INTRODUCTION CHAPTER 1

Eskom Holdings Limited (Eskom) is investigating the conversion of the five units at the existing Open Cycle Gas Turbine (OCGT) plant at Gourikwa Power Station (located near Mossel Bay in the Western Cape) to a Combined Cycle Gas Turbine (CCGT) plant. The existing Gourikwa OCGT Power Station consists of five OCGT units (i.e. three existing OCGT units, plus an additional two OCGT units, currently under construction) resulting in a total nominal capacity of 750 MW for the power station. The proposed conversion will increase the generating capacity of this existing power station by approximately 400 MW. The proposed conversion involves the addition of Heat Recovery Steam Generators (HRSG) to generate steam, and steam turbines and generators to the existing gas turbine plant (essentially adding a steam cycle to the existing gas cycle), and will be established on the same site as the existing Gourikwa Power Station. Essentially, the conversion of the power plant to CCGT units consists of recovering waste heat from each turbine to drive a steam turbine.

Eskom is also proposing the construction of a 400kV transmission power line between the Gourikwa Power Station and the existing Proteus Substation to transmit the additional power generated at Gourikwa Power Station into the national electricity grid.

The Gourikwa Power Station conversion and associated transmission integration project can be seen as a third phase of the original Gourikwa OCGT power station project. The construction of the initial OCGT units (i.e. the three units now in operation) was the first phase of the project. The second phase of the project (currently under construction) involves the expansion of the power station by adding another two OCGT units and a switchyard to the power station.

The nature and extent of the Gourikwa Power Station conversion and transmission integration project, as well as potential environmental impacts associated with the construction of a facility of this nature (as well as all associated infrastructure) is explored in more detail in this Draft Environmental Impact Report.

1.1. The Need, Desirability and Background to the Proposed Project

Eskom contributes to its vision of "together building the powerbase for sustainable growth and development" through its core business focus on electricity generation, transportation, trading and retail. Achieving the vision requires in-depth planning and rigorous implementation in a complex

environment characterised by higher economic growth, greater demand for electricity and the heightened need for significant infrastructure expansion.

Considering the Government's Accelerated and Shared Growth Initiative for South Africa (ASGI-SA) targets and the growth in power needs currently being experienced, South Africa will require additional power generation capacity in the next five to ten years. To supply this additional demand in the medium-term, a variety of options such as demand side management, co-generation and gas-fired plants (open cycle and combined cycle) continue to be investigated by Eskom in addition to conventional long-term supply options (such as coal and nuclear fuel plants).

As one of its increased electricity supply options, Eskom is proposing the conversion of the OCGT units at the existing Gourikwa Power Station (near Mossel Bay) as well as the Ankerlig Power Station (located near Atlantis) in the Western Cape to **Combined Cycle Gas Turbine (CCGT)** units. Due to the forecast in the demand for electricity (until approximately 2014) and constraints associated with meeting this projected demand, the conversion of these OCGT units to CCGT units is one of the few options available to Eskom to manage the projected electricity demand in the medium-term.

The conversion of the Open Cycle Gas Turbine (OCGT) units at the Gourikwa Power Station and/or the Ankerlig Power Station will increase the generating capacity of the OCGT units within the Western Cape by a maximum of approximately 1120 MW (i.e. ~720 MW at Ankerlig and ~400 MW at Gourikwa). This increase in generating capacity would be achieved by increasing the efficiency of the gas turbine plant (i.e. more power generated and sent out, for the same amount of fuel used at the same operating regime). Overall thermal efficiency is therefore increased from approximately 34% for the current OCGTs to approximately 50% to 55% for the proposed CCGT plant, depending on the operating regime of the plant.

