

Hydropower Sustainability Assessment  
Protocol Section IV Trail

ESKOM

Palmiet/Drakensberg Pumped Storage  
Schemes

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A handwritten signature in black ink, appearing to be 'R. Griffin', written in a cursive style.

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## Table of Contents

<b>1</b>	<b>Introductory Information.....</b>	<b>3</b>
1.1	Company .....	3
1.2	Project.....	3
1.3	Status of Project, and Protocol Section Applied.....	4
1.4	Motivation for and Purpose of the Assessment.....	4
1.5	Disclaimers and Confidentiality Agreements, if any .....	4
1.6	Schedule of the Assessment .....	5
<b>2</b>	<b>Assessment Results from the Draft Protocol Trial – General ..</b>	<b>6</b>
2.1	Objectivity and Replicability .....	6
2.2	Understandability .....	6
2.3	Scope and Comprehensiveness .....	7
2.4	Ease of Use .....	8
2.5	Impact and Effectiveness.....	9
2.6	Applicability to Range of Scale and Regions .....	9
2.7	Adequacy of Implementation Guidance .....	10
2.8	Presentation of Results.....	10
<b>3</b>	<b>Assessment Result from the Draft Protocol Trial – Aspect by Aspect .....</b>	<b>11</b>
3.1	River Basin & Transboundary Issues.....	11
3.2	Hydrological Resource Availability & Management.....	11
3.3	Economic Viability Including Additional Benefits.....	11
3.4	Financial Viability .....	11
3.5	Corporate Governance .....	11
3.6	Procurement .....	11
3.7	Markets, Innovation & Research.....	11
3.8	Asset Reliability & Efficiency.....	11
3.9	Social Management Plan .....	11
3.10	Project Affected Communities.....	11
3.11	Indigenous Peoples .....	12
3.12	Benefit Sharing .....	12
3.13	Labour & Working Conditions .....	12
3.14	Cultural Heritage.....	12
3.15	Public Health.....	12
3.16	Asset & Community Safety .....	12
3.17	Environmental Management Plan.....	12
3.18	Catchment Management.....	12
3.19	Reservoir Management.....	12
3.20	Environmental Flows & Downstream Sustainability .....	12
3.21	Biodiversity & Invasive Species .....	12
3.22	Erosion & Sedimentation .....	12
3.23	Water Quality .....	12

## **1 INTRODUCTORY INFORMATION**

### **1.1 Company**

Eskom is a South African company and is the single largest supplier of electricity in Africa, providing approximately 45% of the continent's power needs. It is also one of the top 10 utilities in the world by generation capacity and supplies 95% of electricity consumed in South Africa.

The Generation Division has 24 power stations with a nominal capacity of over 44 000 megawatts. The division operates the largest dry-cooled coal-fired power station in the world as well as Africa's only nuclear power station.

The nuclear and coal-fired power stations provide base-load capacity for the national grid. The conventional hydro-electric, pumped storage, wind and gas turbine stations provide additional electricity during peak demand periods and when unforeseen shortages of capacity occur.

Eskom's hydropower has a capacity of 2 061MW and consists of two pumped storage power stations and six hydro-electric power stations.

### **1.2 Project**

#### **Palmiet**

The Palmiet Pumped Storage Scheme is a joint venture between Eskom and the Department of Water Affairs and Forestry (now Department of Water and Environmental Affairs). The power station is operated by Peaking Generation a business unit of the Generation Division of Eskom. Construction began in 1983 and the power station was commissioned in 1988.

The scheme has a dual role:

- to generate electricity for the Eskom National Grid during peak and emergency demand periods
- to transfer much needed water from the Palmiet River to Cape Town.

The scheme comprises two dams, the upper Rockview and lower Kogelberg Dam on the watershed between the Palmiet and Steenbras rivers. For power generating purposes, water flows from the Rockview reservoir to the lower Kogelberg reservoir via two 200MW reversible pump/turbines. During off peak periods the water collected in the Kogelberg Dam is pumped back again. During winter rainfall months, excess water in the Palmiet River is pumped to the Rockview reservoir. From here water specifically allocated to the DWAF for water supply flows by gravity into the Steenbras Dam via a separate conduit. This supplements the annual water supply of Cape Town by an average of 25 million cubic metres.

Palmiet Pumped Storage Scheme is located in the heart of the Kogelberg Biosphere Reserve – one of the world's richest biodiversity sites and home to 1 600 fynbos plant species.

