggestions which are included in the Construction EMP. No comments or suggestions to make changes were received by the assessment practitioner from any other sources.

The **Impact Assessment** investigated the **significance** of impacts, **alternative** options and **mitigation** measures where applicable. This report also includes a **Construction Environmental Management Programme (CEMP)**.

Provided the applicant abides by the recommendations and the conditions of the CEMP, it is recommended that the proposed hydro-power station project is implemented at the preferred site.

## **2. ABBREVIATIONS**

ASAP	As Soon As Possible
Asl	Above sea level
BEE	Black Economic Empowerment
cm	centimetre
CEMP	Construction Environmental Management Programme
DEDET	Department of Economic Development, Environment and Tourism
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
ESCOM	Electricity Supply Commission
GPS	Geographical Positioning System
ha	Hectare
I&AP's	Interested and Affected Parties
IEM	Integrated Environmental Management
kPa	kilopascal
m	metre
mm	millimeter
MPTA	Mpumalanga Tourism and Parks Agency
MW	megawatts
m/s	metre per second
NA	Not Applicable
NHBRC	National Housing Building Regulations Council
OHASA	Occupational Health and Safety Act
OMP	Operational Management Plan

PDI	Previously Disadvantaged Individual
PPP	Public Participation Process
RES	Rhengu Environmental Services
rpm	revolutions per minute
ROD	Record of Decision
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
sqm	square metre

### **3. GENERAL INFORMATION**

<b>Project Title</b>	Environmental Impact Assessment: Basic Assessment Report Donora Falls Hydro Project on Portion 5 of the Farm Doornkraal 244, Mbombela Local Municipality, Mpumalanga Province. Project Number: 17/2/3/E-7.
----------------------	---

<b>Name of Applicant</b>	Donora Farm Hydro Pty. Ltd.
<b>Address</b>	P. O. Box 1229 Nelspruit 1200
<b>Contact Person</b>	Mr. Johan van der Merwe
<b>Telephone Number</b>	013 755 6186
<b>Cell Number</b>	082 557 6199
<b>Fax Number</b>	013 755 3162

<b>Name of Consultant</b>	Rhengu Environmental Services (RES)
<b>Address</b>	P. O. Box 1046 Malelane 1320
<b>Contact Person/s</b>	Ralf Kalwa
<b>Telephone Number</b>	082 414 7088
<b>Fax Number</b>	086 685 8003
<b>Date of Report</b>	June 2011

<b>Date of Public/Focus Group Meeting/s</b>	1. Meeting 1: 21/10/2010 2. Meeting 2: 28/10/2010. 3. Meeting 3: 06/12/2010
<b>Persons/Officials Present</b>	<p><b><u>Meeting 1: DEDET:</u></b></p> 1. Michael Nyirenda (DEDET). 2. Sibusiso Langa (DEDET). 3. Paul Oosthuizen (Project Engineer). 4. Ian de Jager (Project Engineer). 5. Johan van der Merwe (Applicant). 6. Stephnie van der Merwe (Applicant). 7. Ralf Kalwa (EAP). <p><b><u>Meeting 2: Interested and Affected Parties:</u></b></p> 1. Douw Steyn (I&AP). 2. Rob Maguire (I&AP). 3. Barry Victor (I&AP). 4. Van Zyl Manktelow (I&AP). 5. Johan and Stephnie van der Merwe (Applicant). 6. Paul Oosthuizen (Project Engineer). 7. Ralf Kalwa (EAP). <p><b><u>Meeting 3: DWA and Interested and Affected Parties:</u></b></p> 1. Lufuno Rambau (DWA). 2. Mpho Sebola (DWA). 3. Prudence Dzambukeri (DWA). 4. Sampie Shabangu (DWA). 5. Douw Steyn (I&AP). 6. Barry Victor (I&AP). 7. Johan and Stephnie van der Merwe (Applicant). 8. Paul Oosthuizen (Project Engineer). 9. Ralf Kalwa (EAP). 10. Althea van der Merwe (Consultant: WUL). 11. Liz Lambert (Consultant: WUL).

**4. LOCALITY INFORMATION**

<b>Name of Place and Locality.</b>	The development site is on Portion 5 of the Farm: Doornkraal 244, on the Nels River near Brondal. The farm is located off the tar road leading between Nelspruit and Lydenburg. The farm is bordered in all wind directions by farms practicing agricultural and forestry land uses. The following GPS Co-ordinates are applicable to define the site position: Donora Weir: S 25° 18' 46.47" E 30° 50' 07.82" Hydro Station: S 25° 19' 12.14" E 30° 50' 45.42" Eskom MB136/22: S 25° 19' 19.25" E 30 °50' 30.43"
<b>Region/District</b>	The property is found near the Ehlanzeni Region near the towns of Brondal and Nelspruit in Mpumalanga.
<b>Title Deed</b>	See <b>Appendix G.</b>
<b>Size of Portion 5: Doornkraal 244.</b>	Approximately 201 ha.
<b>Local Authority</b>	Thaba Chweu Local Authority.
<b>Nearest Town/s</b>	Brondal-Nelspruit.
<b>Nearest Main Road</b>	Main road between Nelspruit and Lydenburg, approximately 20km west of Nelspruit.

**Type of area where the proposed development will take place (mark all applicable blocks).**

CBD		Rural	X	City		Recreational area	X
Commercial		Agricultural	X	Town		Inf. Settlement	
Industrial		Staff Housing		Township		Other:	
Tourism	X	Road	X	In a Building			

## **5. PROJECT INFORMATION**

### **5.1. Current Status and Infrastructure:**

- The farming activities are mixed with macadamia orchards and cattle farming at the centre of the operations.
- A tourism development node along the Nels River compliments the farmers approach to diversify his business.
- Finally, a number of well stocked dams allow guests to the farm an opportunity to relax whilst fishing.
- The farm is well serviced with a number of homesteads and support infrastructure which includes store rooms, warehouses and garages.
- Various access roads and service lines supply potable/irrigation water and power supply (ESCOM).
- A staff compliment of 18 occupy various permanent positions on the farm.
- A number of camps have been set aside to provide grazing for cattle and other herbivores on the farm.
- A gravel access road links up with the provincial tar road.