This EIA Study considers the conversion of the OCGT units at the **Gourikwa Power Station** to CCGT units, and considers a **maximum capacity increase of 400 MW**. Environmental studies for the conversion of the OCGT units at the Ankerlig Power Station are the subject of a separate EIA process, and Eskom have submitted a separate application for the maximum capacity increase at this power station[1]. However, the decision around the total number of OCGT units to be converted to CCGT units, and the final split of generation capacity between

[1] The EIA process for the Ankerlig Power Station Conversion and Transmission Integration Project is registered with DEAT under Application Reference numbers 12/12/20/1014 (power station) and 12/12/20/1037 (transmission power line). The Final EIA Report for this project has been submitted to DEAT for review and decision-making.

these two power stations is still to be determined through feasibility studies being undertaken by Eskom.

As electricity cannot be readily or inexpensively stored, it is required that electricity must be efficiently transmitted from the point of generation to the end user. Transmission capacity is required to keep up with both electricity generation capacity and electricity demand. Therefore, in order to integrate the additional power generated at the Gourikwa Power Station into the national electricity grid, the construction of a new **400 kV transmission power line** between the Gourikwa Power Station and the Proteus Substation will be required.

1.2. Background to the Gourikwa Conversion Project and EIA Process

Environmental Impact Assessment (EIA) processes have previously been undertaken by Eskom for the approved OCGT units at Gourikwa (the existing three units (with a nominal capacity of 450 MW) approved in December 2005 and the additional two units (with a nominal capacity of 300 MW) approved in August 2007). The construction and commissioning of the initial three OCGT units is complete and these units have been operational since mid-2007. Construction of the additional two OCGT units is currently underway and is expected to be complete in the first quarter of 2009. The electricity generation capacity of the Gourikwa Power Station will assist Eskom in meeting the peaking electricity generation demands[2] in the medium-term (i.e. up to 2014).

Comment: Please confirm when construction will be compete/units commissioned.

Subsequently, considering the strategic electricity planning in place (refer to Chapter 2) and taking into account the continued growth in electricity demand, Eskom has determined that there is a need for **additional** power generation capacity in the **medium-term**. In considering the most suitable options to meet the increased electricity demand in the medium-term, Eskom has concluded that it would be feasible to convert the existing Gourikwa OCGT units to CCGT units, thereby generating additional capacity for the same amount of fuel (under a similar operating regime) considering the load factors at which the units may have to operate.

1.3. Project Overview

The proposed CCGT project is to take place within the existing Gourikwa OCGT Power Station site, located adjacent to the PetroSA Gas to Liquid (GTL) facility. The power station site is located adjacent to the N2 near the Mossel Bay Industrial Area in the Western Cape, approximately 10 km west of the residential areas of the town of Mossel Bay (refer to Figure 1.1).

[2] OCGT units are best suited for peaking generation capacity (i.e. for peak periods in the morning and evenings).

Three alternative 400kV transmission line routes were investigated in the Scoping phase for the new required transmission line, but one of the alternatives was discarded on the basis of the findings of the scoping evaluation. Therefore only Alternatives 2 and 3 have been investigated in the EIA phase. The proposed power line Alternatives 2 and 3 would both run from Gourikwa to Proteus Substation, parallel and adjacent to an existing 400kV transmission line (refer to Figure 1.1).

In summary, the components of this project are as follows

» Conversion of five OGCT units at Gourikwa Power Station to CCGT units
» Construction of a new 400kV power line between Gourikwa Power Station and Proteus Substation
» Construction of a new water pipeline between the PetroSA facility and Gourikwa Power Station (parallel to the existing diesel pipeline);
» Construction of a gas pipeline between the PetroSA facility and the Gourikwa Power Station (parallel to the existing diesel pipeline and proposed water pipeline); and
» Construction of a new access road to Gourikwa Power Station from the N2 National Road.

Details of the proposed project are summarised below and are detailed in Chapter 3.

Figure 1.1: Locality map showing the location of the existing Gourikwa Power Station and the associated project components nominated for consideration in the EIA Phase

1.3.1. Power Station Conversion

The Gourikwa Power Station comprises five OCGT units (i.e. 3 existing OCGT units, plus 2 additional OCGT units under construction) each with a nominal capacity of ~150 MW, resulting in a total nominal capacity of 750 MW for the power station. Each OCGT unit consists of one gas turbine driving an electric generator.