**Drakensberg**

Construction on the Drakensberg Pumped Storage Scheme started in 1974 and was completed by 1981. During construction, great care was taken to preserve the environment including re-grassing of disturbed areas and the construction of the dams in a way that would attract birds. Four dams are involved in the scheme; the Driekloof Dam (a branch of the Sterkfontein Dam), the Kilburn Dam, the Woodstock Dam and the Driel Barrage. The power station is located between the Driekloof and Kilburn Dams. Since the Driekloof and Sterkfontein Dams also form part of the Tugela-Vaal Water Project some of the water pumped to the Driekloof Dam may, when required, flow to the Vaal Dam and not be available for return to the Kilburn Dam. The Woodstock Dam and Driel Barrage are used to supply water to Kilburn Dam when required.

The scheme provides for up to 27.6 GWh of electricity storage in the form of 27 million m<sup>3</sup> of water. The water is pumped up (470m) to Driekloof during times of low national power consumption (generally over night and weekends) and released back into Kilburn through four 250 MW turbine generators in times of high electricity demand.

The four 250MW reversible pump turbines are situated 52 storeys below ground level. The pumped water that spills over the upper Driekloof Dam wall flows into the Sterkfontein Dam and from there to the industrial heartland of South Africa, the Gauteng area. Thus water is pumped from the Indian Ocean catchment area to the Atlantic Ocean catchment area.

The machine hall, the centre of the scheme is large enough to accommodate a block of apartments 13 storeys high with 77 apartments per storey.

**1.3 Status of Project, and Protocol Section Applied**

Palmiet has been in operation for the past 21 years and Drakensberg for the past 28 years, therefore the Hydropower Sustainability Assessment Protocol Section IV has been applied.

**1.4 Motivation for and Purpose of the Assessment**

The primary objective is to validate the Forum's work so far by providing feedback on how well the Draft Protocol measures sustainability, and to inform the final revision.

**1.5 Disclaimers and Confidentiality Agreements, if any**

None.

## 1.6 Schedule of the Assessment

### Palmiet

Date	Time	Description
6 Oct	08h00	Intro/Tour
	09h30	Initial meeting
	10h30	Assessment
	12h30	Lunch
	13h00	Assessment
	16h00	End of day one

7 Oct	08h00	Assessment
	12h30	Lunch
	13h00	Assessment
	15h30	Close out Meeting
	16h00	End

Representation:

- Eskom Peaking - Palmiet Power Station
- Department of Water and Environmental Affairs
- Local Farmers Association
- Kogelberg Biosphere Reserve Association
- Groenland Water Users Association

### Drakensberg

Date	Time	Description
9 Nov	12h00	Intro Tour
	13h00	Initial Meeting
	13h20	Assessment - (7)
	16h30	End of Day one

10 Nov	08h00	Assessment - (8)
	12h30	Lunch
	13h00	Assessment - (7)
	15h30	Close out Meeting
	16h00	End

Representation:

- Eskom Peaking - Drakensberg Power Station
- Eskom Peaking - Ingula Power Station

## **2 ASSESSMENT RESULTS FROM THE DRAFT PROTOCOL TRIAL – GENERAL**

### **2.1 Objectivity and Replicability**

Pumped Storage Schemes are not necessarily located in a river basin, and their Reservoirs are relatively small compared to other Hydropower Stations. Therefore some aspects could be considered as not relevant.

It was felt that the rating descriptions and Guidance Notes need to be updated and expanded, once practically tested in a number of assessments to ensure some degree of replicability.

Some projects are already audited by external bodies: in the case of Eskom there are regular safety, environmental and quality audits. If these auditing bodies are officially accredited, this would reduce the time required to spend on these particular assessments e.g. Palmiet/Drakensberg hold the NOSCAR, the highest level of achievement awarded by NOSA (National Occupational Safety Association of Southern Africa) and Peaking is accredited in terms of ISO 9001 and ISO 14001. The site inspection would be evidence of site specific compliance.

### **2.2 Understandability**

The legal terminology of the document may make it more difficult to understand for those whose first language is not English and for supervisory technical staff to interpret and understand the protocol. However at the conclusion of the assessment, the staff having been assisted through the document, a more common understanding was achieved.

During the assessment the definition of “River Basin” and “River Catchment” was not clear to all parties. In subsequent reviewing of the definitions, the difference was evident.

The aspect “Social Management Plan” is named “Social Impact Assessment & Management” on page 6 of the Guidance notes.

