Report No: [4793/402719]

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS: PROPOSED COAL-FIRED POWER STATIONS AND ASSOCIATED INFRASTRUCTURE IN THE WATERBERG, LIMPOPO

DRAFT SCOPING REPORT

November 2008

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GLOSSARY OF TERMS

Airshed	An airshed is a part of the atmosphere that behaves in a coherent way with respect to the dispersion of emissions. It typically forms an analytical or management unit and is also a geographic boundary for air quality standards
Base Load	Base load refers to the electricity generated to meet the continuous need for electricity at any hour of the day or night at all times and during all seasons
Environment	The surroundings (biophysical, social and economic) within which humans exist and that are made up of i. the land, water and atmosphere of the earth; ii. micro organisms, plant and animal life; iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing
Environmental Impact Assessment (EIA)	A study of the environmental consequences of a proposed course of action.
Environmental Impact Report (EIR)	A report assessing the potential significant impacts as identified during the Scoping phase.
Environmental impact	An environmental change caused by some human act
Peaking or Peak Load	Peaking refers to the periods between approximately 06:00 and 09:00 in the mornings and 18:00 and 21:00 in the evenings when electricity usage "peaks"
Public Participation Process	A process of involving the public in order to identify needs, address concerns, in order to contribute to more informed decision making relating to a proposed project, programme or development
Mothballed	A power station withdrawn from service for an indefinite period.
Red Data Book (South African)	An inventory of rare, endangered, threatened or vulnerable species of South African plants and animals

Scoping	A procedure for determining the extent of and approach to an EIA, used to focus the EIA to ensure that only the significant issues and reasonable alternatives are examined in detail
Scoping Report	A report describing the issues identified

ABBREVIATIONS

AHP	Analytical Hierarchy Process
AsgiSA	Accelerated and Shared Growth Initiative for South Africa
APPA	Atmospheric Pollution Prevention Act (No. 45 of 1965)
BID	Background Information Document
DEAT	Department of Environmental Affairs and Tourism
DEDET	Department of Economic Development Environment and Tourism
DME	Department of Minerals and Energy
DSR	Draft Scoping Report
DR	District road
DWAF	Department of Water Affairs and Forestry
EAP	Environmental Assessment Practitioner
EAPSA	Environmental Assessment Practitioner of South Africa
ECA	Environment Conservation Act (No. 73 of 1989)
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Plan
EWT	Endangered Wildlife Trust
FBC	Fluidised bed combustion
FGD	Flue gas desulphurisation
FSR	Final Scoping Report
GA	General Authorisation in terms of the National Water Act
GCS	Groundwater Consulting Services
GGP	Gross Geographic Product
GN	Government Notice

ha	Hectare
HIA	Heritage Impact Assessment
HV	High Voltage
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Plan
IGCC	Integrated coal gasification combined cycle
ISEP	Integrated Strategic Electricity Planning
km	Kilometre
kV	Kilovolt
kWh	Kilowatt hour
l	Litres
LM	Local Municipality
m	Metre
m^3	Cubic metre
mamsl	Metres above mean sea level
MCDA	Multi-criteria Decision Analysis
MPa	megapascals
MPRDA	Mineral and Petroleum Resources Development Act (No. 28 of 2002)
Mt	Million tons
MW	Megawatt
NEMA	National Environmental Management Act (No. 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (No. 25 of 1999)
NIRP	National Integrated Resource Plan

NO_x	Oxides of nitrogen
NWA	National Water Act (No 36 of 1998)
NWRS	National Water Resources Strategy
OEM	Original Equipment Manufacturer
OCGT	Open Cycle Gas Turbines
PM_{10}	Particulates with a diameter of 10 µm or more
ppm	Parts per Million
pf	Pulverised fuel
PPP	Public Participation Process
ROM	Run-of-mine
SAHRA	South African Heritage Resources Agency
SANS	South African National Standards
SAM	Social Accounting Matrix
SIA	Social Impact Assessment
SCI	Sasol Chemical Industries
SDF	Spatial Development Framework
SO_2	Sulphur dioxide
SO_x	Oxides of sulphur
SoE	State-owned Enterprises
SSF	Sasol Synthetic Fuels
ToR	Terms of Reference
UCG	Underground Coal Gasification
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
WMA	Water Management Area

WWTW	Wastewater treatment works
WTW	Water treatment works

1 INTRODUCTION

The purpose of this Chapter is to introduce the project and describe the relevant legal framework within which the project takes place. Other applicable policies and guidelines are also discussed. The Terms of Reference, scope of and approach to the Environmental Impact Assessment are described and assumptions and limitations are stated.

1.1 INTRODUCTION

Over the last decade, South Africa has experienced a steady growth in the demand for electricity on the back of healthy economic growth. The continued growth in the economy has exhausted the surplus electricity generation capacity of the national electricity utility, Eskom Holdings (Pty) Ltd (Eskom) and has progressively reduced the electricity reserves.

It is expected that the reserve margin will continue on a downward trend for the next couple of years until new base-load power plants are built. In spite of capacity coming on line, which includes the bringing back to service of mothballed power stations such as Camden, Grootvlei and Komati, and building Open Cycle Gas Turbines (OCGT) in Mossel Bay and Atlantis, Western Cape, the electricity demand within the country is still higher than available capacity. Eskom is stepping up the implementation of its capacity expansion programme and is in the process of constructing two coal-fired power stations, Kusile near Witbank and Medupi near Lephalale, Ingula pumped storage scheme near Ladysmith and extending the Atlantis and Mossel bay Open Cycle Gas Turbines (OCGT's). Additional base load and peaking options are required to meet the growing demand, Eskom is therefore investigating nuclear and coal-fired power stations and intend to start construction on peaking plant and wind in the near future.

This Environmental Impact Assessment is for the proposed construction of two new coal-fired power stations and associated infrastructure in the Waterberg (refer to **Figure 1.1**). The power station precincts would include the power station buildings, administration buildings (administrative, medical, maintenance, services) and the high voltage yards, amongst others. The likely associated infrastructure[1] includes a water treatment works, a wastewater treatment works, access roads, transmission lines (including MV and HV lines), railway line, water supply pipelines, a coal stockyard, an ash disposal facility, a coal and ash conveyor system, substation, power supply for construction, telecommunications towers/masts and facilities and water storage facilities. The two power stations are unlikely to be able to share infrastructure, due to distances between any two stations and project phasing, and therefore there is little opportunity to reduce infrastructural requirements.

[1] A separate Environmental Impact Assessment process will be undertaken for the development of a coal mine to supply coal to the power station.

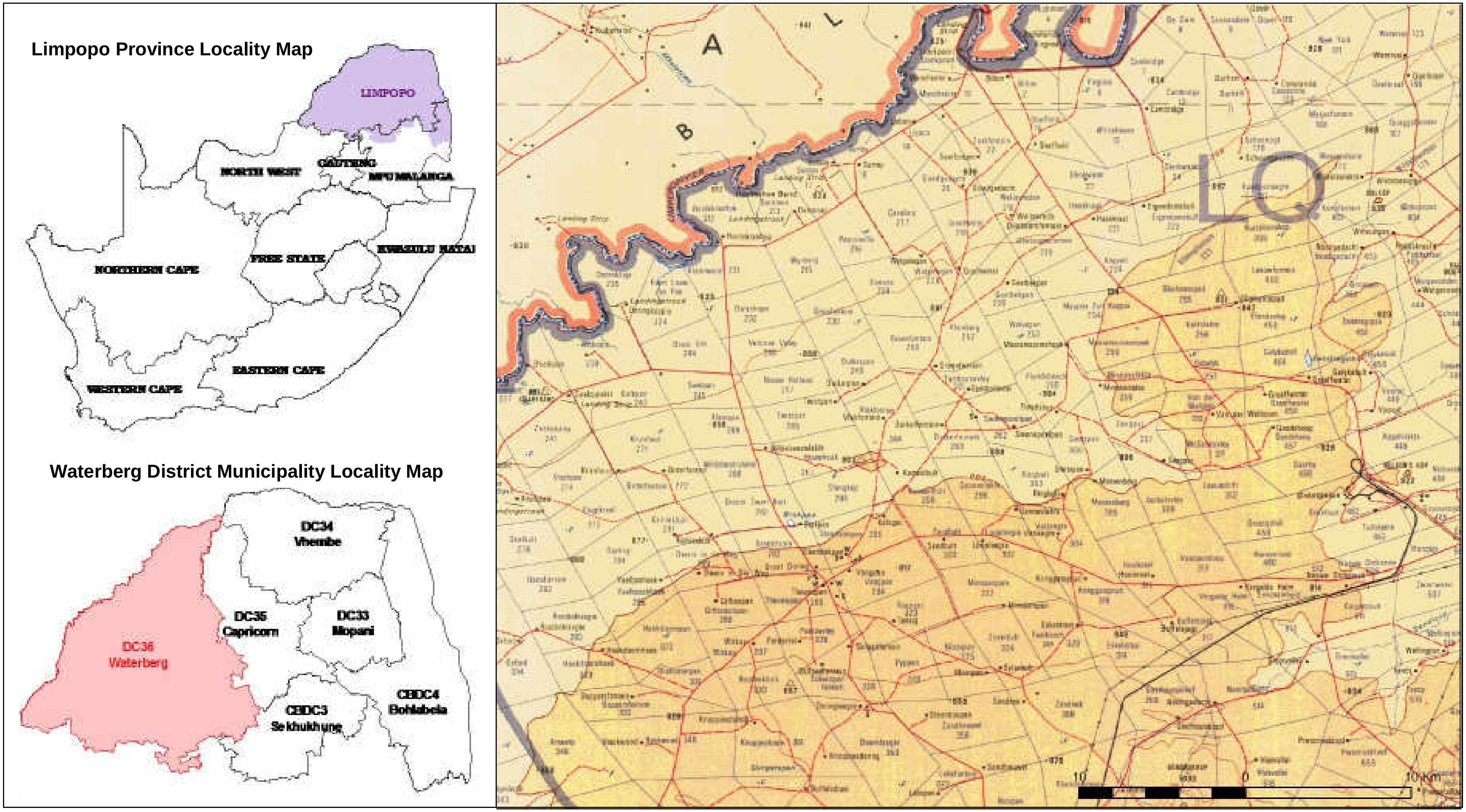

Figure 1.1 Location of the broad study area

In terms of the National Environmental Management Act (No. 107 of 1998) (as amended), the proposed development triggers a suite of activities, which require authorisation from the competent environmental authority before it can be undertaken. Since Eskom is a state-owned enterprise, the competent authority is the national Department of Environmental Affairs and Tourism (DEAT). DEAT's decision will be based on the outcome of this Environmental Impact Assessment (EIA) process. This report serves to document the Scoping Phase of the EIA process (the EIA process and sequence of documents produced as a result of the process is illustrated in **Figure 1.2**).