The concept of converting the OCGT units to CCGT units is to utilise the **heat energy** from the exhaust of the gas turbine to create steam in a Heat Recovery Steam Generator (HRSG) in order to drive a steam turbine, instead of this heat energy being exhausted and lost to the atmosphere (as is the current scenario). Conversion of the units to CCGT is therefore based on increased cycle efficiency.

Simply stated, this can be achieved through the following (and is illustrated in Figure 1.2):

» When the hot gas exits the gas turbine as exhaust gas, it has a temperature of up to 600°C. This heat energy is transferred to water in the heat recovery steam generator, instead of being exhausted to the atmosphere.
» The heat is used to generate steam (water vapour), which powers the steam turbine to produce mechanical energy.

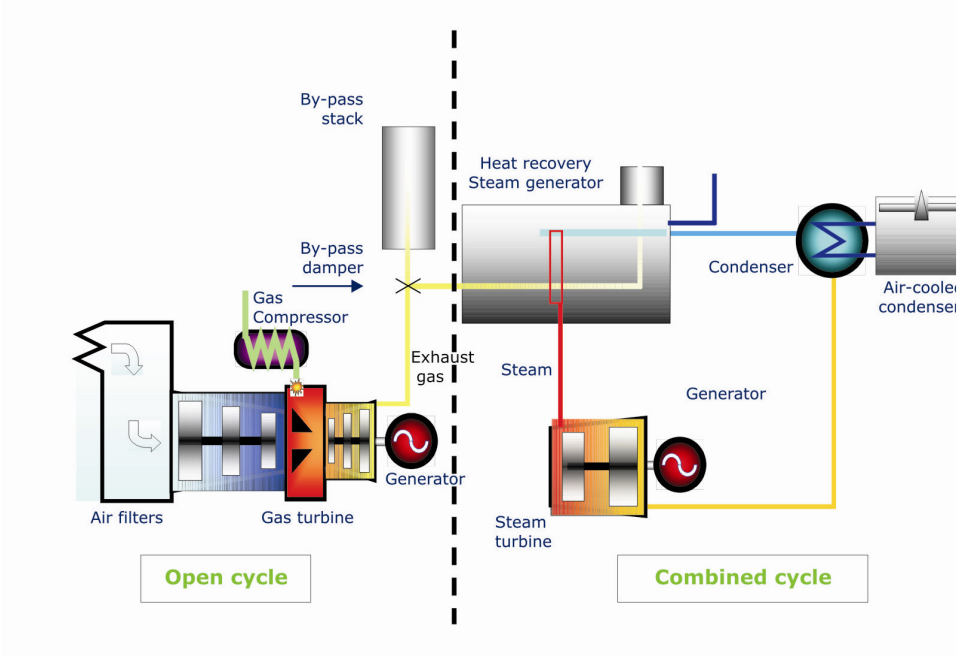

Figure 1.2: Simplified schematic illustrating the CCGT conversion process and components

» The resulting mechanical energy is transferred to a generator, where it is converted into electricity (i.e. electrical energy).
» A condenser converts exhaust steam from the steam turbine back into saturated water through a cooling process.

Conversion of the units to CCGT is undertaken to increase cycle thermal efficiency. It is estimated that each converted unit will produce approximately 80 MW additional capacity, i.e. approximately 50% more than a standard OCGT unit. Therefore, a maximum of an additional 5 x 80 MW (400 MW in total) increase in capacity is foreseen from the OCGT to CCGT conversion. The **total nominal capacity** of the Gourikwa Power Station would, therefore increase to approximately **1 150 MW**.