The aspect “Environmental Management Plan” is named “Environmental Impact Assessment & Management”.

The word “plan” in the aspect names caused confusion and it gave the impression that a formal plan is necessary in order to be effective for that particular aspect. It is recommended to rather use the descriptions on page 6 of the Guidance Notes.

While some hydropower facilities are independent entities, others are part of large corporates and assessment of certain aspects e.g. “Financial Viability” or “Governance” will need to be based on corporate policies, procedures and standards.

Palmiet/Drakensberg forms part of Peaking Generation which forms part of the bigger corporate Generation Business which forms part of the bigger

corporate Eskom Holdings Limited. This means that Palmiet/Drakensberg need to operate according to the standards, procedures and policies that are generated at higher levels over which they have no control. The question raised was whether to only assess project documents or to assess all related company documents?

The terminology used is not consistent throughout the Protocol; the aspects refer to four different terms namely "Project", "Hydropower Station", "Hydropower Facility" and "Hydropower Project".

The defining of the boundaries for the assessment was a topic of extensive discussion due to the multi purpose nature of Drakensberg and Palmiet. The title of the assessment is the "Sustainability of Hydropower Projects", this can be interpreted to mean that only the hydropower components of an overall scheme should be assessed. Drakensberg and Palmiet as pumped storage schemes have dual roles in carrying out water transfer for a third party. This makes it difficult to carry out an assessment as some of the aspects relate to catchment and river basins which implies that the other parties need to be assessed. Other aspects are related to economic and financial viability which in Drakensberg's and Palmiet's case could be taken to mean that the Peaking Business Unit to which they report into and / or the bigger Eskom corporate need to be assessed.

If the purpose is determined prior to assessment it may be possible to clear up some of these boundary issues. If it is for hydropower project comparison / benchmarking / award purposes it may be better to exclude non electricity generating activities and corporate aspects. If the owner is intending to use it to motivate for funding for extensions or new projects, then the assessment of the corporate body would be important and the non electricity generating activities could be excluded. Only for comparison / benchmarking of other multi purpose projects would the third party also be assessed but it would have to be clarified if the third party's economic and financial aspects should also be assessed.

If aspects are deemed to be not relevant, comparisons between projects will be difficult.

### **2.3 Scope and Comprehensiveness**

It was noted that the decommissioning of a Hydro Power Project might not be able to be comprehensively assessed with the currently available Sections as decommissioning has very specific aspects that need to be addressed.

The aspect of the security and access control at a Hydro Power Project may be looked at to be included as this reduces the risk of physical damage to the project. This is obviously a bigger issue in some countries than in others. As a matter of interest, Drakensberg is designated national key points that has to comply with the South African National Key Point Act.

Current staff have exceptional knowledge about their specific areas which greatly assisted the answering of assessment questions and achieving high

scores. In today's world with high staff turnover rates the scores could have been lower if there were new employees responsible for some of the specific areas. It is thus important that knowledge is kept and shared between employees in order to achieve or sustain a sustainable environment. A recommendation will be to add another aspect for Knowledge Management.

It is suggested that stakeholder management and communication covered as aspects in their own right. Stakeholder management and internal and external communication have their own procedures, strategies and processes that can be assessed. Communication could be seen as a subset of Stakeholder Management and assessed as such or could be seen as an aspect on its own. The management of specific issues, with specific stakeholders begins with the identification of a hydropower project, right to the end of its operating life. A data base and participation in local forums could be evidence of involvement with communities. There should be a smooth transition of stakeholder management from planning to operational phases. Commitments made in the early phases are often not carried over to construction and operating phases.

## **2.4 Ease of Use**

On page 6 in the guidance notes, the aspects are all grouped in logical order according to different perspectives, but the aspects in the assessment itself are in a different order. It will be easier if the aspects in the assessment are also grouped per perspective. The assessment can then be scheduled according to the perspectives and only the people relevant or responsible have to attend to the assessment when a certain perspective is addressed.

The Attributes "Level of Compliance" and "Level of Conformance with Plans" are not consistent through out the document in the same sequence.

The Aspect Assessment Score Cards (e.g. Table 1) at the back of the Protocol refer regularly to the Attribute guidance notes that are at the front end of the Protocol. This causes a lot of paging through while doing the assessment. A recommendation will be to separate the assessment part from the guidance notes to enable users to have the two documents open at the relevant areas simultaneously.