The purpose of this Scoping Report[2] is to provide the background and outline the scope of work proposed to be undertaken in the EIA Report phase. Accordingly, the Scoping Report:

- Outlines the legal and policy framework;
- Outlines Eskom's envisaged electricity infrastructure plan in the Waterberg Region;
- Describes the site selection process;
- Describes the proposed project and its alternatives;
- Describes the biophysical and socio-economic context;
- Describes the Public Participation Process undertaken to date;
- Identifies potential impacts, including cumulative impacts, that will be assessed in the EIA Phase, inclusive of specialist studies that will be undertaken;
- Details the assessment methodology that will be adopted; and
- Describes the range of alternatives that require further investigation in the EIA Phase.

1.2 LEGAL REQUIREMENTS

1.2.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The National Environmental Management Act (No. 107 of 1998) (NEMA), as amended, establishes the principles for decision-making on matters affecting the environment. Section 2 sets out the National Environmental Management Principles which apply to the actions of organs of state that may significantly affect the environment. Furthermore, Section 28(1) states that "every person who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring". If such pollution cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution.

Eskom has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of NEMA. In developing the EIA process Ninham Shand has been cognisant of this need, and accordingly the EIA process has been undertaken in terms of NEMA and the EIA Regulations promulgated on 21 April 2006[3].

[2] Section 29 of Regulation 385 of NEMA lists the content required in a Scoping Report.
[3] Government Notice No. R 385, R 386 and R 387 in Government Gazette No 28753 of 21 April 2006.

In terms of the EIA regulations certain activities are identified, which require authorisation from the competent environmental authority, in this case the DEAT, before commencing. Listed activities in Government Notice (GN) No. 387 require Scoping and EIA whilst those in GN No. 386 require Basic Assessment (unless they are being assessed under an EIA process). The activities being applied for in this EIA process are listed in **Table 1.1**.

Table 1.1 Listed activities to be authorised for the proposed power station

NO.	LISTED ACTIVITY
	GN No. R387, July 2006
1	The construction of facilities or infrastructure, including associated structures or infrastructure, for- a) The generation of electricity where- i. The electricity output Is 20 megawatts of more; or ii. The elements of the facility cover a combined area in excess of 1 hectare;
	c) the above ground storage of a dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of 1 000 cubic metres or more at any one location or site including the storage of one or more dangerous goods, in a tank farm;
	e) any process or activity which requires a permit of license in terms of legislation governing the release of emissions, pollution, effluent or waste and which is not identified in Government Notice No. R386 of 2006;
	f) the recycling, re-use, handling, temporary storage or treatment of general waste with a throughput capacity of 50 tons or more daily average measured over a period of 30 days;
	g) the use, recycling, handling, treatment, storage or final disposal of hazardous waste;
	l) the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more;
	o) the final disposal of general waste covering an area of 100 square metres or more or 200 cubic metres or more of airspace;
	p) the treatment of effluent, wastewater or sewage with an annual throughput capacity of 15 000 cubic metres or more;
	r) the microbial deactivation, chemical sterilisation or non-thermal treatment of waste or effluent;
	s) rail transportation, excluding railway lines and sidings in industrial areas and underground railway lines in mines, but including – (i) railway lines; (ii) stations; or (iii) shunting yards;
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;
7[4]	Reconnaisance, exploration, production and mining as provided for in the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended in respect of such permits and rights;
10	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
GN No, R386, July 2006	
1	The construction of facilities or infrastructure, including associated structures or infrastructure, for- c) the storage of 250 tons or more but less than 100 000 tons of coal;
	k) the bulk transportation of sewage and water, including storm water, in pipelines with – (i) an internal diameter of 0.36 metres or more; or (ii) a peak throughput of 120 litres per second or more;
	l) the transmission and distribution of electricity above ground with a capacity of more than 33 kilovolts and less than 120 kilovolts;
	n) 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. R387 of 2006;
	o) the recycling, re-use, handling, temporary storage or treatment of general waste with a throughput capacity of 20 cubic metres or more daily average measured over a period of 30 days, but less than 50 tons daily average measured over a period of 30 days;
	p) the temporary storage of hazardous waste;
	q) the landing, parking and maintenance of aircraft including – (i) helicopter landing pads excluding helicopter landing facilities and stops used exclusively by emergency services; (ii) unpaved aircraft landing strips shorter than 1.4 km; (iii) structures for equipment and aircraft storage; (iv) structures for maintenance and repair; (v) structures for fueling and fuel storage; and (vi) structures for air cargo handling;
12	The transformation or removal of any indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered of an endangered ecosystem listed in terms of Section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
13	The abstraction of groundwater at a volume where any general authorization issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded;

[4] Note that authorization for Listed Activity 7 is required from Department of Minerals and Energy, not DEAT. As such separate authorization for this activity will be sought from DME at a later date.

14	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission, but excluding – (a) Masts of 15 metres and lower exclusively used (i) By radio amateurs; or (ii) For lighting purposes (b) Flag poles; and (c) Lightning conductor poles;
15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long;
16	The transformation of undeveloped, vacant of derelict land to – (a) establish infill development covering an area of 5 hectares or more, but less than 20 hectares; or (b) residential, mixed, retail, commercial, industrial or institutional use where such development does not constitutes infill and where the total area to be transformed is bigger than 1 hectare;
20	The transformation of an area zoned for use as public open space or for a conservation purpose to another use;
25	The expansion of or changes to existing facilities for any process or activity, which requires an amendment of an existing permit or license or a new permit or license in terms of legislation governing the release of emissions, pollution, effluent.

Since the proposed project is based in Limpopo province, DEAT will work closely with the provincial Department of Economic Development Environment and Tourism (DEDET), to ensure that the provincial environmental concerns are specifically identified and addressed.

Further information on the EIA approach is provided in **Section1.4**.

1.2.2 THE ATMOSPHERIC POLLUTION PREVENTION ACT

In terms of the Atmospheric Pollution Prevention Act (No. 45 of 1965) (APPA), power generation processes, including the combustion of fuel for the generation of electricity for distribution to the public, are classified as Scheduled Processes, requiring a registration certificate or permit from DEAT: Chief Air Pollution Control Officer. This Act is however scheduled to be repealed shortly, and will be replaced by the National Environmental Management: Air Quality Act (No. 39 of 2004).

1.2.3 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT

The National Environmental Management: Air Quality Act (No. 39 of 2004) (NEMAQA) was promulgated in February 2005, but to date has not come into full effect. This Act aims to reform current air quality legislation and provide national standards regulating the monitoring, management and control of air quality, while at the same time promoting justifiable economic and social development.

The South African standards for ambient air quality are included as Schedule 2 of NEMAQA. These are however considered to be incomplete when compared to legal limits issued by other countries. Air quality standards typically comprise: thresholds, averaging periods, monitoring protocols, timeframes for achieving compliance and typically also permissible frequencies of exceedance. Subsequently, updated ambient air quality standards were proposed on 24 October 2007, and these will be replaced by the official ambient air quality standards, implemented under NEMAQA, by approximately September 2009.

In terms of NEMAQA, an electricity generation process is classified as a listed activity and as such requires an atmospheric emissions license in order to operate. During the transitional period while the new legislation becomes ratified, an application for a registration certificate under the APPA will be taken as an application for an atmospheric emission license under NEMAQA. Holders of registration certificates are responsible for proving compliance with the requirements of such permits and for applying for Atmospheric Emissions Licenses. As the proposed power stations are listed activities they will be required to apply for Atmospheric Emissions Licenses and comply with the new standards when they are promulgated.

1.2.4 NATIONAL HERITAGE RESOURCES ACT

In terms of the National Heritage Resources Act (No. 25 of 1999) (NHRA), any person who intends to undertake "*any development … which will change the character of a site exceeding 5000 m^2 in extent*", *"the construction of a road…powerline, pipeline…exceeding 300m in length"* or *"the rezoning of site larger than 10 000 m^2 in extent…"* must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency. These agencies would in turn indicate whether or not a full Heritage Impact Assessment (HIA) would need to be undertaken.

Section 38(8) of the NHRA specifically excludes the need for a separate HIA where the evaluation of the impact of a development on heritage resources is required in terms of NEMA. Accordingly, since the impact on heritage resources would be considered as part of the EIA process outlined here, no separate HIA would be required. SAHRA or the relevant provincial heritage agency would review the EIA reports and provide comments to DEAT, who would include these in their final Environmental Authorisation. However, should a permit be required for the damaging or removal of specific heritage resources, a separate application would have to be submitted to SAHRA or the relevant provincial heritage agency for the approval of such an activity, if Eskom obtain authorisation and make the decision to pursue the proposed project further.

1.2.5 OTHER APPLICABLE LEGISLATION AND POLICIES

a) National Water Act

In terms of Section 21 of the National Water Act (No. 36 of 1998) (NWA), the taking of water from a water resource, storing of water, impounding or diverting the flow of water in a water course, and the disposal of water which contains waste or has been heated through a power generation process are all considered water uses, which in general must be licensed, unless permitted as a Schedule 1 activity, or permissible in terms of a General Authorisation (GA) under Section 39 of the Act.

Schedule 1 activities relate mostly to small scale domestic usage of water and would therefore not be applicable to the proposed project. The disturbance to the bed or banks of a river, which could possibly take place during the construction of some of the linear infrastructure, could also be undertaken in terms of the above-mentioned GA, provided that Eskom meets the conditions of the GA.

Eskom would obtain the requisite licenses, registrations or GA from the Department of Water Affairs and Forestry (DWAF) directly and these do not form part of the scope of the current EIA process. Comment will however be sought from the DWAF, which will then be forwarded to DEAT to consider during its decision-making process.

Part 3 of the NWA deals with the Reserve, which is divided into the basic human needs Reserve and the ecological Reserve. The basic human needs Reserve provides for the essential needs of individuals served by the water resource in question and includes water for drinking, for food preparation and for personal hygiene. The ecological Reserve relates to the water required to protect the aquatic ecosystems of the water resource. The Reserve refers to both the quantity and quality of the water in the resource, and will vary depending on the class of the resource. In terms of Section 16 of the Act, as soon as reasonably practicable after the class of all or part of a water resource has been determined, the Minister must, by notice in the *Gazette*, determine the Reserve for all or part of that water resource. The Reserve would have to be determined, before DWAF could issue a licence for a new water use, in terms of the NWA. It must however be noted that the power stations may not undertake their own abstraction of water from a water resource, but would be supplied via a larger water supply scheme.

b) Mineral and Petroleum Resources Development Act

In terms of the provisions on the Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA), the sourcing of material for road construction purposes (i.e. the use of borrow pits[5]) is regarded as mining and accordingly is subject to the

[5] Gravel for construction purposes such as roads and foundations is obtained from a borrow pit, which consists of a shallow depression generally 1.5-2.5 m deep and 2-4 ha in area.

requirements of the Act. In terms of the current project, two sections of the Act are most relevant:

- In terms of Section 106(3), "*Any landowner or lawful occupier of land who lawfully, takes sand, stone, rock, gravel or clay for farming or for effecting improvements in connection with such land or community development purposes, is exempted from the provisions of subsection (1) as long as the sand, stone, rock, gravel or clay is not sold or disposed of.*" Accordingly, if the requisite materials can be sourced from the property upon which the power station would be constructed, and if Eskom are the owners of this property, no authorisation would be required in terms of the MPRDA. Eskom would merely be required to notify the Regional Manager of the Department of Minerals and Energy (DME) regarding the proposed activities.