The primary components of the CCGT conversion project include the following:

» A **heat recovery steam generator** (HRSG) will be added to the gas turbine to recover waste heat, to drive the steam turbine cycle. One HRSG can be linked to two or three OCGT units.
» A **condenser** which converts exhaust steam from the steam turbine back into water through a cooling process.
» Depending on the configuration, a **bypass stack** for the CCGT, anticipated to be approximately 60 m in height will be associated with each HRSG.
» **Water treatment plant** (for treatment of potable water and production of demineralised water (for steam generation)).
» **Dry-cooled technology** consisting of a system of air-cooled condenser fans situated in fan banks approximately between 25 m and 30 m above ground.
» A **water pipeline** between the PetroSA facility and the Gourikwa Power Station, proposed parallel to the existing diesel pipeline.
» A **water tank** with a holding volume of ~2.5 million litres (i.e. water storage for ~5 days of operation).
» A **gas pipeline** between the PetroSA facility and the Gourikwa Power Station, proposed parallel to the existing diesel pipeline between the two facilities. The CCGT units can be both liquid fuel-fired (diesel) or natural gas-fired. The CCGT units would initially be diesel-fired, until such time that natural gas becomes available for use.

The proposed conversion infrastructure will be on the site of the existing Gourikwa Power Station, and will not require any additional land take outside of the existing power station boundaries (refer to Figure 1.3).

Comment: All reference to additional fuel storage tank has now been removed, as per Reggie's confirmation that they will no longer be required. Do we need a sentence in somewhere to say why, as someone may wonder why we are no longer considering them.

Figure 1.3: Aerial photograph of the Gourikwa Power Station site showing the existing power station infrastructure, the power station expansion site, as well as the areas for the placement of infrastructure associated with the proposed power station conversion

Water will be required for the CCGT power generation process and for cooling. The feasibility and availability of various water resource options are currently being investigated with PetroSA, including the use of treated water, effluent and/or stormwater from the PetroSA facility. A preferred option will be nominated with the agreement of PetroSA for implementation based on technical, environmental and economic constraints[3]. The water will be piped to the power station from PetroSA via a new **water pipeline** proposed to be constructed parallel to the existing diesel pipeline between the two facilities. This water pipeline would be outside of the existing power station boundaries.

Comment: Please confirm footnote

Eskom also propose the construction of a new dedicated **access road** to the Gourikwa Power Station. The power plant currently shares an access road with PetroSA. The proposed access route is directly off the N2, and would be outside of the existing power station boundaries.

[3] These constraints are the subject of a separate investigation being undertaken by Eskom together with PetroSA.

The OCGT units at the power station are currently fuelled using diesel, which is supplied by the PetroSA facility. The use of diesel as a fuel source following the conversion of the units is considered by Eskom to be a potential economic constraint, as more fuel would be required to operate the power station at a higher load factor (i.e. longer operating hours or a mid-merit operating regime[4]). Therefore, Eskom are currently investigating the opportunities to include natural gas as an option for a fuel source at the Gourikwa Power Station. This natural gas would be sourced from PetroSA and conveyed directly to the power station via a pipeline. This pipeline is proposed to be constructed parallel to the existing diesel and proposed water pipelines between the two facilities.

1.3.2. Integration of the CCGT Power Station into the National Grid

A 400kV transmission power line is required to be constructed between the Gourikwa Power Station and the Proteus Substation (located approximately 11 km north-west of the power station) to integrate the additional power generated at this power station to the national electricity grid. The existing substation (high voltage (HV) yard) at the Gourikwa Power Station will be utilised, and no additional infrastructure or expansion of this HV yard is required to accommodate the new transmission power line. In order to accommodate the new power line at the Proteus Substation, a busbar extension will be required. This will involve terrace work within the existing substation boundary.

Comment: Please confirm that no additional bay would be required.

Comment: Please confirm this is correct/all that is required at Proteus. Thanks

Three technically feasible alternative transmission power line **alignment corridors** (approximately 500 m in width) were investigated in the Scoping phase. On the basis of the scoping evaluation, Alternative 1 was discarded as a feasible alternative. Therefore, only Alternatives 2 and 3 have been investigated in the EIA. Through the EIA process, a preferred alternative power line corridor is to be nominated, provided no environmental fatal flaws are identified.