### **5.2. Planned/Proposed Activity and Infrastructure Specifics and Project Specifics:**

- **Description of Proposed Activities:** Donora Hydro-Electrical Station will be constructed on the farm Doornkraal 244 Portion 5 on the western banks of the Nels River. The farm is located north west from Nelspruit on the road to Brondal/Lydenburg.
- The project will commence at the existing weir above the **Nora Falls**, diverting the water into **the existing irrigation canal** which delivers water to three farmers. The applicant's farm also sources water from the canal.
- The water will follow the canal on the contour for **1278 metres**. The water will be diverted back to the Nels River through a **600 meter** (1.2 meter diameter) pressure pipe with a fall of **76 meter** down to the turbine.
- At maximum capacity, the turbine and generator will generate electricity using the **3m<sup>3</sup>/second** water supply to generate **1.8 MWatt** of electricity at 22 kilovolts.
- The Hydro Station will operate for 24 hours per day throughout the year.
- Shutdowns will only occur for maintenance purposes.
- **Development Specifications:**
- Raise the weir on average by 500mm in **certain sections**. The objective is to ensure that the weir is 1.5m in height over its entire length.
- Enlarge the existing canal to 2mx1.5m wide **where necessary** over a distance of 1278m to convey water at 3m<sup>3</sup>/second (10 800m<sup>3</sup>/hour = 259 200 m<sup>3</sup>/day).
- Install a sluice gate at the end of the canal development (at 1278m) to feed water to the rest of the canal and the farmers downstream as per their water allocation.
- Install a pressure pipe (1.2m in diameter; 600m length) from the canal to the hydro station.
- Build the hydro station building near the Nels River (approximately 48sqm) with an outlet.
- Build a 22kV overhead power line to join up with the existing ESKOM network on the farm (400m in length).



### 5.3. Maintenance Programme:

- **Turbine:** Bearings will be greased weekly.
- **Gearbox:** Oil level will be checked and filled as required. Vibrations will be monitored.
- **Generator:** Bearings will be greased weekly.
- **Panel:** Panel to be dusted off once a month and all **lugs** to be fastened every six months.
- **Canal:** Canal embankments to be kept clear of shrubs and trees as roots will cause the canal to leak.
- **Silt** must be removed annually from the inside of the canal.
- **Sluice Gates:** Canal sluice gates and scour sluices to be checked and cleaned every month for debris and rocks.
- **Over head power lines:** Clear away all branches that grow into the lines and cause interference.

### 5.4. Method Statement (Mechanics of Hydro Electricity Generation):

- **Background:** During the construction of a Hydro Electrical Plant, one must prevent the loss of the potential energy which exists in the water as a result of height (elevation) or pressure. The energy dynamics of a Hydro Plant and a natural water fall are very similar.
- As with a water fall, one starts with water at a high elevation or high potential energy. As the water falls, one increases the kinetic energy and reduces the potential energy.
- **What does one do with this kinetic energy?** In the case of a water fall – the water smashes into rocks or standing water and the kinetic energy is used to break up the water into small droplets (mist) and also to force water to the bottom of the pond sending clouds of mist into the air. Huge volumes of water (mist) evaporate into the air.
- In the case of a Hydro Plant one must carefully - with as little as possible turbulence - guide the water to a lower elevation. Instead of speeding it up one allows the pressure to increase (still potential energy) until one reaches the turbine at the bottom. Now one drops the pressure and allows the water speed to increase as it goes into the turbine. By changing the direction of flow with the use of vanes one converts the kinetic energy of water into the rotation of the turbine mass (kinetic energy).
- This in turn is connected to the generator which converts this kinetic energy into electrical energy.
- This electrical energy is then transported by wire to an end user (e.g. ESKOM) which uses the electrical energy to perform electrical work.
- When the water exits the turbine it has little energy left and only flows gently from the turbine outlet back to the river generating no mist, little turbulence and no excessive evaporation.
- **The Weir and the Canal:** The existing weir and canal were constructed in the early 1900's by the grandfather of the existing owner. This was done by hand over a period of more than a year.
- To raise the existing weir by 500 mm (average of 1.5m over the entire length of the weir) the applicant will use labour as it is impossible to work with machines in this area without damaging the trees and vegetation. The weir itself will be constructed by creating a gabion sandwich with concrete and steel works in the centre.
- Due to the topography of the area the weir consists of **three separate weir sections**. These will be constructed separately to ensure a continued, controlled water flow during construction.
- A fish ladder will be constructed at a suitable site as indicated by the aquatic specialist

involved in the EIA (Dr. Andrew Deacon: See Specialist Report in Appendix D).

- Dr. Deacon will oversee the construction process of the fish-ladder. See Appendix B for an example of a fish-ladder.
- To maintain the reserve flow at the required/prescribed volume, a permanent opening in the bottom of the weir will ensure a constant flow. This will also constantly scour the silt out before entering the canal. This outlet will have to be cleaned out as per a daily schedule.
- The existing canal must be enlarged in **certain areas** up to 1.5m wide and 2m deep. In the densely vegetated areas it will not be possible to access the canal with machines and all work will be undertaken by hand.
- Excavators will be used in open areas. Most of the canal will be lined with concrete to reduce friction and erosion. There is one section where additional supports will be required to form part of the foundation and to prevent the canal from sliding down the incline.
- At predetermined places, designed spill over and scour sections will be created to prevent rainwater run-off flowing into the canal. At these predetermined positions the water can spill over without erosion taking place.
- **Sluice and Pressure Pipe:** At the end of the canal, a sluice will be constructed to ensure a constant flow to the downstream users of the canal. The rest of the water will be directed into the 1.2 meter diameter pipeline via a concrete sump. This pipeline will guide the water downhill to the turbine house. This pipeline will be either a High Density Polyethylene (HDPE) or Resin – glass fibre re-in forced pipe covered by soil and vegetation. Water flow/quantity will be measured at this sluice gate.
- The route of the pipeline will wind through grazing pastures (more than 80%) and the rest of the preferred route will be determined by the Terrestrial Ecologist for the project (No large trees or trees of conservation importance may be removed). As the pipe crosses a dip in the landscape it will be strengthened using steel pipes or be supported by a steel structure depending on the width at the specific point of crossing.
- As the pipe lowers into the valley, the pressure of the water will increase from atmospheric pressure to 760 kPa (7.6 Bar) due to changes in elevation. The pressure class of the pipe will be increased from a class 4 to a class 9 pipe (4 Bar to 9 Bar).
- **Turbine including inlet and outlet facilities:** At the end of the pressure pipe the water will enter a steel pressure chute forming the inlet to the turbine. In this chute the water will be aligned to enter the turbine over the control inlet vane. When the water passes over the inlet control vane, the velocity is increased by reducing the cross section of the inlet. The potential energy (pressure) is now converted into kinetic energy (velocity) – as in the case of a waterfall.
- At this point the water enters the turbine and by deflecting the water past the turbine vanes, the water transfers its kinetic energy to the turbine by moving the vanes.
- The project will make use of a low speed turbine (120 rpm) which is designed to transfer energy at low speeds. As the water exits the turbine through the outlet chute, energy levels are low and it will gradually flow out of the chute back into the river.
- As air is introduced into the turbine casing to regulate the water level in the turbine, some of this air is diluted in the water and the water flowing back to the river will be enriched with air – as is the case in a water fall.
- The turbine shaft will turn the generator shaft which will generate the electrical power. This power will be exported to the Eskom grid by means of wire conductors.
- **Hydro Building:** The hydro building will be constructed on solid foundations in order to mount the turbine and generator to handle the forces of the water. The remainder of the building will consist of brick, mortar and steel structures covered by a corrugated/tile roof.