- If material is to be sourced on a property that would not form part of the power station development, and/ or is not owned by Eskom, authorisation would be required from DME. In terms of Section 27 of the Act, if the proposed borrow pits would be mined in less than two years and would each be less than 1.5 ha in extent, a Mining Permit would be required.

c) Expropriation Act

Should Eskom decide to construct the proposed power station and associated infrastructure, Eskom would need to negotiate with the landowners to obtain the requisite land. Eskom has a policy of applying the "willing buyer, willing seller" concept, and therefore endeavours to purchase land wherever possible in consultation and negotiation with the relevant landowners. However, the State and State-owned-enterprises (SoE) can acquire the rights to use or possess the requisite land through the Expropriation Act (No. 63 of 1975). The Act requires the determination of compensation based on the principle of market value (i.e. what would the value be in the event of both a willing buyer and a willing seller trading the land). There is a suite of additional legislation, which, in conjunction with the Expropriation Act would be used to determine the compensation value.

In the event of Eskom requiring rights to pieces of land, the State acquires the land through the Department of Public Works, and the Department of Land Affairs. Persons living on the affected land, but not relatives of the owner, are considered to have land rights and are entitled to some form of compensation. Similarly, tenants may be entitled to compensation, dependent on the lease agreement stipulations. Land not in private ownership is either state owned or land held in trust by the Minister of Land Affairs. Occupants of the latter are considered to be possessors of land rights and are entitled to compensation.

d) The Kyoto Protocol

The United Nations Framework Convention on Climate Change (UNFCCC) attempted to initiate a process to develop a more specific and binding agreement on the reduction of greenhouse gas emissions. This led to negotiations with a particular focus on the commitments of developed countries, and culminated in the adoption of the Kyoto Protocol in 1997, which came into force in February 2005. The Kyoto Protocol elaborates the FCCC by placing more specific obligations on developed countries and Countries with Economies in Transition. Parties to Annex 1 of the FCCC (developed countries) are obliged to reduce their overall emissions of six greenhouse gases by at least 5 % below the 1990 levels between 2008 and 2012. Non-annex 1 Parties, i.e. developing countries, of which South Africa is one, do not have to make any comparable cuts unless they choose to (Glazewski, 2005).

In developing the Kyoto Protocol, the need to promote sustainable development was recognised. This means implementing policies and measures to, among others, enhance energy efficiency, protect and enhance sinks and reservoirs of greenhouse gases, promote sustainable forms of agriculture, increase the usage of new and renewable forms of energy and of advanced and innovative environmentally sound technologies. The Kyoto Protocol is a legally binding instrument. In response, South African policies are starting to place emphasis on cleaner technology and production, and a shift to sustainable development.

Eskom is working with DEAT to realise the strategic objectives, principles and proposals of the National Climate Change Response Strategy. In this regard, Eskom created and rolled out a plan in line with Government's response strategy during 2005 and 2006 respectively. Priority areas include climate change criteria as part of decision-making, continual improvement in reporting, commitment to national and international government and business processes and participation in Clean Development Mechanisms (Eskom Holdings Ltd, 2006).

Eskom's climate change strategy is summarized in the six-point plan:

(i) Adaptation to the negative impacts of climate change;
(ii) Diversification of the energy mix to lower carbon emitting technologies;
(iii) Energy efficiency measures to reduce demand and greenhouse gas and other emissions;
(iv) Innovation through research, demonstration and development;
(v) Investment through carbon market mechanisms; and
(vi) Progress through advocacy, partnerships and collaboration.

By the end of the first commitment period of the Kyoto Protocol in 2012, a new international framework needs to have been negotiated and ratified that can deliver the stringent emission reductions the Intergovernmental Panel on Climate Change has clearly indicated are needed.

e) Guidelines

This EIA process is informed by the series of national Environmental Guidelines[6] where applicable and relevant:

- Guideline for determining the scope of specialist involvement in EIA Processes (June 2005)
- Guideline for involving biodiversity specialists in EIA processes (June 2005)
- Guideline for involving heritage specialists in EIA processes (June 2005)
- Guideline for involving visual and aesthetic specialists in EIA processes (June 2005)
- Guideline for Environmental Management Plans (June 2005)
- Guideline for the review of specialist input into the EIA Process (June 2005)
- Draft Guideline on Public Participation (November 2006)
- Draft Guideline on Alternatives (November 2006) and
- Draft Guideline on the interpretation of the listed activities (November 2006)

A desktop review of relevant literature, including a review of previous environmental studies in the area was also undertaken. These included, *inter alia*, the following:

- Lephalale Local Municipality Integrated Development Plan (IDP)(2007);
- Waterberg District Municipality Spatial Development Framework (SDF)(2006);
- Vegetation Map of South Africa (Mucina & Rutherford, 2006);
- Environmental Scoping Report for the Proposed Establishment of a New Coal-Fired Power Station in the Lephalale area, Limpopo Province (Bohlweki, 2005);
- EIA for the Proposed Establishment of a New Coal-Fired Power station in the Lephalale Area, Limpopo Province (Bohlweki, 2006);
- EIA for the Delta-Epsilon 765 kV Transmission Integration Project (PBA International (SA) Engineering and Environmental Consulting Services and Margen Industrial Services, 2008);
- EIA for the Mmamabula-Delta 400 kV Transmission Integration Project (PBA International (SA) Engineering and Environmental Consulting Services and Margen Industrial Services, 2007); and
- World Bank Group: Pollution Prevention and Abatement Handbook, 1998, Thermal Power: Guidelines for New Plants

1.3 TERMS OF REFERENCE AND SCOPE OF THE EIA

In June 2008, Eskom appointed a team led by Ninham Shand to undertake an EIA process for the proposed construction of a new coal-fired power station and the associated infrastructure in the Waterberg, Limpopo. After lengthy consideration and planning Eskom amended the EIA application to include an additional 5 400 MW coal-fired power station in the Waterberg.

[6] Note that these Guidelines have not yet been subjected to the requisite public consultation process as required by Section 74 of R385 of NEMA.

Eskom's Integrated Strategic Electricity Plan identified that new power stations are required in the short and medium term to meet future demand. Although other forms of energy, such as wind, solar, hydro and gas, are being pursued, coal-fired and nuclear power stations are, and will remain for some time, the two primary electricity supply options available in South Africa.

As significant quantities of coal are found in the Waterberg area a number of coal-fired power stations could be supported. As more power is required to ensure the reliability of electricity supply into the future it is very likely that, in addition to the original proposed power station, a second coal-fired power station would be located in this area. It was felt by Eskom that it was best to combine the EIA processes for the proposed two power stations. A single EIA process will best assess the additive and cumulative impacts and the proposed siting (location) of the two power stations. This approach would also encourage a more transparent process and allow key stakeholders and I&APs to comment on all information available, including Eskom's forward planning.

As the rationale for the siting of both of these stations is the same, it was proposed that each station be located on one of the three potential sites under study.

Therefore the scope of the environmental work was amended to include a second power station and is as follows:

- Facilitate a site selection process, to assist Eskom in the identification of feasible sites for the proposed power station;
- Undertake an EIA process for the proposed construction of two new coal-fired power stations and associated infrastructure including *inter alia* wastewater treatment works (WWTW), water treatment works (WTW), demineralisation plants, water pipelines, access roads, a high-voltage yards, clean and dirty water dams, coal and other material stockpiles , ash management facilities and all associated infrastructure and equipment;
- Develop an Environmental Management Plan (EMP) for the construction and operational phases of the proposed projects, and a framework EMP for the decommissioning phase of the proposed projects.

Eskom's Terms of Reference (ToR) for the EIA is included as **Annexure A** of this report.

In terms of Eskom planning processes it was established that at least two new coal fired power stations may be required within the next 10 – 15 years, the scope of the work was therefore changed. Hence, authorisation is being sought for the construction of two new coal-fired power stations and the directly associated infrastructure as mentioned above. The consideration of the transportation and supply of sorbent and coal from commercial sources will also be considered in the EIA process as well as the transmission lines required to convey the electricity generated from the power stations to the proposed Delta substation only. The transmission integration projects to evacuate the power from the Delta substation to other parts of the country will be dealt with by a separate EIA process.

This EIA process specifically excludes the requisite coal mine to supply coal to the proposed power station. This aspect constitutes an activity requiring environmental authorisation in its own right, and would be subjected to its own independent EIA processes in due course, once the coal supplier(s) have been identified, potential contracts negotiated and supply agreements signed.

1.4 APPROACH TO THE PROJECT

There are three distinct phases in the EIA process, as required in terms of NEMA, namely the Initial Application, the Scoping and EIA Phases. The EIA process is described below and diagrammatically represented in **Figure 1.2**.

To date, the EIA process has unfolded as follows:

- Submission of an Application Form to notify DEAT of the project, submitted on 23 July 2008. This represents the Initial Application Phase of the EIA process. An acknowledgement of receipt of the Application Form was received from DEAT dated 29 July 2008. Both the Application Form and DEAT's letter of acknowledgement are included in **Annexure B**;
- Distribution of the Background Information Document (BID) (included in **Annexure C**) on 15 September 2008 to inform Interested and Affected Parties (I&APs) of the project and to invite I&APs to register on the database;
- Advertisements were placed in a suite of national, regional and local newspapers notifying the broader public of the initiation of the EIA and inviting them to register as I&APs from 15 September 2008 (the advertisements are included in **Annexure C**);
- Broad authority consultation, via an Authority Meeting on 3 October 2008 (attendance register and notes of the meeting are included in **Annexure C**); and
- A focus group meeting was held with key stakeholders (directly affected landowners and their neighbours) on 4 October 2008 (attendance register and notes of the meetings are included in **Annexure C**).

This Report covers the second phase, namely the Scoping Phase. The Scoping Phase will be followed by the EIA Phase, which will culminate in a comprehensive document, the Environmental Impact Report (EIR).

Scoping is defined as a procedure for determining the extent of and approach to the EIA phase and involves the following key tasks:

- Involvement of relevant authorities and I&APs;
- Identification and selection of feasible alternatives to be taken through to the EIA phase;
- Identification of significant issues/ impacts associated with each alternative to be examined in the EIR; and
- Determination of specific ToR for the specialist studies required in the EIR (Plan of Study for EIR).

As the precursor to the formal EIA process, Eskom, assisted by Ninham Shand, undertook a site selection process in order to focus the subsequent investigations of the Scoping and EIR phases. This process and the results thereof are presented and discussed in **Chapter 3** of this report.