Transmission power lines are constructed and operated within a servitude that is established along the entire length of the line (55 m wide for a 400kV line). Within this servitude, Eskom would have certain rights and controls that support the safe, effective operation and maintenance of the power line. The process of achieving options to acquire servitudes is referred to as the Servitude Negotiation Process with each affected landowner. The negotiation process is undertaken directly by Eskom and is independent of, and follows on from the EIA process.

[4] Mid-merit capacity is during the daytime from about 6 am to about 10 pm on weekdays.

1.4. Requirement for an Environmental Impact Assessment Process

The proposed power station and transmission power line integration project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). This section provides a brief overview of EIA Regulations and their application to this project.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs and Tourism (DEAT) is the competent authority for this project as Eskom is a statutory body. An application for authorisation has been accepted by DEAT (under Application Reference numbers **12/12/20/1141** (power station conversion) and **12/12/20/1142** (proposed transmission power line). Through the decision-making process, DEAT will be supported by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP).

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project. Eskom appointed Savannah Environmental (Pty) Ltd to conduct the independent EIA process for the proposed project.

An EIA is also an effective planning and decision-making tool for the project proponent. It allows the environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issue(s) reported on in the Scoping and EIA reports as well as dialogue with affected parties.

In terms of sections 24 and 24D of NEMA, as read with Government Notices R385 (Regulations 27–36) and R387, a Scoping and EIA are required to be undertaken for this proposed project as it includes the following activities listed in terms of GN R386 and R387 (GG No 28753 of 21 April 2006) relevant to the **power station conversion**:

No & date of relevant notice	Activity No (in terms of relevant Regulation/ notice)	Description of listed activity
Government Notice R387 (21 April 2006)	1(a)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where (i) the electricity output is 20 megawatts or more; or (ii) the elements of the facility cover a combined area in excess of 1 hectare
Government Notice R387 (21 April 2006)	1(c)	The above-ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of 1000 cubic meters or more at any one location or site including the storage of one or more dangerous goods, in a tank farm
Government Notice R387 (21 April 2006)	1(e)	Any process or activity which requires a permit or licence in terms of legislation governing the generation or release of emissions, pollution, effluent or waste and which is not identified in Government Notice No. R 386 of 2006
Government Notice R387 (21 April 2006)	1(j)	The bulk transportation of dangerous goods using pipelines, funiculars or conveyors with a throughput capacity of 50 tons or 50 cubic metres or more per day
Government Notice R387 (21 April 2006)	2	Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more
Government Notice R386 (21 April 2006)	1(k)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the bulk transportation of sewage and water, including storm water, in pipelines with - » an internal diameter of 0,36 metres or more; or » a peak throughput of 120 litres per second or more
Government Notice R386 (21 April 2006)	1(n)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the off-stream storage of water, including dams and reservoirs, with a capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of the activity listed in item 6 of Government Notice No. R. 387 of 2006
Government Notice R386 (21 April 2006)	1(s)	The treatment of effluent, wastewater or sewage with an annual throughput capacity of more than 2000 cubic meters but less than 15 000 cubic meters.

No & date of relevant notice	Activity No (in terms of relevant Regulation/ notice)	Description of listed activity
Government Notice R386 (21 April 2006)	7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site.
Government Notice R386 (21 April 2006)	14	The construction of masts of any material of type and of any height, including those used for telecommunications broadcasting and radio transmission, but excluding (a) masts of 15m and lower exclusively used by (i) radio amateurs; or (ii) for lightening purposes (b) flagpoles; and (c) lightening conductor poles
Government Notice R386 (21 April 2006)	15	The construction of a road that is wider than 4 m or that has a reserve wider than 6 m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 m long.