### **5.5. Needs- and Desirability of Proposed Activity: Power Generation using a Hydro Plant**

- The generation of electricity from hydro power plants is the oldest form of power generation in the world. It has been reported that the town of Pilgrims' Rest had electricity before the city of London and that the electricity was generated from a hydro plant.
- Hydro plants have been in operation in South Africa for more than 100 years.
- As the Eskom coal fired power stations increased their capacity in the 1980's many small and medium sized hydro power plants in South Africa were decommissioned.
- During the past decade however, coal resources have become depleted/scarce and power stations have aged considerably. This has placed pressure on Eskom meeting the power demands of the country and beyond its borders.
- Eskom is now keen on the generation of power using alternative methods, e.g. hydro power and is supportive of the generation of power using "Green Methods" in particular.
- **Sunday Times 8 August 2010: Government Drags Heels over Electricity:** By Jana Marais reports as follows: The risk of rolling blackouts is rising as government drags its feet in appointing more independent electricity suppliers to help Eskom meet increasing power demands. We can now expect to see blackouts again as the economy recovers, says Free Market Foundation executive director Leon Louw. Kannan Lakmeeharan, division executive for system operation and planning at Eskom, said that the company hoped there would not be a repeat of the 2008 blackouts, but warned that "the situation is getting tighter by the year". Energy regulator NERSA had set aside R 11 billion to buy electricity from Independent Power Producers (IPP) over the next three years. Lakmeeharan confirmed that another 1000 to 1500 MW could potentially be generated through co-generation agreements with companies. Finally, security of supply for the next three to four years from Eskom is a concern. Until Medupi is commissioned and online, we are going to struggle (Lorraine Lotter, Chair of the Energy Committee at Business Unity SA).
- **Sunday Times 24 October 2010: Eskom Plans are Powering Ahead:** By Jana Marais reports as follows: Eskom will not be able to keep the lights on by itself over the next two years. It will need the help of the whole of SA, says the utility's CEO, Brian Dames. Eskom currently has a maximum capacity of 41 000 megawatts with demand around 37 000 MW. This is less than 10% reserve margin which is about half of what is internationally seen as acceptable. Where capacity is available for co-generation or for independent power producers (IPP's), partnerships must be urgently finalized (Dames). IPP's will play a crucial role in augmenting the supply of electricity, said Dames.
- **Note:** The proposed Donora Hydro Station will generate 1.8 MW of electricity. This "green energy" has less impact on the broader environment and supports the concerns raised by the articles listed above. Furthermore this quantity of power is sufficient to supply the equivalent of electricity to 200 households.

**6. DESCRIPTION OF NATURAL ENVIRONMENT (See Specialist Study by Dr. Andrew Deacon in Appendix D for more detail on the ecology of the farm and also refer to Mucina and Rutherford, 2006)**

Topography	Mountain	Midslope	Flats	Valley	W/Land	R/Bank	Other
		X	X	X	X	X	
<b>Description: Geology and Soils.</b>	<ul style="list-style-type: none"> <li>• Veld Type: SVI 9 Legogote Sour Bushveld: Mucina and Rutherford (2006).</li> <li>• Most of the area is underlain by gneiss and migmatite of the Nelspruit Suite.</li> <li>• The southern part occurs on the potassium poor rocks of the Kaap Valle Tonalite.</li> <li>• Archaean granite plains with granite inselbergs and large granite boulders are also found in this landscape.</li> <li>• Soils are mispah, glenrosa, and hutton forms often shallow to deep, sandy/gravelly and well drained.</li> <li>• Diabase intrusions are common.</li> <li>• This terrain is regarded as stable for building purposes.</li> </ul>						
<b>Climate</b>	<ul style="list-style-type: none"> <li>• Summer rainfall with dry winters.</li> <li>• The annual average rainfall in the site area is around 700 mm on the footslopes and up to 1500mm near the grasslands towards the west.</li> <li>• Generally a frost free region except in higher reaches.</li> <li>• Mean annual maximum and minimum temperatures for Nelspruit (approximately 20km east of Nora Falls) are 35.7°C and 1.6°C for October and July respectively.</li> </ul>						
<b>Stability</b>	Buildings, e.g. pump houses, homesteads, offices, stables, workshops etc.; have been developed on these soils using normal construction methods and processes. Soils are considered as stable.						

<b>Flora Description</b>	<ul style="list-style-type: none"> <li>• As per the classification by Mucina and Rutherford (2006) the farm falls within the <b>Legogote Sour Bushveld Veld Type</b>. Under pristine, natural conditions the following vegetation species were found in this area:</li> <li>• <b>Tree species that dominate this veld type include:</b> <i>Pterocarpus angolensis</i>; <i>Sclerocarya birrea</i>; <i>Acacia davyi</i>; <i>Acacia sieberiana</i>; <i>Combretum zeyheri</i>; <i>Erythrina latissima</i>; <i>Parinari curatellifolia</i>; <i>Terminalia sericea</i>; <i>Trichilia emetica</i>; <i>Vernonia amygdalina</i>; <i>Acacia caffra</i>; <i>Antidesma venosum</i>; <i>Erythroxylum ermarginatum</i>; <i>Faurea rochetiana</i>; <i>Faurea saligna</i>; <i>Ficus burkei</i>; <i>Ficus glumosa</i>; <i>Ficus ingens</i>; <i>Ficus petersii</i>; <i>Heteropyxis natalensis</i>; <i>Peltophorum africanum</i>; <i>Piliostigma thonningii</i>; <i>Pterocarpus rotundifolius</i> and <i>Schotia brachypetala</i>.</li> <li>• <b>Succulent Tree:</b> <i>Euphorbia ingens</i>.</li> <li>• <b>Shrub species in this vegetation type included:</b> <i>Diospyros lycioides</i>; <i>Erythroxylum delagoense</i>; <i>Olea europaea</i>; <i>Pachystigma macrocalyx</i>; <i>Pseudarthria hookeri</i>; <i>Rhus pentheri</i>; <i>Diospyros galpinii</i>; <i>Flamingia grahamiana</i>; <i>Agathisanthemum bojeri</i>; <i>Eriosema psoraleoides</i>; <i>Gymnosporia heterophylla</i>; <i>Hemizygia punctata</i>; <i>Indigofera filipes</i>; <i>Myrothmanus flabellifolius</i> and <i>Rhus rogersii</i>.</li> <li>• <b>Succulent Shrubs:</b> <i>Aloe petricola</i>; <i>Euphorbia vandermerwei</i> and <i>Huernia kirkii</i>.</li> <li>• <b>Woody Climbers included:</b> <i>Acacia ataxacantha</i>; <i>Bauhinia galpinii</i>; <i>Helinus</i></li> </ul>
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	<p><i>integrifolius</i> and <i>Sphedamnocarpus pruriens</i>.</p> <ul style="list-style-type: none"> <li>• <b>Grasses and other Graminoids included:</b> <i>Bothriochloa bladhii</i>; <i>Cymbopogon caesius</i>; <i>Cymbopogon nardus</i>; <i>Hyparrhenia cymbaria</i>; <i>Hyparrhenia poecilotracha</i>; <i>Hyperthelia dissoluta</i>; <i>Panicum maximum</i>; <i>Andropogon schirensis</i>; <i>Paspalum scrobiculatum</i> and <i>Schizachyrium sanguineum</i>.</li> <li>• <b>Herbs included:</b> <i>Gerbera ambigua</i>; <i>Gerbera viridifolia</i>; <i>Hemizygia persimilis</i>; <i>Hibiscus sidiformis</i>; <i>Ocimum gratissimum</i> and <i>Waltheria indica</i>.</li> <li>• <b>Note:</b> The composition of the vegetation on the farm has largely been transformed over the past 70 years through farming practices and cleared for orchards and grazing camps.</li> </ul>
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Are there any known archaeological, cultural- or historical sites on or near the proposed development?