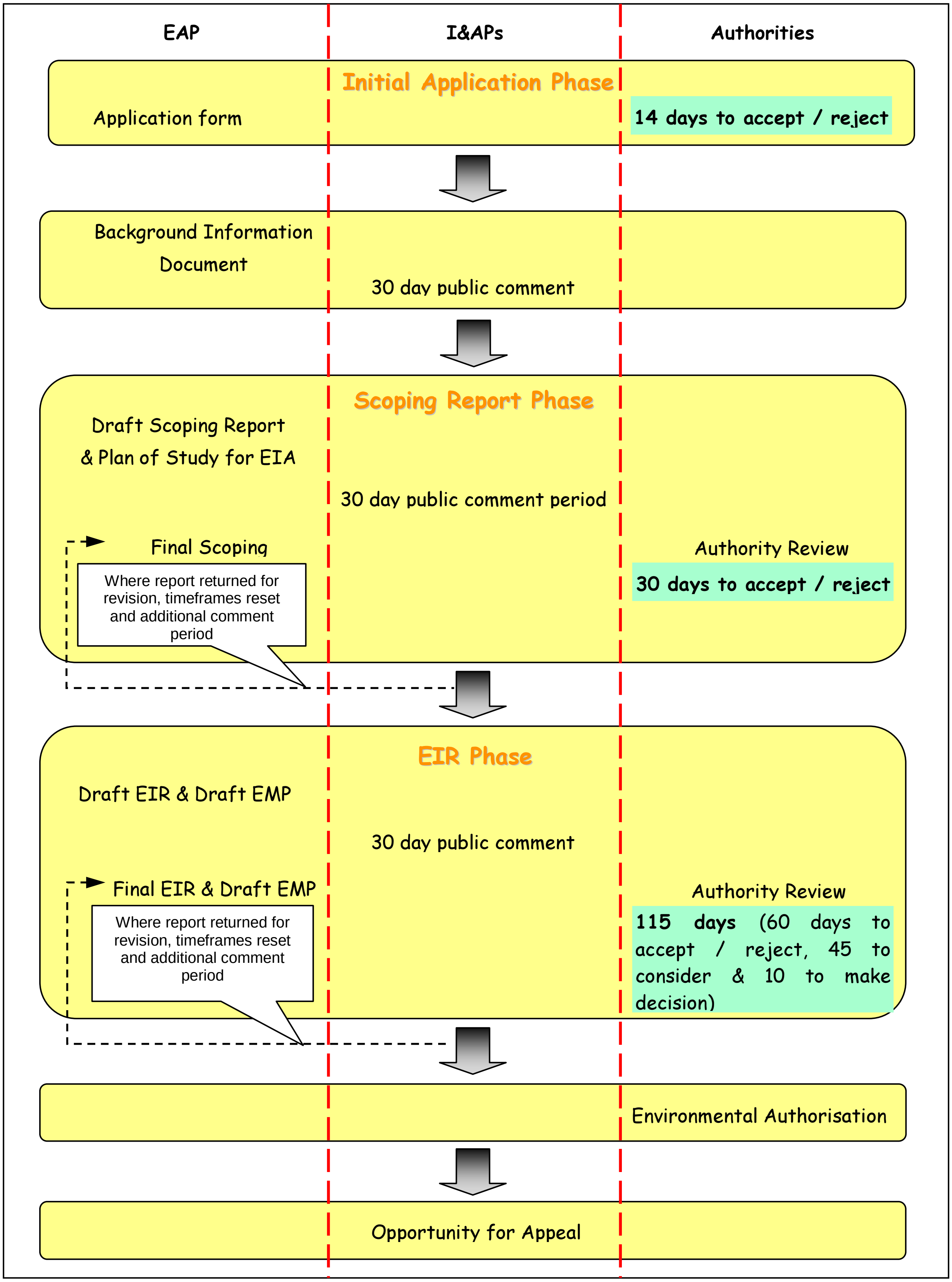

Figure 1.2 The EIA process in terms of NEMA

1.4.1 THE SCOPING REPORT PHASE

An inception field trip was held on 6 October 2008 with all specialists (except the air quality and noise impact assessment specialists) of the EIA team and the client body. The purpose of the field trip was to facilitate an understanding of the key aspects such as:

- Biophysical issues:
  - Terrestrial and aquatic fauna and flora;
  - Local ambient air quality;
  - Groundwater resources;
  - Visual aspects
- Social issues:
  - Heritage issues
  - Location of local communities;
  - Land use issues and planning;
- Construction phase issues.

The information gathered from the site visit was used in refining the ToR for the EIA process and the specialist studies to be undertaken during the EIR phase.

Consultation with the public forms an integral component of this investigation and enables I&APs, e.g. directly affected landowners, national, provincial and local authorities, environmental groups, civic associations and communities, to identify their issues and concerns, relating to the proposed activities, which they feel should be addressed in the Scoping Report. A detailed summary of the public participation process, and the issues and concerns raised by the various I&APs is provided in **Chapter 5**.

1.4.2 AUTHORITY INVOLVEMENT

The Application Form was submitted to DEAT on 23 July 2008 (refer to **Annexure B**). A broad authority meeting was held with relevant authorities on 3 October 2008 at Machauka Lodge, in Lephalale.

Authorities that were invited to participate include:

- Lephalale Local Municipality;
- Limpopo Department of Health and Welfare;
- National Department of Agriculture;
- Department of Minerals and Energy;
- South African Heritage Resources Agency;
- DEAT: Air Quality and Climate Change and Environmental Manager;
- Waterberg District Municipality;
- DEDET;
- DWAF;
- Department of Transport; and
- Road Agency: Limpopo.

Authorities that participated in the meeting included:

- DWAF;
- DEAT;
- Department of Public Works
- Lephalale Local Municipality;
- Waterberg District Municipality; and
- DEDET.

DEAT accepted the Application Form on 29 July 2008 (refer to **Annexure B** for a copy of the letter of acceptance).

1.4.3 DECISION MAKING

Once the Final Scoping Report has been completed with all I&AP comments incorporated into the Issues Trail, it will be submitted to DEAT for its review. The competent authority must, within 30 days of receipt of the Scoping Report, in writing –

(a) Accept the report and Plan of Study for EIA contained in the report and advise the Environmental Assessment Practitioner (EAP) to proceed with the tasks contemplated in the Plan of Study for EIA, or

(b) Request the EAP to make such amendments to the report or the Plan of Study for EIA as the component authority may require, or

(c) Reject the Scoping Report or Plan of Study for EIA if it

(i) Does not contain material information required in terms of these regulations, or

(ii) Has not taken into account guidelines applicable in respect of Scoping Reports and Plans of Study for EIA.

1.5 ASSUMPTIONS AND LIMITATIONS

1.5.1 ASSUMPTIONS

In undertaking this investigation and compiling the Scoping Report, the following has been assumed:

- The strategic level investigations undertaken by Eskom prior to the commencement of the EIA process are technologically acceptable and robust.
- This project level EIA deals with two coal-fired power stations in the Waterberg, and is unable to assess the policy level and strategic decision-making which led to this project.
- The EIA process for the power stations is distinct from the EIA processes for the requisite coal mine and the transmission integration (if required). It is assumed that this separation does not constitute a procedural flaw in terms of the EIA process.
- The information provided by the applicant and specialists is accurate and unbiased.
- The scope of this investigation is limited to assessing the environmental impacts associated with the proposed power stations and their associated infrastructure.

- The site selection process utilised to identify and screen potential sites is acceptable to DEAT and the results therefore are considered a defendable starting point for the EIA process.

1.5.2 GAPS IN KNOWLEDGE

This Scoping Report has identified the potential environmental impacts associated with the proposed activities. However, the scope of impacts presented in this report could change, should new information become available during the EIR phase. The purpose of this section is therefore to highlight gaps in knowledge when the Scoping Report phase of the project was undertaken.

- The planning for the proposed power stations is at a feasibility level for the first of these two stations, and a pre-feasibility level for the second one, and therefore many of the specific details are not available at this stage of the EIA process. This EIA process forms a part of the suite of feasibility studies, and as these studies progress, more information will become available to inform the EIA process. This will require the various authorities, and especially DEAT, to issue their comments and ultimately their Environmental Authorisation to allow for the type of refinements that typically occur during these feasibility studies and detailed design phase of complex projects. Undertaking the EIA process in parallel with the feasibility study does however have a number of benefits, such as facilitating environmental aspects into the site selection, layout, and design and therefore ultimately encouraging a more environmentally sensitive and sustainable development.
- The environmental impacts associated with a new coal mine to feed the proposed power station are not considered, due to, *inter alia*, uncertainties with respect to the coal supplier and the location of the coal source.
- Similarly, environmental impacts associated with the borrow pits cannot be commented on due to the lack of technical information and locations of the borrow pits. Approval of the borrow pits would be required from DME and hence the impacts of the borrow pits would be assessed under a separate process.
- The cumulative impacts associated with future developments exploiting the large scale coal resource in the Waterberg may not all be commented on as potential future projects are not all known.

1.6 INDEPENDENCE

The requirement for independence of the environmental consultant is aimed at reducing the potential for bias in the environmental process. Neither Ninham Shand nor any of its sub-consultants are subsidiaries of Eskom. Furthermore, we do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed project.

The Project Director, Mr Brett Lawson and the Project Manager, Mr Ashwin West, are appropriately qualified and registered with the relevant professional bodies. Mr Lawson is a certified Environmental Assessment Practitioner of South Africa (EAPSA), and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions. Mr West is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions. Consequently Ninham Shand is bound by the codes of conduct for EAPSA and the South African Council for Natural Scientific Professions. The CV summaries of the key Ninham Shand staff as well as the key public participation consultants are included in the Plan of Study for EIA contained in **Chapter 7**.

1.7 STRUCTURE OF THE SCOPING REPORT

Table 1.2 presents the structure of the Scoping report as well as the applicable sections that address the required information in terms of NEMA. Specifically, Section 29 (I) A of the EIA Regulations requires that the following information is provided:

Table 1.2 NEMA requirements for Scoping Reports

(a)	Details of: (i) the EAP who prepared the report; (ii) the expertise of the EAP to carry out Scoping procedures;
(b)	a description of the proposed activity and of any feasible reasonable alternatives that have been identified;
(c)	a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is: (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken;
(d)	a description of the environment that may be affected where the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;
(e)	an identification of all legislation and guidelines that have been considered in the preparation of the Scoping Report;
(f)	a description of environmental issues and potential impacts, including cumulative impacts, that have been identified;
(g)	information on the methodology that will be adopted in assessing the potential impacts that have been identified, including any specialist studies or specialised processes that will be undertaken;
(h)	details of the public participation processes conducted in terms of Regulation 28(a), including; (i) the steps that were taken to notify potentially I&APs of the application; (ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the application have been displayed, placed or given; (iii) a list of all persons or organisations that were identified and registered in terms of Regulation 57 as I&APs in relation to the application; and (iv) a summary of the issues raised by interested and affected parties, the date

	of receipt and response of the EAP to these issues;
(i)	a Plan of Study for EIA which sets out the proposed approach to the environmental impact assessment of the application, which must include: (i) a description of the tasks that will be undertaken as part of the EIA process, including any specialist reports or specialised processes, and the manner in which such tasks will be undertaken; (ii) an indication of the stages at which the competent authority will be consulted; (iii) a description of the proposed method of assessing the environmental issues and alternatives, including the option of not processing with the activity; and (iv) particulars of the public participation process that will be conducted during the EIA process; and (j) any specific information required by the competent authority.