The following activities listed in terms of GN R386 and R387 (GG No 28753 of 21 April 2006) relevant to the **transmission power line integration**:

No & date of relevant notice	Activity No (in terms of relevant Regulation/ notice)	Description of listed activity
Government Notice R387 (21 April 2006)	1(l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more
Government Notice R386 (21 April 2006)	1(m)	any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including – a) canals; b) channels; c) bridges; d) dams; and e) weirs
Government Notice R386 (21 April 2006)	7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location or site.
Government	12	The transformation or removal of indigenous

No & date of relevant notice	Activity No (in terms of relevant Regulation/ notice)	Description of listed activity
Notice R386 (21 April 2006)		vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
Government Notice R386 (21 April 2006)	14	The construction of masts of any material of type and of any height, including those used for telecommunications broadcasting and radio transmission, but excluding (a) masts of 15m and lower exclusively used by (i) radio amateurs; or (ii) for lightening purposes (b) flagpoles; and (c) lightening conductor poles
Government Notice R386 (21 April 2006)	15	The construction of a road that is wider than 4 m or that has a reserve wider than 6 m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 m long.

This report documents the assessment of the potential environmental impacts of the proposed construction, operation and decommissioning of the proposed power station conversion and transmission integration project. This EIA Phase followed the Scoping Phase, and was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.5. Objectives of the Environmental Impact Assessment Process

The scoping phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA phase. This was achieved through an evaluation of the proposed project, involving the project proponent, specialists with experience in undertaking EIAs for similar projects, and a public consultation process with key stakeholders that included government, non-governmental organisations and interested and affected parties (I&APs).

The EIA addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction, operation and decommissioning, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date through the EIA process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review of the draft EIA Report prior to submission to DEAT.

The EIA Report consists of nine sections:

» **Chapter 1** provides background to the proposed power station conversion and transmission integration project and the environmental impact assessment process.
» **Chapter 2** provides the strategic context for energy planning in South Africa.
» **Chapter 3** describes the components of the proposed project (project scope).
» **Chapter 4** outlines the approach used to undertake the EIA phase of the EIA process, including the consultation programme that was undertaken and input received from interested and affected parties.
» **Chapter 5** describes the existing biophysical and socio-economic environment (description of the affected environment) that may be affected by the proposed project.
» **Chapter 6** presents the assessment of environmental impacts associated with the proposed power station conversion.
» **Chapter 7** presents the assessment of environmental impacts associated with the proposed transmission power lines.
» **Chapter 8** presents the conclusions and recommendation by the EAP, incorporating specialists' input into the EIA process as well as an Impact Statement.
» **Chapter 9** provides a list of references and information sources used in undertaking EIA and compiling the EIA Report.

1.6. Details of Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA

Savannah Environmental was contracted by Eskom Holdings Limited as an independent environmental assessment practitioner (EAP) to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any its specialist sub-consultants on this project are subsidiaries of or affiliated to Eskom Holdings Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

The Savannah Environmental project team have more than eleven (11) years experience in environmental assessment and environmental management, and

have been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa. Savannah Environmental's competence to lead an EIA for a project of this nature has been demonstrated through the execution of other EIA processes under the NEMA EIA Regulations. Strong competencies have been developed in project management of environmental EIA processes, as well as strategic environmental assessment and compliance advice, and the identification of environmental management solutions and mitigation/risk minimising measures.

Jo-Anne Thomas and Karen Jodas, the principal reviewers and co-authors of this Draft EIA Report, are both registered Professional Natural Scientists (in the practice of environmental science) with the South African Council for Natural Scientific Professions. They have gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA processes over the past eleven (11) years. They have successfully managed and undertaken EIA processes for other power generation projects for Eskom Holdings Limited throughout South Africa. They were assisted in the compilation of this report by Zama Dlamini, who has more than six years experience in the environmental management field. Curricula vitae for the Savannah Environmental project team consultants are included in Appendix A.

In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed several specialist consultants to conduct specialist studies, as required. Details of these specialist studies are included in Chapter 4. The curricula vitae for the EIA specialist consultants are also included in Appendix A.