Yes	No
	X

- The **existing weir** is located in the Nels River. The weir height will be raised by 500mm in certain sections where the height is below 1.5m.
- The **existing canal** requires operational maintenance (fixing) from time to time. Approximately 1278m of the existing canal will be repaired properly and widened/deepened as per the project specifications described earlier.
- A **pipeline** (600m) will transport the water from the canal across a grazing field and along a fenceline to the hydro station site. The majority of the route is transformed and or disturbed. A short section (250m) winds its way through riparian bush. Dr. Andrew Deacon (Appendix D) submitted recommendations and mitigation measures to address any potential impacts along this route.
- The **powerline** (400m) will link up with existing networks which presently criss-cross the farm.
- The **proposed building** will be sited next to the Nels River near a rocky outcrop.
- **No artefacts** have been observed during the farming activities which have occurred on the property for decades
- However, should any artefacts or a find be incidentally discovered during trenching/construction, the proponent **must engage the services of an accredited archaeologist** to deal with the find.
- It is recommended that an **Environmental Control Officer (ECO)** oversee the implementation of the development phase and the handling procedure of any finds is described in the Construction Environmental Management Programme (CEMP).

What general precautionary measures will be taken if an archaeological, cultural- or historical site is discovered?

- Should any artefact, or historical site be **incidentally** discovered during excavations for foundations as well as in future, all works must cease with immediate effect.
- The find must be reported to the Project Manager for the development and the ECO for the project. These representatives will initiate an Action Plan in conjunction with SAHRA and the developer to address the management and handling of the find.

## **7. ENVIRONMENTAL ISSUES; IMPACT ASSESSMENT**

This chapter describes the **issues, concerns and opinions** identified:

- during the **public participation process, i.e. focus group meetings;**
- by **authorities and the applicant/management authority** during consultation- and pre-application meetings and telephonic discussions;
- by the **consultant** based on previous experience in the Lowveld area.

### **7.1. Key Issues: See Issues and Responses Report in Appendix E.**

The following key **issues/impacts** were identified during the meetings with farmers, neighbours and representatives from various departments:

<b>Environmental Aspects</b>	<ul style="list-style-type: none"> <li>• Water Supply.</li> <li>• Oxygen Levels.</li> <li>• Fish Ladder.</li> <li>• Lawful Water Use.</li> <li>• Water Abstraction versus Water Diversion.</li> <li>• Temperature and Water Quality.</li> <li>• Water Flow (Quantity and Volume).</li> <li>• Riparian Zone: Elevation and Floodline Levels.</li> <li>• Water Release: Control and Management.</li> </ul>
<b>Economic- Operational Aspects</b>	<ul style="list-style-type: none"> <li>• Electricity Generated.</li> <li>• Project Costs.</li> </ul>
<b>Social Aspects</b>	<ul style="list-style-type: none"> <li>• Electricity to Farmers.</li> <li>• Condition of Canal.</li> <li>• Water Rights.</li> <li>• Water Supply.</li> <li>• Construction Timing.</li> <li>• Crocodile Irrigation Board.</li> </ul>

**Note:** Dr. Andrew Deacon addressed many of the queries and comments listed above in the Specialist Study which is attached in Appendix D. All Interested and Affected Parties were afforded more than 30 days to study the Specialist Study and submit comments before it was included as an Appendix D to the Basic Assessment Report. Dr. H. Botha from MTPA submitted some useful comments and suggestions which were included in the CEMP.

## **7.2. Ranking of Environmental Issues Identified**

To identify the issues, these were ranked as per the four different criteria outlined in the Environmental Impact Assessment Guideline Document for assessing impacts in Environmental Impact Reports.

The environmental elements (issues/impacts) are evaluated according to the following criteria:

**1. Intensity** – 4 Categories were distinguished:

Positive (+), Negative (-), No Impact (0), and Uncertain (U).

The positive- and negative categories were further divided to distinguish between low-, medium-, and significant impacts.

Scores were awarded as follows:

**Low = 1, Medium = 2, and Significant = 3.**

**Issues/Impacts** were ranked in order of importance as:

- |  |                 |
|--|-----------------|
| 1. Critical Issues/Impacts with scores               | ≥ -5 to -9,     |
| 2. Important Issues/Impacts with scores              | < -5 to -1, and |
| 3. Operational/Management Issues/Impacts with scores | ≥ 0.            |