Section 29 of NEMA regulations explicitly requires specific content to be addressed in the Scoping Report. **Table 1.3** assists the reader to find the relevant section in the report.

Table 1.3 Location of content prescribed by NEMA for Scoping Reports

REGULATION	CONTENT AS REQUIRED BY NEMA	CHAPTER/ANNEXURE	PAGE
29 (1) (a)	EAP and expertise of the EAP	Chapter 7	109
29 (1) (b)	Description of the proposed activity	Chapter 4	45
29 (1) (c)	Description of the property	Chapter 6	65
29 (1) (d)	Description of the environment	Chapter 6	65
29 (1) (e)	Identification of all legislation	Chapter 1	3
29 (1) (f)	Description of all environmental issues and potential impacts	Chapter 6	65
29 (1) (g)	Information on the methodology	Chapter 7	101
29 (1) (h)	Details of the Public Participation Process	Chapter 5	59
29 (1) (i)	Plan of study for EIA	Chapter 7	99
29 (1) (j)	Additional information		

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Chapter 2

2 STRATEGIC OVERVIEW OF ELECTRICITY DEMAND AND SUPPLY IN SOUTH AFRICA

The purpose of this Chapter is to provide a strategic overview of the electricity demand in South Africa and of to provide a rationale for the selection of the Waterberg region for further coal-driven development. An overview of the potential future electricity related development in the Waterberg region is also given.

2.1 SOUTH AFRICA'S ELECTRICITY REQUIREMENTS

Electricity demand in South Africa has been growing steadily, and there is currently some 40 000 MW of installed capacity (base load and peaking power) available. South Africa's economic growth target has been set by the Government as six percent per annum via the Accelerated and Shared Growth Initiative for South Africa (AsgiSA). Based on this proposed growth, South Africa would require an additional approximately 40 000 MW of generating capacity by 2025. This equates to growth in the generating capacity of four percent per annum. However, based on a more moderate economic growth rate of four percent per annum, South Africa would require an additional 20 000 MW by 2025, which equates to growth in the generating capacity of some two to three percent per annum. Refer to **Figure 2.1** below for the long term forecast of electricity demand.

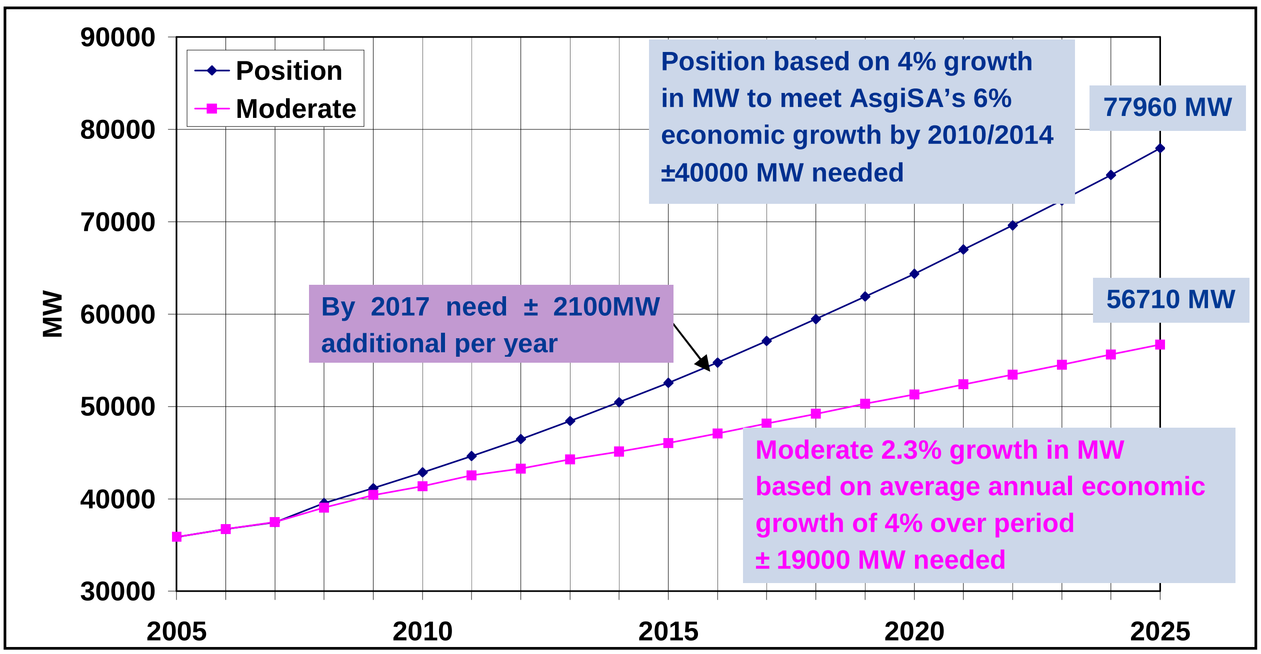

Figure 2.1 Long term electricity demand forecast (national and foreign)

Further to the above demands, the existing power stations have a limited life span, of some 50 years. Once these power stations start reaching the end of their commercial lives, South Africa will have to replace the existing capacity and add additional capacity to the grid as demand grows. **Figure 2.2** below illustrates the life span of the installed generation capacity, and how the capacity starts to decrease by 2025, as the existing power stations start to become decommissioned.

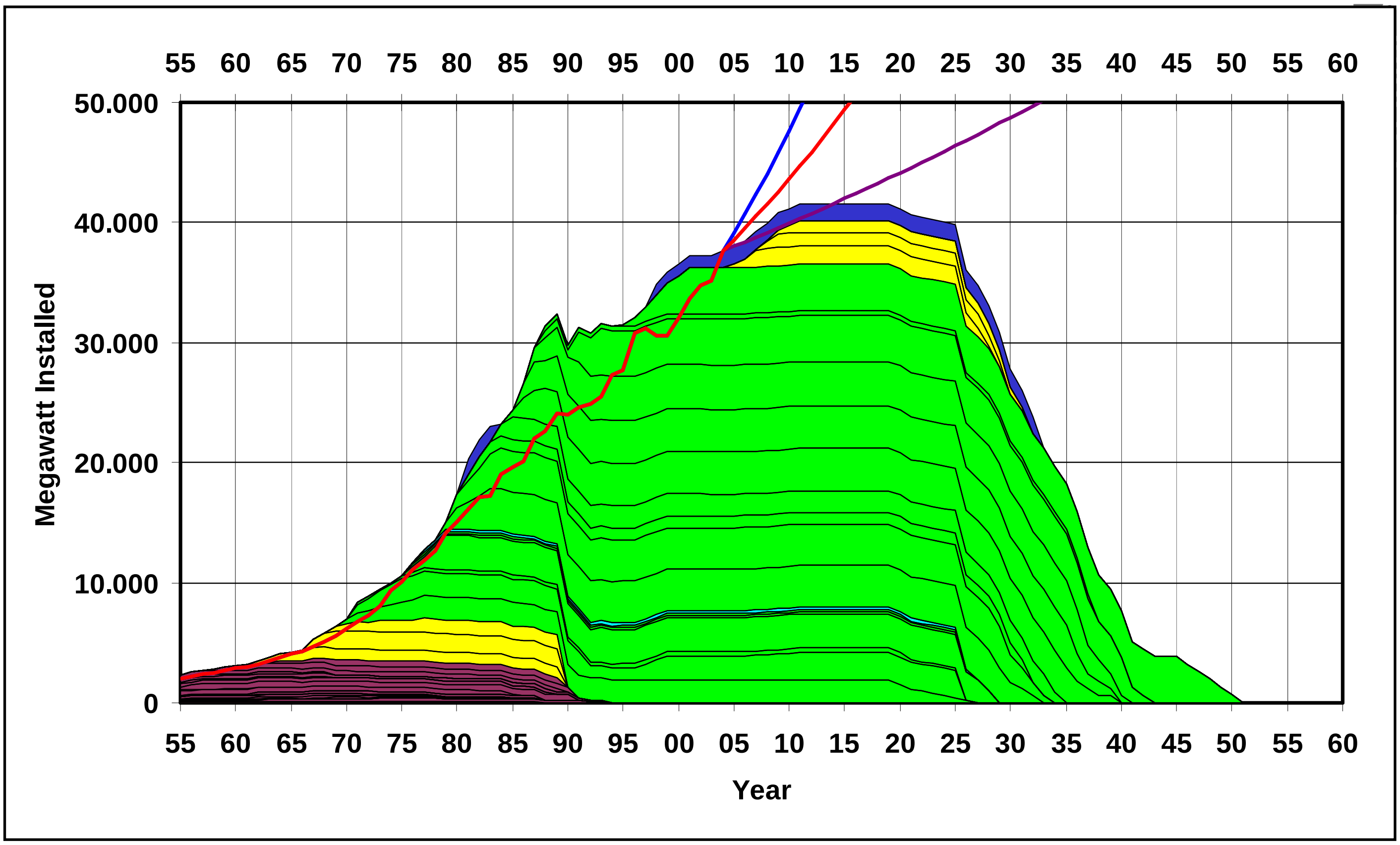

Figure 2.2 Installed generation capacity

Demand for electricity is further complicated due to its spatial and temporal scale. The majority of South Africa's electricity generation currently takes place in the eastern part of the country, where the majority of the coal resources are located. However, electricity is required throughout the country with Gauteng being a major demand centre. From a temporal perspective, electricity demand varies throughout the day, with demand peaking approximately between 06:00 and 09:00 and between 18:00 and 21:00, when the majority of people are at home. This makes the supply of electricity more complex and requires a suite of supply options, to cater for the base load requirements as well as the peak requirements. This is illustrated in **Figure 2.3** below.