The format of the Aspect Score Cards were found to be very busy table with too much duplication, a recommendation is made to simplify it (e.g. as in table 1).

	Attribute	5 Excellent	4 Very Good	3 Good	2 Poor	1 Very Poor
Process Attributes	Assessment	<ul style="list-style-type: none"> <li>Quality of the process leading to understanding of the existing regional socio-economic baseline, regional economic activity and infrastructure, and related constraints and opportunities</li> <li>Quality of the Process leading to an Understanding of the opportunities to leverage regional development through the project to support broader economic development objectives</li> <li>Analysis of economic viability of the project through cost-benefit analysis which includes social, environmental and economic aspects</li> </ul>				
	Management Planning	<ul style="list-style-type: none"> <li>Quality of the planning process to optimize delivery of project benefits [see management guidance note]</li> </ul>				
	Consultation Process	<ul style="list-style-type: none"> <li>Quality of the consultation process [See consultation guidance note]</li> </ul>				
Performance Attributes	Stakeholder Support	<ul style="list-style-type: none"> <li>Level of stakeholder support for analysis and planning for additional benefits [see stakeholder support guidance note]</li> </ul>				
	Compliance	<ul style="list-style-type: none"> <li>Generally not relevant</li> </ul>				
	Conformance with Plans	<ul style="list-style-type: none"> <li>Conformance with plans for additional benefits [see conformance with plans guidance note]</li> </ul>				
	Effectiveness	<ul style="list-style-type: none"> <li>Optimisation of opportunities to deliver additional benefits to directly affected stakeholders and the broader community</li> <li>Success in achieving net project benefits based on cost benefit analysis factoring in social and environmental</li> </ul>	Fully optimised with no gaps	Close to fully optimised with very few non-critical gaps	Well optimised with a number of non-critical gaps	Somewhat optimised with critical gaps

Table 1: Aspect Score Card

Several approaches were tested and discussed on how to give one score for attributes with more than one sub-attribute (e.g. Table 1 first attribute). A decision was made to take the lowest sub-attribute score. For example, if a score of 2 and 4 are attained for an attribute with two sub-attributes then 2 was taken as the attribute score. If the average score of 3 is used as the final score, it will mean that there are no critical gaps, but critical gaps have already been identified for one of the sub-attributes. Therefore the lowest score has to be taken. The same will apply when the two sub-attribute scores are 4 and 5, some non critical gaps have been identified which mean the final score can not be higher than 4.

## 2.5 Impact and Effectiveness

The more the learning points are shared between Projects the more the impact and benefit of the protocol will have for the Projects.

## 2.6 Applicability to Range of Scale and Regions

Both Palmiet and Drakensberg have been in operation for more than 20 years and at the time they were built the rules and regulations were totally different from now. In some cases no assessments were done because there was no requirement for it at that time. A lot of things were also done in an informal way and no documentation exists to prove that it was done. It could be difficult to compare a Hydropower Project that has been in operation for 25 years with one that has been in operation for 6 months.

It was also difficult for the current staff to answer questions about things that happened more than 20 years ago, and this supports the point that was made in 2.3 that Knowledge Management is an important aspect to be sustainable.

## 2.7 Adequacy of Implementation Guidance

The Implementation Guidance is duplicated in all four sections of the Protocol and makes up a large portion of the documents. The Protocol can be seen as overwhelming as it is a rather thick document. It also includes some information that is not relevant to all parties involved in the assessment. As suggested earlier, this could be alleviated by splitting the Guidance Notes from the assessment.