**2. Duration** - Is the impact – **Short-**, **Medium** term, or **Permanent**.

**3. Probability** of impact – **Improbable (I)**; **Probable (?)**; **Definite (D)**,

**4. Extent** – Is the effect **Local**; **Regional**; **National**; or **International**.

**NA:** Not Applicable

### 7.3. Environmental Screening: Determination of Significance

KEY OF SYMBOLS TO BE USED IN TABLE BELOW				
Intensity of impact/issue:	Significant Impact	Medium Impact	Low Impact	
Positive (+)	+3	+2	+1	
Negative (-)	-3	-2	-1	
Impact uncertain (U)		U		
No envisaged impact (0)		0		
Duration of impact/issue	Short Term = S	Medium Term = M	Permanent = P	
Probability of impact/issue	Improbable = I	Probable = ?	Definite = D	
Extent of impact/issue	Local = L	Regional = R	National/International = N	
TABLE FOR IDENTIFICATION OF POTENTIAL ENVIRONMENTAL IMPACTS				
NA: Not Applicable	POTENTIAL IMPACT/ISSUE	DEVELOPMENT PHASE	OPERATIONAL PHASE	TOTAL SCORE
<b>ENVIRONMENTAL ASPECTS:</b>				
	1. <b>Water Supply:</b> How much water must be diverted into the canal over and above the allocated amount to generate the power in the hydro plant?	NA	-1; P; D; L	-1
	2. <b>Oxygen Levels:</b> When the water is returned to the river after it has been through the turbine the oxygen levels of the water will be different to what it was before it was used to generate electricity.	NA	+1; P; D; L	+1
	3. <b>Fish Ladder:</b> Will a fish ladder be constructed at the weir?	NA	+3; P; D; R	+3
	4. <b>Lawful Water Use:</b> Is there an existing lawful water use registered for the water in the canal and from the river? Additional to this from which entitlement will the additional volume of water into the canal be sourced?	NA	0; P; D; L	0
	5. <b>Water Abstraction vs Water Diversions:</b> A discussion ensued between various members in the meeting around the technicality of whether this project was about a water abstraction versus a water diversion and or whether we are dealing with water storage? Also an argument was raised pertaining to the relevance of applying for S (21) (h)?	NA	0; P; D; L	0
	6. <b>Temperature and Water Quality:</b> Please check up on the temperature and the quality of the water that is returned into the Nels River (after discharge) and before it is diverted out of the river into the canal.	NA	-1; P; D; L	-1



7. <b>Water Flow</b> (Quantity and Volume): A discussion ensued between various members in the meeting around the quantity of water in the river, in the canal and how this will be controlled and measured? SS also wanted to know what the long term flow average was in the river.	NA	0; P; D; L	0
8. <b>Riparian Zone, Elevation- and Floodline Levels</b> : The study must indicate the outline of the riparian zone and the 1:100 year floodline levels.	NA	0; P; D; L	0
9. <b>Release of Water from the Hydro Plant</b> : How will the water be returned to the river?	NA	0; P; D; L	0
<b>ECONOMIC/OPERATIONAL ASPECTS:</b>			
1. <b>Electricity</b> : Van Zyl wanted to know how much power would be generated?	NA	+3; P; D; N	+3
2. <b>Project Costs</b> : What will the project cost?	NA	+1; P; D; L	+1
3. <b>Project Costs</b> : Will the costs of the project be covered by the sale of the power generated?	NA	+1; P; D; L	+1
<b>SOCIAL ASPECTS:</b>			
1. <b>Electricity</b> : Barry enquired whether the farmers downstream could benefit from the electricity that will be generated at the hydro plant?	NA	+1; P; D; L	+1
2. <b>Condition of Canal</b> : The meeting agreed that the canal required quite a lot of maintenance and that any improvement to the condition of the canal would be beneficial to all parties downstream. The members were positive about the canal being fixed albeit for 1278 metres.	NA	+1; P; D; L	+1
3. <b>Water Rights</b> : The members at the meeting wanted assurance that the water rights would not be affected in any way AND that their allocations would be guaranteed?	NA	0; P; D; L	0
4. <b>Water Supply during Construction</b> : Rob enquired how their water supply in the canal would be affected during construction. The downstream farmers require a sustainable supply of water at all times?	-1; M; D; L	+1; P; D; L	0
5. <b>Construction Timing</b> : The meeting had different views as to the timing of construction. There are pro's and con's for both a winter and a summer construction period.	-1; M; D; L	+1; P; D; L	0
6. <b>Crocodile Irrigation Board</b> : Do the farmers that source water from the canal and weir belong to the Crocodile River Major Irrigation Board?	NA	NA	NA

## **7.4. Issues Identified**

### **7.4.1 Critical Issues: ( $\geq -5$ to $-9$ )**

No **Critical Issues** were identified during the screening process.

### **7.4.2 Important Issues: ( $< -5$ to $-1$ )**

- Temperature and Water Quality.
- Water Supply.

### **7.4.3. Operational/Management Issues: ( $\geq 0$ )**

- Lawful Water Use.
- Water Abstraction versus Water Diversion.
- Water Flow (Quantity and Volume).
- Riparian Zone: Elevation and Flood Line Levels.
- Water Release: Control and Management.
- Water Rights.
- Construction Timing.
- Water Supply (Construction).

### **7.4.4. Positive Impacts**

- Oxygen Levels.
- Fish Ladder.
- Electricity Generated.
- Project Costs.
- Electricity to Farmers.
- Condition of the Canal.

**7.5. Impacts/Issues: (This Section must be read in conjunction with the contents of the Construction Environmental Management Programme (CEMP))**

Environmental Issues	Discussion/Mitigation/Management Approach
<p>1. <b>Water Supply:</b> How much water must be diverted into the canal over and above the allocated amount to generate the power in the hydro plant?</p>	<p>3m<sup>3</sup> per second. The minimum in-stream flow requirement of the river will be maintained. To ensure river flow maintenance a minimum of 0.104m<sup>3</sup>/s (October) must be maintained at all times. This will change on a monthly basis. See Table 31 in Specialist Report from Dr. Andrew Deacon (Appendix D).</p>
<p>2. <b>Oxygen Levels:</b> When the water is returned to the river after it has been through the turbine the oxygen levels of the water will be different to what it was before it was used to generate electricity.</p>	<p><b>See Executive Summary of Deacon Specialist Study:</b> The Donora low-head hydro power facility will not experience similar problems associated with larger hydro-electric facilities as it is a run-of-river facility (not a large dam) with a small weir. It will thus not have the same problems related to dissolved oxygen-, temperature and sediment problems often associated with larger impoundments. <b>Minimum flows per month as indicated in Table 31 of the Deacon Specialist Study must however be honoured at all times.</b> Research by Campbell 2010, supports Dr. Deacon's conclusions.</p>
<p>3. <b>Fish Ladder:</b> Will a fish ladder be constructed at the weir?</p>	<p>See Specialist Study by Dr. Deacon in <b>Appendix D</b>. A fish ladder will be included at the weir to ensure a connectivity between the upper weir waters and the below weir waters. The design and construction procedure of the fish ladder will be managed by Dr. Andrew Deacon who is well known for his expertise in this field especially in the Kruger National Park. Dr. Deacon has suggested that a natural approach to design of the ladder is used. See photograph in <b>Appendix B</b> for an example of a fish ladder. This will be finalized once the final plans of the weir are submitted. During the construction process at the weir Dr. Deacon will be on site to ensure that natural rock is placed and cemented into place below the weir wall (steps not higher than 15cm) to form holding ponds and cascades which will suit the various fish species needs and abilities. Natural rock fish ladders are aesthetically more appealing and provide for effective corridors to connect the various water sections.</p>
<p>4. <b>Lawful Water Use:</b> Is there an existing lawful water use registered for</p>	<p>The canal falls under the jurisdiction of the Gladdespruit and the</p>