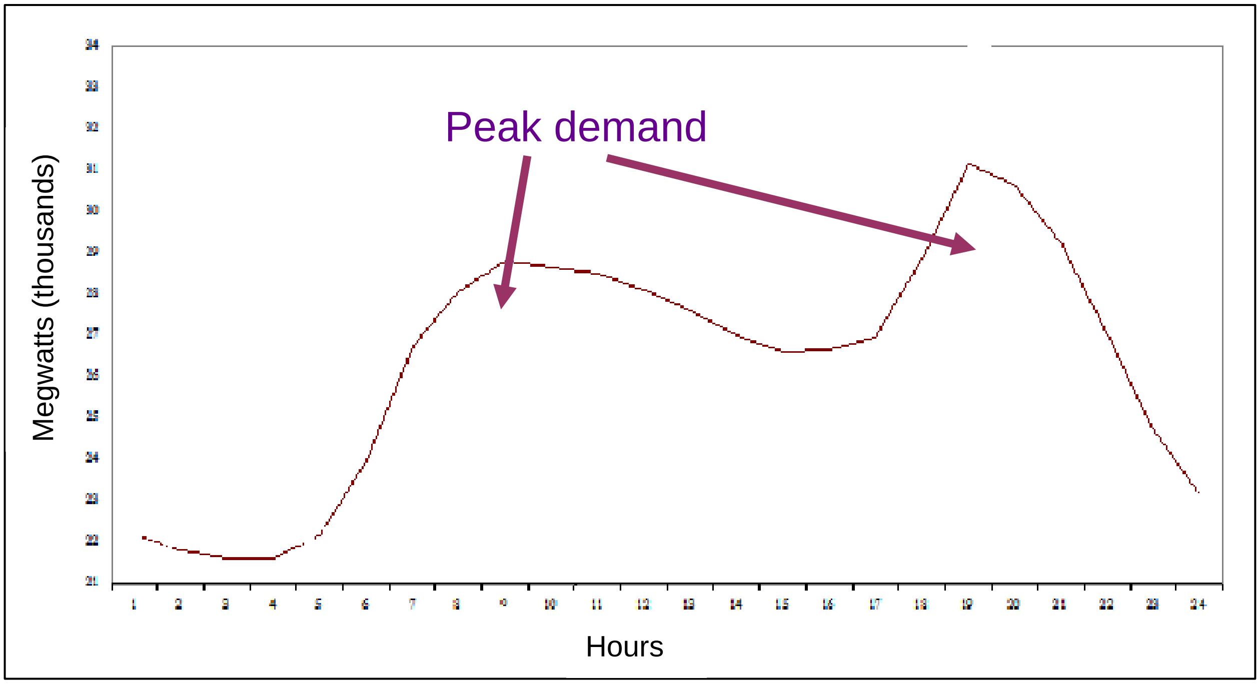

Figure 2.3 Graph indicating average electricity demand over a 24 hour period

There are two key challenges for Eskom with respect to the supply of electricity to South Africa. Firstly, Eskom has to manage the balance and mismatch between demand and supply, to avoid building too many power stations which would result in over-capacity and ‘stranded’ resources, but also to avoid constraining economic development because of capacity limitations. Furthermore, Eskom must choose the right mix of generating options, to meet the challenges of cost, lead time, environmental constraints and operating characteristics of the supply options. The process for choosing the best electricity generation options is outlined in **Section 2.2** below.

2.2 POLICY FRAMEWORK FOR THE SUPPLY OF ELECTRICITY

Eskom is the primary supplier of electricity in South Africa, providing approximately 95 % of the electricity consumed. The decision to expand Eskom’s electricity generation capacity was based on national policy and informed by on-going strategic planning undertaken by the national DME, the National Energy Regulator of South Africa (NERSA) and Eskom. The hierarchy of policy and planning documentation that reflects this state of affairs is illustrated in **Figure 2.4** and described below.

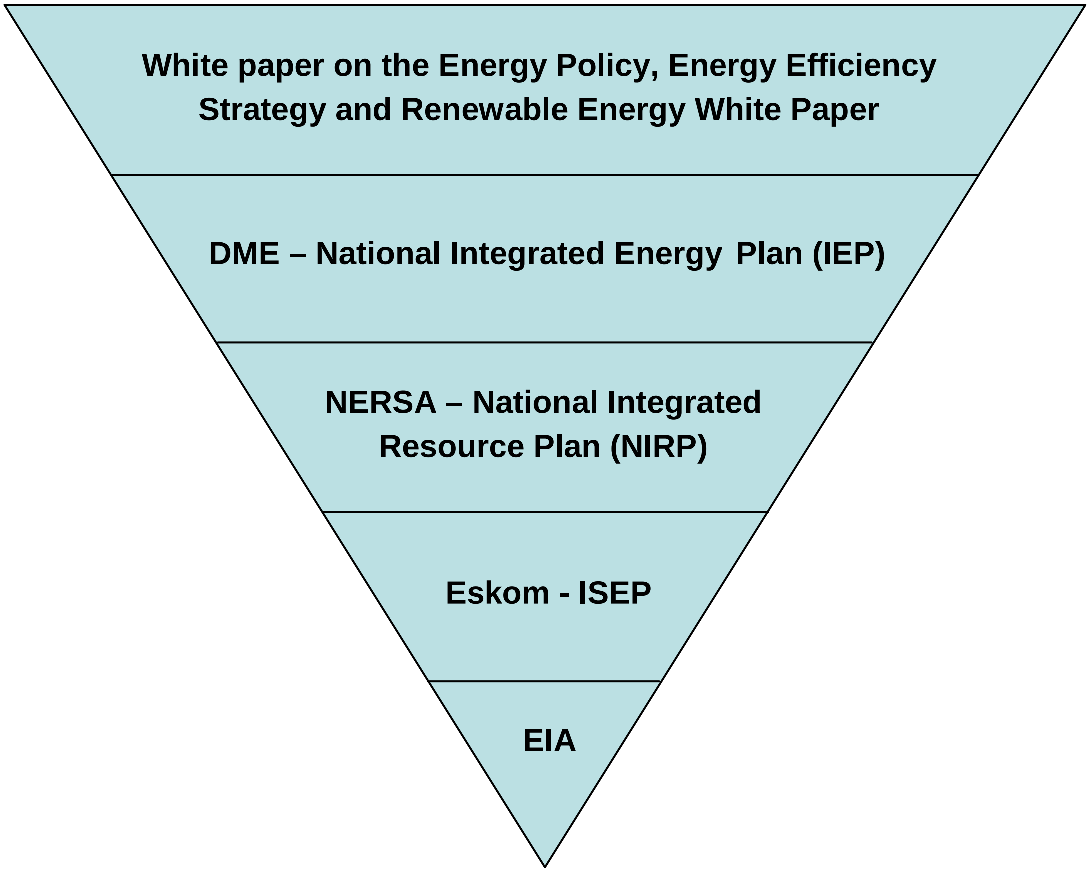

Figure 2.4 Hierarchy of policy and planning documents

2.2.1 WHITE PAPER ON THE ENERGY POLICY OF THE REPUBLIC OF SOUTH AFRICA

Development within the energy sector in South Africa is governed by the White Paper on the Energy Policy of the Republic of South Africa, published by DME in 1998. This White Paper sets out five objectives for the further development of the energy sector. The five objectives are as follows:

- Increased access to affordable energy services;
- Improved energy governance;
- Stimulating economic development;
- Managing energy-related environmental and health impacts; and
- Securing supply through diversity.

Furthermore, the Energy Policy identified the need to undertake an Integrated Energy Planning (IEP) process in order to achieve a balance between the energy demand and resource availability, whilst taking into account the health, safety and environmental[7] parameters. In addition, the policy identified the need for the adoption of a National Integrated Resource Planning (NIRP) approach to provide a long-term cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

The Energy Efficiency Strategy of the Republic of South Africa is a document geared towards the development and implementation of energy efficiency practices in South Africa. It receives its mandate from the White Paper, and links energy sector development with national socio-economic development plans. The White Paper on Renewable Energy sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

2.2.2 INTEGRATED ENERGY PLAN

DME commissioned the IEP, 2003 to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance in providing low cost electricity for social and economic development, ensuring security of supply and minimising the associated environmental impacts.

The IEP projected that the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa by 2007. Furthermore, the IEP concluded that, based on energy resources available in South Africa, coal would be the primary fuel source in the planning horizon, which was specified as the years 2000 to 2020 i.e. a 20 year planning horizon.

2.2.3 NATIONAL INTEGRATED RESOURCE PLAN

In response to the White Paper's objective relating to affordable energy services, the National Electricity Regulator (now NERSA) commissioned a NIRP. The objective of the NIRP is to determine the least-cost supply option for the country, provide information on the opportunities for investment into new power stations and evaluate the security of supply.

The national electricity demand forecast took a number of factors into account. They were:

- A 2.8 % average annual economic growth;
- The development and expansion of a number of large energy-intensive industrial projects;

[7] Environmental parameters include economic and social aspects.

- Electrification needs;
- A reduction in electricity-intensive industries over the 20 year planning horizon;
- A reduction in electricity consumers – NIRP anticipates people switching to the direct use of natural gas;
- The supply of electricity to large mining and industrial projects in Namibia and Mozambique; and
- Typical demand profiles.

The outcome of the NIRP (2003/2004 version) determined that while coal would remain the major fuel for generating electricity over the next 20 years, additional energy generation facilities would be required from 2007 onwards.

2.2.4 INTEGRATED STRATEGIC ELECTRICITY PLANNING

Integrated Strategic Electricity Planning (ISEP) is the process by which Eskom forecasts the scenarios for growth in electricity demand over the next 20 years and evaluates the alternative means (supply-side and demand-side) to meet and manage that demand. The planning process provides economically and environmentally acceptable options for flexible and timely decision-making, considering Eskom and its shareholder's objectives and taking into account available energy reserves and renewable energy potential.

The criteria for assessing the quality of the plan include:

- *Cost:* defined as the lowest Net Present Value cost of the plan where the value of reliability is assessed by assigning a "cost of unserved energy" to all energy requirements that are not met by the proposed plan. The cost versus reliability trade-off is at the heart of the optimisation algorithms employed in the ISEP process.
- *Flexibility:* refers to the ability of the plan to adapt to changing circumstances with minimum penalty. A key objective is to maximise the amount of flexibility that is available to enable the accommodation of uncertainties without compromising reliability.
- *Robustness:* defines how well committed investments perform under all relevant scenarios.
- *Sustainability:* refers to the contemporary (people, planet, prosperity) understanding of sustainability and includes environmental and climate change considerations.
- *Implementation:* the ability of the organisation to implement the solution. This includes the ability to raise the required funds, access the necessary skills and source the required fuel and equipment.

While the major energy source will remain coal, Eskom plans to reduce coal's current 84 % share of the national primary energy to below 70 % by 2026. To achieve this, a much higher proportion of nuclear generation (currently 4 %) is envisaged by 2026, while additional renewable energy options (in excess of 2 % by 2026) will also be pursued. Pumped storage and gas fired stations will be established to the extent required for peak supply considerations, while electricity imports from neighbouring countries (to a maximum of the reserve margin) will also be negotiated.

The most recently approved ISEP plan by Eskom's board (February 2008) identifies the need for increased base load[8] by approximately 2014. **Figure 2.5** below illustrates Eskom's "project funnel" which shows the range of supply options being considered by Eskom to meet the increasing demand for electricity in the country[9].

An increase in peaking supply has been achieved through the commissioning of the OCGT facilities in Atlantis and Mossel Bay. Research projects include a demonstration solar power project, demonstration wind energy project, underground coal gasification and the pebble bed modular reactor.