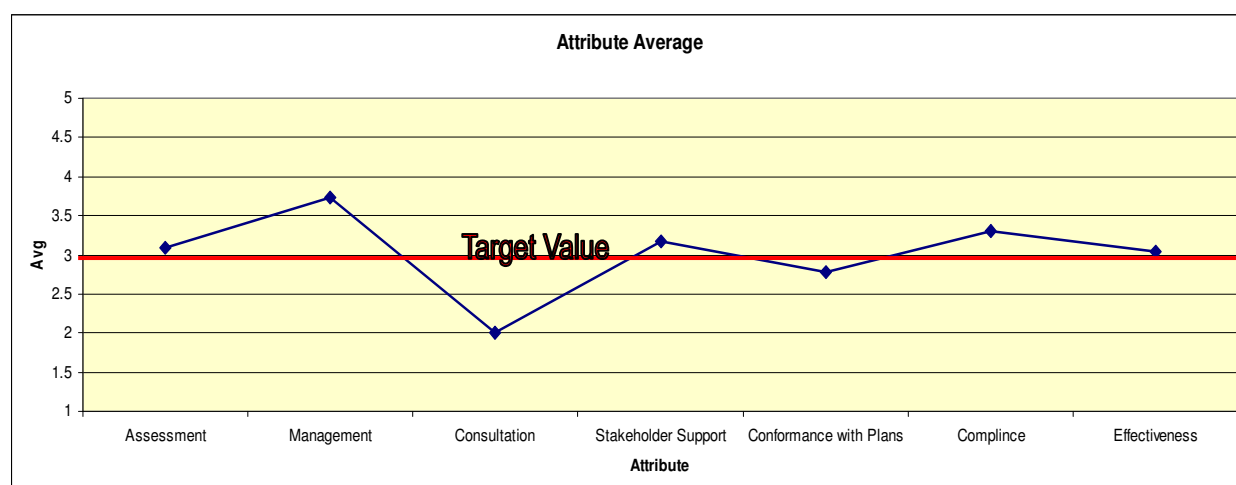
Other Issues:

- Table 3 appears after Table 4
- The order of the aspects on page 6 Table 1 of the guidance notes is not the same order as the aspects in the assessment.
- On page 21 the heading is Project Implementation and it should be Project Operation

## 2.8 Presentation of Results

The space provided in the evidence column of the auditor worksheet Table 3 on page 10 of Section IV is not enough to fill out all the evidence presented.

A suggestion is to add another graph (e.g. Figure 1) which shows the average score of the attributes with a target value. This will emphasise to the project which attributes need to get attention. For example Figure 1 indicates that the project needs to concentrate on their consultation processes.



**Figure 1: Attribute Average**

A suggestion was made at Drakensberg to send an electronic file with the assessment scores to the Power Stations which will allow them to draw their own graphs and do their own analysis.

### **3 ASSESSMENT RESULT FROM THE DRAFT PROTOCOL TRIAL – ASPECT BY ASPECT**

Not many aspects were covered during the trial as much of the time was taken discussing more generic issues around the assessment as a whole. This was particularly the case at Palmiet where the team was privileged to have David Harrison and Donal o’Leary in attendance. (Report by Donal attached as a separate attachment to this report.) There was also attendance by a Department of Water Affairs and Environment representative as well as a representative from the local community. The attendance of these representatives gave a lot of insight to issues beyond the Eskom Palmiet boundaries.

#### **3.1 River Basin & Transboundary Issues**

The attribute “Compliance” is described as generally not relevant in the protocol (p24), in South Africa there are some legal requirements where compliance is needed with regards to the “Aspect River Basin & Transboundary Issues”.

#### **3.2 Hydrological Resource Availability & Management**

No comment

#### **3.3 Economic Viability Including Additional Benefits**

No comment

#### **3.4 Financial Viability**

This aspect elicited much discussion around the boundaries of the assessment and the relevance. The relevance would be determined by the purpose of the assessment (benchmarking vs certification vs funding support).

#### **3.5 Corporate Governance**

No comment

#### **3.6 Procurement**

No comment

#### **3.7 Markets, Innovation & Research**

No comment

#### **3.8 Asset Reliability & Efficiency**

No comment

#### **3.9 Social Management Plan**

No comment

#### **3.10 Project Affected Communities**

The aspects “Social Management Plan” and “Project Affected Communities” overlap and are duplicated in some characteristics.

**3.11 Indigenous Peoples**

This aspect was not scored because the feeling was that “Indigenous People” are already covered under the aspect “Project Affected Communities”.

**3.12 Benefit Sharing**

No comment

**3.13 Labour & Working Conditions**

Health and Safety are extremely important aspects on any site as the aspect deals with people’s lives and has its own processes and compliance requirements. It was recommended that Health and Safety be separated from the “Labour & Working Conditions” aspect and to add it as another aspect.

**3.14 Cultural Heritage**

No comment

**3.15 Public Health**

No comment

**3.16 Asset & Community Safety**

No comment

**3.17 Environmental Management Plan**

No comment

**3.18 Catchment Management**

Compliance could very well be relevant.

**3.19 Reservoir Management**

No comment

**3.20 Environmental Flows & Downstream Sustainability**

No comment

**3.21 Biodiversity & Invasive Species**

No comment

**3.22 Erosion & Sedimentation**

No comment

**3.23 Water Quality**

No comment