the water in the canal and from the river? Additional to this from which entitlement will the additional volume of water into the canal be sourced?	scheduling is registered with the Department of Water Affairs. Water will be supplied under the registered entitlement.
5. <b>Water Abstraction vs Water Diversions:</b> A discussion ensued between various members in the meeting around the technicality of whether this project was about a water abstraction versus a water diversion and or whether we are dealing with water storage? Also an argument was raised pertaining to the relevance of applying for S (21) (h)?	DWA (Sample Shabangu) confirmed to Althea van der Merwe that he agreed that the water uses applicable are S21(c) and (i) for diverting the flow and impeding on the banks of a water course. Section 21 (h) is also applicable for the disposal of water back into the river.
6. <b>Temperature and Water Quality:</b> Please check up on the temperature and the quality of the water that is returned into the Nels River (after discharge) and before it is diverted out of the river into the canal.	Dr. Deacon has recommended that a Bio-Monitoring System is included in the authorization of this project as a condition which must be met and satisfied in future. This programme must be designed to measure oxygen and temperature levels (pre-construction and post construction; upstream and downstream of the hydro plant)). It will also look at the effect of reduced flow in the river due to abstraction of water for the hydro plant. It must also be noted that the <b>Flow Levels</b> listed in Table 31 <b>may be refined</b> as Dr. Deacon's monitoring results reveal additional or new information. Finally, the programme must assess the capability of the local fish to utilize the newly constructed fishway at the weir.
7. <b>Water Flow</b> (Quantity and Volume): A discussion ensued between various members in the meeting around the quantity of water in the river, in the canal and how this will be controlled and measured? SS also wanted to know what the long term flow average was in the river.	It was decided that 3 water measuring sites/meters would be installed: One at the canal entrance, one at the sluice gate to the farmers and one at the hydro station. Water Flow averages for the Nels River are listed per month in Table 31 of the Specialist Study by Dr. Andrew Deacon. To ensure river flow maintenance a minimum of 0.104m <sup>3</sup> /s (October) must be maintained at all times. This figure will be lowered to 0.063m <sup>3</sup> /s during drought conditions. The meters that will be installed at the canal entrance, one at the sluice gate to the farmers and one at the hydro station will monitor this supply and flow rate. The average flow of the river varies from 1m <sup>3</sup> /s in the winter to 6m <sup>3</sup> /s in the summer with peaks of up to 20m <sup>3</sup> /s after rain storms. The hydro can function from 0.6m <sup>3</sup> /s up to 3m <sup>3</sup> /s depending on the availability of the water.

8. <b>Riparian Zone, Elevation- and Floodline Levels:</b> The study must indicate the outline of the riparian zone and the 1:100 year floodline levels.	Dr. Deacon demarcated/delineated the riparian zone and this zone is clearly defined in the Specialist Study attached as <b>Appendix D</b> .
9. <b>Release of Water from the Hydro Plant:</b> How will the water be returned to the river?	A gabion mattress (300mm thick) will be installed below the water release point at the hydro building to allow for a gradual dissipation of water back into the Nels River.
<b>Economic/Operational Issues</b>	
1. <b>Electricity:</b> Van Zyl wanted to know how much power would be generated?	<b>Discussion/Mitigation/Management Approach</b> 1.8 Mega Watt of electricity will be generated and put into the National Grid. This electricity can then be used to supply power to some 200 medium sized households. In the region of R 15 million.
2. <b>Project Costs:</b> What will the project cost?	Yes, but it is a long term project. Budgets will be finalised once the Impact Assessment process has been finalized and approved. The developer has secured the budget to finance this project.
3. <b>Project Costs:</b> Will the costs of the project be covered by the sale of the power generated?	<b>Discussion/Mitigation/Management Approach</b> No, not directly. The electricity will be sold to the National Grid. Many reports have been submitted recently especially in the press by ESKOM. ESKOM is requesting for the establishment of private enterprise partnerships and for these partnerships to supply green energy to the national grid. Also see <b>Chapter 5.5</b> which describes the need for green energy.
2. <b>Condition of Canal:</b> The meeting agreed that the canal required quite a lot of maintenance and that any improvement to the condition of the canal would be beneficial to all parties downstream. The members were positive about the canal being fixed albeit for 1278 metres.	Comments noted.
3. <b>Water Rights:</b> The members at the meeting wanted assurance that the water rights would not be affected in any way AND that their allocations would be guaranteed?	All water rights would be honoured and all allocations per user would be maintained. A specialist (Althea van der Merwe) has been appointed to handle all aspects pertaining to water use; water licensing; registration, and liaison with the Department of Water Affairs.
4. <b>Water Supply during Construction:</b> Rob enquired how their water supply in the canal would be affected during construction. The downstream farmers require a sustainable supply of water at all times?	The construction process would be staggered to ensure a sustainable supply of water through the canal during construction. The developer (applicant) would also augment the supply of water in the canal from

	<p>his storage dam as and when required to ensure a steady flow into the canal.</p> <p>It has been confirmed that the timing of construction and repair of the canal would have to be pre-planned carefully and one would have to adapt according to prevailing weather conditions. As it is the canal is often shut down for repair work. Liaison with all parties, as has been the case up until now, will be important.</p> <p>These aspects are highlighted in the Construction Environmental Management Programme (CEMP) which forms part of the EIA documentation.</p>
5. <b>Construction Timing:</b> The meeting had different views as to the timing of construction. There are pro's and con's for both a winter and a summer construction period.	<p>This aspect would have to be refined; however the water supply to the farmers through the canal must be maintained at all costs during the construction period (winter or summer).</p>
6. <b>Crocodile Irrigation Board:</b> Do the farmers that source water from the canal and weir belong to the Crocodile River Major Irrigation Board?	<p>The farmers do not belong to the Crocodile River Major Irrigation Board. They have been allocated scheduled water from the Gladde Spruit which is administered by the Department of Water Affairs.</p>

## **7.6. Description of Options, Phases and Alternatives**

### **7.6.1. Site Alternatives:**

#### **1. No Go Option:**

No known environmental reasons were identified which could make this a “No Go” option. All Interested and Affected Parties that registered were supportive of the project in principle and co-operated actively and constructively during the assessments process. Provided the developer adheres to the contents of the Construction: Environmental Management Programme (CEMP), the recommendations by Dr. Andrew Deacon (included in the CEMP) and the conditions described in this report, no fatal flaw is foreseen. In his conclusion on all the terrestrial- and aquatic aspects of the site, Dr. Deacon did not identify any aspect which would have a detrimental effect on the environment. Dr. H. Botha from MTPA (See comments in Appendix E) concurs with Dr. Deacon's conclusions and suggestions of mitigation.