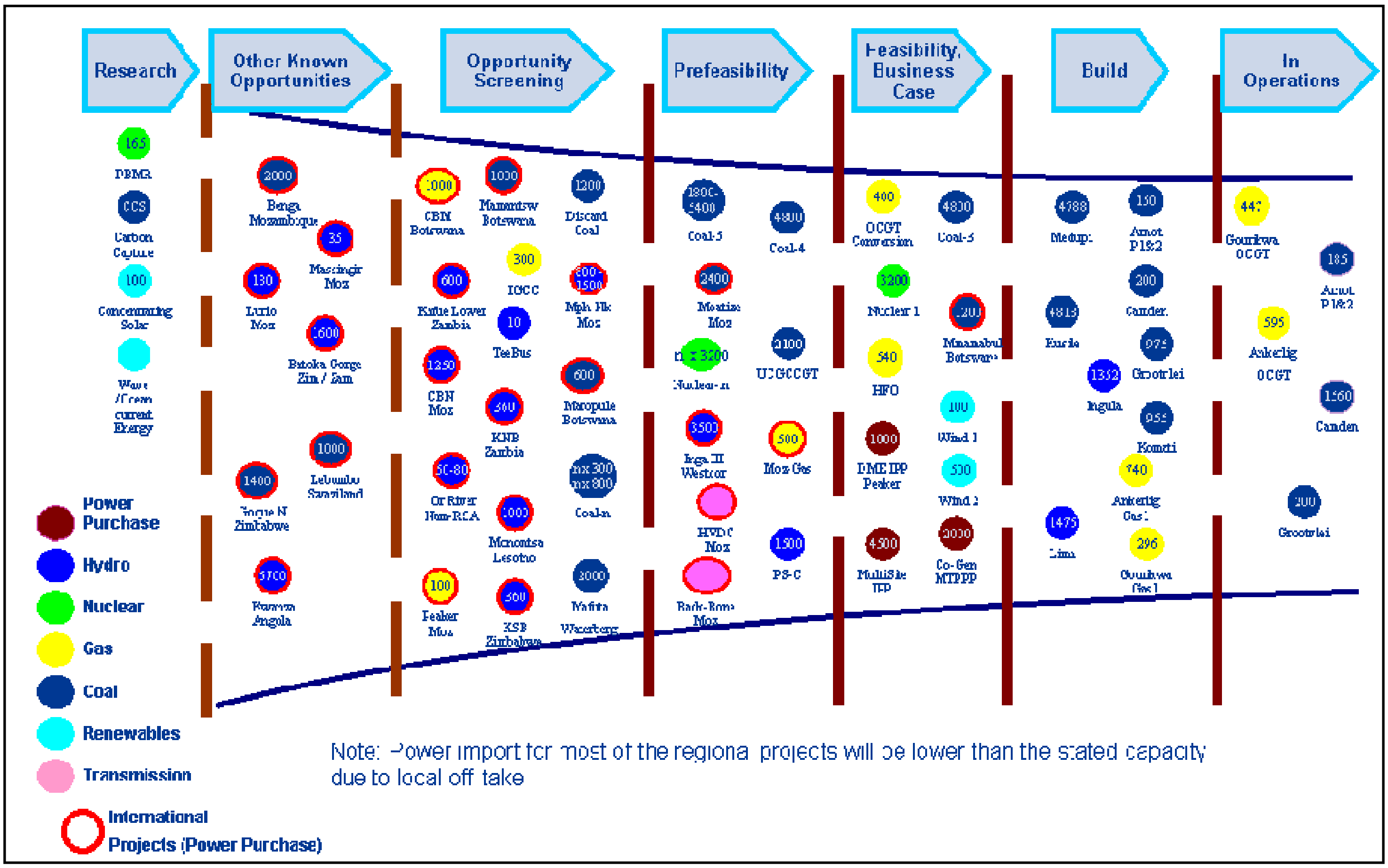

Figure 2.5 Eskom's 'projects funnel' indicating the stage of capacity generation projects

[8] Base load refers to the electricity generated to meet the continuous need for electricity at any hour of the day or night.
[9] Please note that within each category (e.g. the "prefeasibility" category) of the funnel, the position of a project relative to other projects within that category is not an indication of its state of relative progress.

A range of projects are currently under investigation, which include *inter alia* new coal power stations in the Vaal and Waterberg, nuclear power stations, combined cycle gas turbine plant, converting the OCGT facilities to combined cycle gas turbine facilities, wind energy facilities and pumped-storage schemes.

Lastly, three mothballed power stations, viz. the Camden, Komati and Grootvlei stations, are currently being returned-to-service, a pumped storage scheme is being constructed on the border of KwaZulu-Natal and the Free State, and the Medupi and Kusile coal-fired power stations are under construction, and are all consequently reflected in the 'build' portion of the funnel diagram.

The current EIA process is for the proposed two new coal-fired power stations located southwest of the existing Matimba and Medupi Power Stations in the Waterberg area.

The selection of the Waterberg area for the location of new coal-fired power stations was largely informed at a strategic level by the availability of coal to supply such power stations. From a technical and economic perspective, it is optimal to place the coal-fired power station as close to the coal source as possible. At this point it is unknown from which supplier the coal will be obtained. However the coal resource is located to the north of the Eenzaamheid fault line which follows the DR1675 road for the most part into Botswana. This is discussed in **Section 2.3** below.

2.3 SELECTION OF THE WATERBERG REGION FOR FURTHER COAL-DRIVEN DEVELOPMENT

Coal is found in South Africa in 19 coalfields (see **Figure 2.6** located mainly in the provinces of KwaZulu-Natal, Mpumalanga, Limpopo and the Free State, with lesser amounts in Gauteng, North West and the Eastern Cape. The Waterberg, Highveld and the Witbank coalfields contain more than 70 % of the total reserves. The latest Minerals Bureau estimate sets the reserves at 33.8 billion tons, considered to last until around 2050 (Jeffrey, 2005).

When identifying potential coal regions that would have sufficient volume to supply a power station, it is important to secure coal of the desired quality and quantity (i.e. coal for power generation, at volumes of approximately 19 million tons (Mt) per annum per 5 400 MW power station) at a reasonable cost to sustain a new power stations throughout its life span, i.e. at least 50 years. Therefore some 950 Mt of steam coal would be required to operate a 5 400 MW power station.

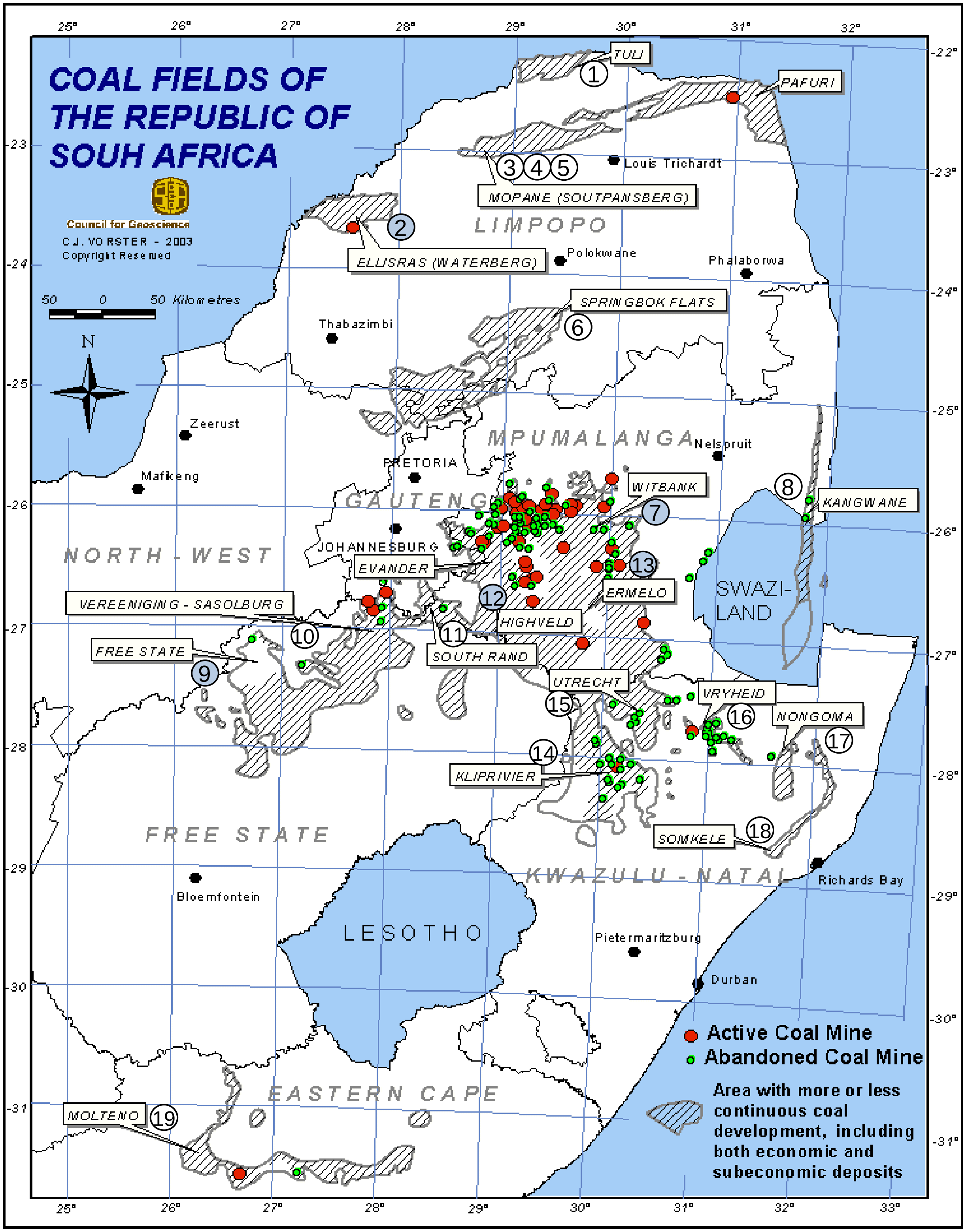

Figure 2.6 Location of coalfields in South Africa (after Jeffrey, 2005)
(numbers correspond to the table below)

Table 2.1 summarises the production and utilization of the coal reserves in South Africa and also indicates the remaining volume of coal. Blocks with grey shading below indicate resources that could potentially supply the requisite coal, due to the volume of remaining recoverable reserves.