#### **2. The Donora Falls Site (Route Option 3 is the preferred route):**

The land earmarked for the proposed development is fixed and belongs to the Van der Merwe family. Mr. J. van der Merwe's grandfather was instrumental in the construction of the canal many years ago. The farm has remained in the hands of the family since then and Mr. van der Merwe has expressed the wish to optimize existing infra-structure and facilities to generate green energy. Engineers have evaluated the site for the generation of electricity and identified the best sustainable option based on quantity of water supply, length of canal to be repaired, fall (height in metres) required to generate the water flow to the hydro station and economic viability.

A number of route alternatives were considered. To summarise the following is relevant:

Option	Description	Disadvantage/Advantage	Cost	kWatt	R/KWatt
1.	North of Nels River	Construct a new canal through natural untouched vegetation.	R 12 000 000.00	1000	R 12 000.00
2.	South of Nels River above lodge/s.	Low elevation which will result in low kWatts produced.	R 13 000 000.00	1000	R 13 000.00
3.	South of Nels River below lodge/s.	Use existing canal, high elevation. More kWatt produced.	R 19 000 000.00	1800	R 10 555.00
4.	South of Nels River- end of the farm.	Very long, costly canal to upgrade 2.7km. More kWatt produced. Very costly.	R 22 000 000.00	1900	R 11 578.95

**Note: Option 3 is the preferred option. See Appendix A for copies of maps and alternative routes.**

### **7.6.2. Demand Alternatives:**

#### **1. Power Supply:**

A small amount of ESCOM supply would be required for maintenance service (lighting) provision at the hydro-facility.

#### **2. Solid Waste:**

Once construction is completed no additional solid waste will be generated during this power generation process. Solid waste/litter generated during the construction process will be handled in accordance with the conditions of the CEMP, suffice to say that all litter will be taken off site daily in black bags.

Household waste is currently disposed of at the registered waste management site in Nelspruit. The waste and litter that is generated during the construction/development phase will tap into this existing waste management programme.

### **7.6.3. Scheduling Phases/Alternatives:**

#### **1. Time of Year (Season):**

The **construction process** (repairing the canal, raising the weir, building the hydro facility etc.) is largely weather dependent. Construction will essentially be undertaken by hand (to limit/prevent damage to vegetation) and the construction process will thus be time consuming. For most part the construction process will thus be undertaken during the drier season (less rain; low flow periods) of the year and from Mondays to Saturdays (6-9 months construction period).

**Noise Management:** The developer generates a certain amount of revenue from the provision of tourism facilities and events management, which will necessitate a judicious management of construction staff and noise. To mitigate, the conditions as described in the CEMP will apply at all times.

The construction of the building will be of short duration (6-8 weeks) and can take place all year round. Occasional delays may occur during the wet season but these delays will be of limited nature.

### **7.6.4. Input/Systems Alternatives:**

#### **1. Construction Approach:**

Style, layout, colour and architectural design must be commensurate with the surrounding natural environment and blend in with existing infra-structure which is essentially of an earthy (brown face bricks, non reflective) nature. This approach was implemented with the development of the tourism infra-structure. See **Site Photographs** in **Appendix B**.

Brick and mortar (face bricks) and a tile roof will be used to construct the facility. The floor will consist of bunded concrete.



### 7.6.5. Process Alternatives:

<b>Power Generation: Hydro Power Advantages</b>	<b>Power Generation: Coal Fired Power Stations Advantages</b>
1. Controlled generation of power. No foreign materials end up in the atmosphere.	1. Well known process and RSA is well versed in the production of power through this process.
2. Clean, efficient and reliable process. Very easy and simple to operate.	2. Fast and efficient process.
3. A Green Approach to power generation.	3. Can generate vast quantities of power.
4. Water is diverted and it is re-cycled for re-use. The water supply on site is reliable and available.	
5. No fossil fuels are used. Existing resource (water) is channelled out of the system/s for a short distance and then returned to the natural cycle.	
6. The end product (water) is returned to the system unpolluted. Quantity and quality is not affected.	
7. Operational temperatures and oxygen levels are not affected negatively.	
8. More than 90% of the construction process will be labour intensive and between 15-20 staff will be employed for the duration of the project of 6 to 9 months depending on prevailing weather conditions.	
9. Two permanent staff will be employed to operate the hydro station.	
10. The site is fixed and the weir and canal are functional. To implement this project a few expansions are required (raise the weir; repair and widen the canal).	
<b>Power Generation: Hydro Power Disadvantages</b>	<b>Power Generation: Coal Fired Power Stations Disadvantages</b>
1. Drought conditions may affect water supply in extreme situations.	1. Uses fossil fuels thereby adding to the pollution footprint in the environment.
	2. Coal is in limited supply and these diminishing fossil fuels are required in large volumes to generate power.
	3. Waste goes into the general atmosphere.
	4. Uses vast quantities of water (affecting quality and quantity of water) and contributes to the acid rain problem.
	5. The financial outlay required to generate power is substantially higher than the monies required to implement a hydro facility of the same magnitude.

### **Summary of Preferred Alternatives: Key Points:**

- The preferred site and route as per option 3 and as indicated on the map is submitted for approval. See Appendix A for final preferred route alignment.
- The CEMP will guide the development process. The CEMP includes all the mitigation measures listed by Dr. Deacon, Dr. Botha and others as essential to the protection of the environment.
- The advantages of hydro-power generation especially on a small scale outweighs the advantages of coal generated power.
- The weir and the canal are already in place. The weir must be raised and the canal must be repaired and widened in certain sections.
- The preferred site for the building is indicated on the maps. The site will be placed on a rocky base and no large trees especially those of conservation importance will be removed.
- The maintenance of the low flow levels as listed in Table 31 of the Specialist Report (Appendix D) will determine the amount of water that is diverted around towards the hydro-station.
- Water flow will be measured at 3 measuring points.
- The water that is diverted via the hydro-station will be returned to the Nels River.
- 1.8MW of green energy will be generated for supply to the National Energy Grid.
- Dr. Deacon will oversee the implementation of the fishway at the existing weir. Presently the weir has no fishway in place.
- A Bio-Monitoring Programme must be launched to monitor the flows upstream and downstream of the weir and the hydro plant. This must include measuring parameters such as prevailing temperature and oxygen levels. Finally the effectivity of the fishway must be assessed over time. It is recommended that Dr. Deacon develop this Monitoring Programme in conjunction with input from DWA officials.

## **8. PUBLIC PARTICIPATION**

1. The process was advertised as follows:

1.1. RES met with officials from DEDET (Provincial). The department issued an instruction to commence with the Environmental Assessment (**See Appendix H**). A newspaper advertisement inviting public participation was published in the Lowvelder (local and regional newspaper) on **29 October 2010**.

Advertisements were also placed at the entrance/access to the site on the tar road and at various points along the entrance road to the site. Furthermore the advertisement was also sent via e-mail to all neighbours bordering the property.

Officials from the Department of Water Affairs were also notified specifically and engaged in on site inspections and discussions. The MTPA, SAHRA and the Thaba Chewu Local Municipality were engaged to participate in the process.

See **Appendix E** for copies of notices, advertisements and newspaper clippings.

2. Although the intention to implement this activity was advertised as prescribed above and potential Interested and Affected Parties were given more than 30 days to register, no involvement from the broader Public nor any Interest Groups was forthcoming. Participation by Interested Groups was therefore limited and channelled towards neighbours and officials from the various government departments.

3. Consultation was formalised through focus group meetings with each neighbour and or official department.

4. Copies of the Specialist Study on Aquatic and Terrestrial Aspects by Dr. Andrew Deacon were submitted to all Interested and Affected Parties and Government Officials for a period of more than 30 days. The MTPA (Dr. H. Botha) submitted Ref. 4624 dated 23 May 2011 with comments. All comments have been included in the CEMP. See Appendix E for Dr. Botha's comments.

5. Copies of the Draft Basic Assessment Report (DBAR) were submitted for comments as per the distribution list on page 2. We await their response to the contents of the DBAR.

6. Issues and Impacts were assessed for significance during the Impact Assessment Phase of the project. Where applicable alternatives were submitted for consideration and or measures of mitigation were suggested.

7. See **Appendix E** for a comprehensive set of minutes and the Issues and Responses Report.

## **9. DECOMMISSIONING PHASE**

It is unlikely that the proposed development will be decommissioned in the foreseeable future however elements of the site may require a change in land use or have to undergo a process of decommissioning in some form or another. For this event a number of **key objectives and principles** are submitted for consideration.

### **9.1. Decommissioning Objectives**

The developer remains responsible for all the decommissioning activities in the area. The infrastructure will undergo a full and comprehensive decommissioning programme. This programme must be described in a **decommissioning plan**.

It is recommended that an **Independent Environmental Assessment Practitioner (EAP)** is appointed at the time to **compile a detailed decommissioning plan** to address all the aspects of the decommissioning process prevalent at the time.

### **9.2. Decommissioning Approach (Under guidance of an EAP)**

Essentially the following approach must be implemented:

#### **9.2.1. Removable Concrete Structures**

- All foreign material such as gravel and concrete must be broken up and removed to a designated gravel pit, which will be identified by the authorities for purposes of rehabilitation.
- All roads, buildings and service infra-structure must be demolished and removed off site.
- All service lines, where applicable (electrical- and water supply) must be removed and trenches rehabilitated.
- The lie of the land must be returned to fit in with the adjoining land surface or as per recommendations submitted by DEDET.

#### **9.2.2. Reinstatement**

- All foreign material must be removed and disposed of at a borrow pit earmarked for rehabilitation.
- The disturbed area must be levelled off and contoured to fit in with the rest of the landscape.
- The disturbed area must be ripped, and fertilised to enhance re-vegetation.
- The exposed soil must be brush packed with brushes and grass material from the area, to serve as a seed bank for re-vegetation.
- The reinstated area must be irrigated once a week to promote the re-vegetation process.
- These aspects will require on site monitoring, as the occurrence of natural rainfall will determine the frequency of irrigation required.

## **10. MONITORING and AUDITING**

It is recommended, that in the event that this development proposal/application is approved, that the developer appoint an independent **Environmental Control Officer (ECO)** to oversee the implementation of the Environmental Management Programme (EMP) and **monitor compliance** of the **Environmental Impact Assessment (EIA)**.

Furthermore, if the proposal is approved, the ECO must ensure that all the **conditions** as set out in the **Record of Decision (ROD)/Environmental Authorisation** issued by the DEDET, are met and implemented as stipulated. The ECO must submit a monthly **Audit Report** to the developer, contractor and to DEDET for record and implementation purposes.

The **role of the ECO** and independent audit teams are well defined in the framework of the **Integrated Environmental Management (IEM)**.

## **11. RECOMMENDATIONS:**

Based on the mitigation measures discussed in this report and the contents of the Construction Environmental Management Programme (CEMP) being implemented the following recommendations are submitted for purposes of summation. This submission is in no order of priority.

This report was circulated to Interested and Affected Parties for comments and perusal. Where applicable these comments were included into the Report.

- Appoint an Ecological Control Officer to oversee the construction phase of the project.
- Construct/implement the facility at the preferred site (Route Option 3) and initiate the project under the conditions described in the EMP: Construction.
- Liaise closely with the DEDET and DWA officials during the construction process to ensure a sustainable approach to the development. The ECO must play a vital role in this regard and submit monthly audit reports.
- Implement and adhere to the contents of the Construction Environmental Management Programme (CEMP).
- Use hand labour where possible to avoid impact on the surrounding vegetation by heavy machinery.
- Ensure that Dr. Andrew Deacon is on site to manage the implementation of the fishway. A photograph of an example is included in Appendix B under site photographs.
- Adhere to all the design specifications as proposed in this document.
- Sensitise the Contractor/labourers to be aware of the importance of cultural artefacts and implement the recommended procedure (in the CEMP) in the event that such a discovery is made accidentally during construction.
- Should any artefact or historical site be discovered during excavations for foundations as well as in future, all works must cease with immediate effect.
- The find must be reported to the ECO and the Project Manager for the project. These representatives will initiate an Action Plan to address the management and handling of the find.
- Pay special attention to all the aspects pertaining to topsoil protection and topsoil management as described in the CEMP.
- Pay special attention to the aspect pertaining to the handling and management of hazardous materials (where applicable) and specifically fuels.
- Pay special attention to the handling and management of concrete and cement.
- Install the 3 measuring devices as indicated in the discussion (the diversion at the weir; the sluice gate down to the pipeline and at the hydro station).
- Implement all aspects of site clean up, rehabilitation and site handover as described in the CEMP.

An analysis of the environmental impacts and issues has not revealed any fatal flaws. All the impacts and issues identified and discussed during the investigation can be mitigated to an acceptable degree.

Provided the developer implements the implications of this report, the CEMP and the mitigation measures proposed, it is recommended that the activity be implemented at the preferred site.

## **12. REFERENCES**

**Department of Environmental Affairs and Tourism**, 1998. *Guideline Document, EIA Regulations, implementation of sections 21, 22 & 26 of the Environment Conservation Act*. Government Printer, Pretoria.

**Gertenbach W P D**, 1980. *Rainfall patterns in the Kruger National Park*. Koedoe 23, National Parks Board, Pp 35 – 43.

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**Mucina L. and Rutherford M.C.**, 2006. *The vegetation of South Africa, Lesotho and Swaziland*.