Table 2.1 Production and utilisation of coalfields and remaining reserves

No.	Coalfield	Production and Utilisation	Remaining recoverable[10] reserves (2000) in Millions of tons (Mt)
1	Limpopo (Tuli)	No current exploitation.	107.00
2	Waterberg (Ellisras)	The Waterberg coals are used for steelmaking (coal for the Corex process at Saldanha Steel and coking coal for Iscor's Vanderbyl steelworks) and **power generation** (**Eskom's Matimba power station**). Some coal is exported via the Matola terminal in Mozambique for steam generation in order to make the extraction of the steelmaking coals viable.	15 103.00
3,4&5	Soutpansberg	Due to the limited exploration data available in public domain publications, one must assume that the entire Soutpansberg Coalfield contains coals that are suitable, after beneficiation, as coking coals for the metallurgical and steelmaking industries.	260.89
6	Springbok Flats	No current exploitation.	1 700.00
7	Witbank	Of the 71 operating collieries in South Africa at the end of 2001, 39 (55 %) of these were located in the Witbank Coalfield. In 2001, the coalfield accounted for 155.13 Mt (about 52.5 %) of the total 295.55 Mt run-of-mine (ROM) production. The Witbank Coalfield seams have diverse characteristics, resulting in a range of potential markets/utilization in the **power generation**, export, domestic, metallurgical, liquefaction and chemical sectors. The No. 2 seam is a critical source of high-yield export quality steam coal while the No. 5 seam is the source of metallurgical coal for the local steel industry. The lower grade coals are consumed domestically by Eskom for **power generation**.	10 139.77
8	Kangwane		146.04
9	Free State	New Vaal Colliery is the only operating mine. There are however other coal related developments	4 918.78

[10] The coal reserve is defined as "only…that portion of the total coal resources of which the nature and distribution have been fairly well established and which is at present economically recoverable or borders on economic recoverability". (Jeffrey, 2005)

Chapter 2

No.	Coalfield	Production and Utilisation	Remaining recoverable[10] reserves (2000) in Millions of tons (Mt)
		planned for the area.	
10	Vereeniging-Sasolburg	The operating collieries within the Sasolburg-Vereeniging Coalfield are the Sigma Colliery, incorporating the Wonderwater Strip Mine, in the Sigma Basin and the New Vaal Colliery situated in the northern portion of the Cornelia Basin. Only the No. 2B and No. 3 coal-seams are mined at Wonderwater Strip Mine with the soft overburden material removed by truck and shovel operations one cut ahead of mining and battered back to within the natural angle of repose. The increasing difficulty in underground mining conditions and increasing production costs have resulted in investigations to open a new strip mine section (Sigma North-West) to supplement and to later replace the production from the underground section of the Sigma Colliery. The winding down of operations at Sigma Colliery was planned to begin in 2004 and to coincide with the build-up of natural gas supplies to SCI from Mozambique. As with all the coal produced by Sasol Mining, **the coal from Sigma Colliery is supplied to Sasol Synthetic Fuels (SSF) and Sasol Chemical Industries (SCI)**. New Vaal Colliery is a dedicated supplier of coal to **Eskom's Lethabo Power Station**.	1 898.09
11	South Rand	No operating mines.	707.97
12	Highveld	The Highveld Coalfield is the next most productive coalfield with ten operating collieries. In 2001, it accounted for about 73.65 million tons (24.9 %) of the total ROM production. Mining was largely initiated by the development of the coal-fired **Kriel and Matla power stations** with collieries established to feed these power stations. Since then, the five Sasol mines around the Secunda area were developed. **All the Sasol mines are dedicated coal suppliers to the SSF and SCI** where the coal is used as a feedstock in the production of liquid fuels and chemicals. The coal produced at Forzando and Dorstfontein Collieries is exported, whereas New Denmark Colliery is a dedicated supplier of coal to **Eskom's Tutuka power station**.	10 006.51
13	Ermelo	In 2002 there were ten operating collieries in the Ermelo Coalfield, most of which are small to	4 596.89

Chapter 2

No.	Coalfield	Production and Utilisation	Remaining recoverable[10] reserves (2000) in Millions of tons (Mt)
		medium sized. Mining in this coalfield has been dormant for some time with most mines closed with reserves. Of the total saleable production of 222.55 Mt in 2001, the Ermelo Coalfield contributed about 7.2 million tons. Most of the high-grade steam coal produced by Xstrata Coal SA in the Ermelo Coalfield is destined for **export**. In the past, the now closed Ermelo Mines and Usutu Colliery supplied **Eskom's Camden power station**, with defunct Majuba Colliery supplying the **Majuba power station**. Camden is being brought back on-stream and will be supplied by a black empowerment consortium operating Golang Colliery, incorporating Golfview Colliery and the former Usutu Colliery.	
14	Klip River	There has been a substantial decline in coal-mining in KwaZulu-Natal over recent years, with the closing of major collieries within the coalfields. Ten collieries are currently operational—four each in the Klip River and Vryheid coalfields, and a single operation in each of the Utrecht and Nongoma coalfields. The KwaZulu-Natal coalfields are the major producers of high quality anthracite in the country. The Welgedacht Colliery produces only bituminous coal with some collieries in the Vryheid Coalfield producing coking coal. The total saleable anthracite production for 2001 amounted to 2.56 Mt; around 80 % of it came from the KwaZulu-Natal coalfields while 4 % came from Nkomati Anthracite in the Kangwane Coalfield and 8 % from small ad-hoc exporters. Before the opening of Grootegeluk and Tshikondeni Coal Mines, the KwaZulu-Natal coalfields were the only source of high-grade coking coal for Iscor. The coalfields are still set to remain the country's major source of anthracite,	569.74
15	Utrecht		584.53
16	Vryheid		122.20

No.	Coalfield	Production and Utilisation	Remaining recoverable[10] reserves (2000) in Millions of tons (Mt)
17	Nongoma	bituminous and high quality metallurgical coal for local industry. Other major coal users in the area are the pulp, paper and textile industry. Gus Seam mined in all major collieries within the Vryheid Coalfield. The Alfred Seam has not been extensively mined but has been worked in opencast operation.	82.82 (Somkhele & Nongoma)
18	Somkhele	Main seam is economic, has been exploited in the past. Further development probable in near future.	
19	Molteno-Indwe	No current exploitation; minor exploitation in the past; plans for future development.	

(taken from Jeffrey, 2005)

Based on the amount available indicated in the above table there are seven coalfields which have sufficient recoverable reserves to supply the proposed power stations namely, Ermelo, Highveld, Vereeniging-Sasolburg, Free State, Witbank, Springbok Flats and Waterberg (Ellisras) Coalfields (indicated by shading in the table).

Ermelo supplies coal to Majuba power station and the previously–mothballed Camden power station[11]. While Ermelo has sufficient coal to supply a coal-fired power station the cost of mining the coal in this area is relatively high.

The Highveld Coalfield reserves are important to the long-term life of the Sasol facilities of Sasol Synthetic Fuels (SSF) and Sasol Chemical Industries (SCI), which require 40 Mt a year. It is likely that production will continue for a considerable number of years (Jeffrey, 2005) and hence this coalfield is unlikely to have capacity to supply further powers stations and Sasol's needs. The Vereeniging-Sasolburg Coalfield is also a supplier to SSF and SCI, as well as supplying coal to Eskom's Lethabo power station (Jeffrey, 2005).

The coal reserves of the Free State Coalfield, which is in the vicinity of the Vereeniging-Sasolburg coalfield, are of a low grade which is suitable for power generation and possible liquid fuel production. As mentioned in the table above, there are further coal related developments identified for the area, including at least one power station for which Eskom has applied for environmental authorisation. Furthermore, the coal field is located partially within a Priority Airshed, as declared by DEAT, and consequently further coal-related development may not be

[11] http://www.keatonenergy.com/cm/sa_coal.asp

in keeping with the proposed pollution reduction and abatement measures being applied to the airshed.

The Witbank Coalfield is nearing depletion (Jeffrey, 2005) due to the rate at which coal is being mined and it has been suggested that the Waterberg Coalfield could replace this due to its potential to be the country's largest remaining *in situ* coal resources. The Witbank Coalfield is divided into five seams, the fourth of which contains poor quality coal. The bottom layer of the No. 4 coal seam is mined for power station feedstock and domestic steam coal. The remaining seams are mined for export coal, metallurgical feedstock and coking coal (Jeffrey, 2005). There is a desire to utilize these existing coal resources in the extension of the lifespan of existing coal-related developments in the area.

The coal reserves of the Springbok Flats are largely unexplored. A range of coal grades are available including steam coal. The coal reserve is however associated with uranium deposits and the coal resource is deep. Due to the depth of the coal the cost of extraction is likely to be relatively high making this resource less desirable.

The Waterberg coal reserve is estimated at 75 000 Mt of coal, which is approximately 40 % of South Africa's remaining coal reserves (Le Roux, 2007). Of this the recoverable reserves at the end of 2000 were estimated at 15 103 Mt. However this estimate could increase as new methods of extraction are developed (including underground coal gasification).

Even though seven of the coal fields have significant coal resources capable of supplying the requisite quantities of coal for a power station, many of these resources are not available, as they have been committed to existing or other future projects. Consequently, Eskom issued a Request for Information to supply coal to a new coal-fired power station in South Africa. A suite of mining companies responded to the call, and made coal offers in various locations around the country.The Waterberg coalfield is considered to be a suitable source of the coal, due to the reasonable quality of the coal, and, since the coal is relatively shallow, the relative ease of extraction via open-cast mining operations. Consequently, the Waterberg coalfield was identified as the most feasible coal resource for further power station utilisation.

2.4 OVERVIEW OF THE POTENTIAL FUTURE ELECTRICITY RELATED DEVELOPMENT IN THE WATERBERG REGION

In October 2004, government took allowed Eskom to lead this current phase of building new electricity generation capacity and the associated powerline infrastructure.

Additional power stations, major power lines and substations are urgently being constructed to meet rising electricity demand in South Africa. The approved capacity expansion budget is

R343 billion[12] up to 2013 and is expected to grow to more than a trillion rand by 2026. Ultimately Eskom will double its capacity to 80 000 MW by 2026.

The planning for the execution of the build programme is continuous and thus is constantly revisited. However, the basis of the planning is through Eskom's ISEP process. This provides Eskom energy and demand forecasting for up to 20 years into the future. As part of this process, data is gathered on supply-and demand-side costs and performances. Then the mix of these options and the timing of their use are optimised to meet the load forecast with suitable reliability, taking into account risks and assessment criteria.

The planning process provides economically and environmentally acceptable options for flexible and timely decision-making, considering Eskom and our shareholder's objectives and taking into account available energy reserves and renewable energy potential. The criteria for assessing the quality of the plan include cost, flexibility, robustness, sustainability and implementation.

As indicated above, the plan is dynamic and thus there is the need for Eskom to engage with stakeholders on its planning and the build programme.

Over and above the EIA process and its public participation activities, as well as the existing stakeholder engagement initiatives Eskom is planning the establishment of fora around the country in those areas where the expansion programmes will or could take place.

The forum will provide a platform for regular engagements and communication with the affected communities and will provide timeous and up-to-date responses to stakeholder issues.

The first forum is being established in the Waterberg area. As a precursor to the establishment of the forum, an information sharing session between Eskom and any interested and affected parties in the Waterberg area is planned for 11 December 2008. This will happen at two different venues, namely Thabazimbi and Lephalale or Modimolle on the same day.

The purpose of these sessions is to share Eskom's "bigger picture" - that is the long-term electricity plan (generation, transmission and distribution). The establishment of the Waterberg-Eskom Environmental Management Forum will be discussed including its make-up and objectives.

Chapter 2

[12] This is nominal rand, and based on 2007 financial assumptions.

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3 THE SITE SELECTION PROCESS

The purpose of this chapter is to document and describe the process and rationale by which the proposed sites were identified and selected. It describes the regional boundaries within which the sites were identified and the criteria used to identify potential sites.

3.1 BACKGROUND

As outlined in **Chapter 1** above, given the need to develop additional electricity generation capacity and the reliance on coal as the source of energy for the next 20 years, Eskom initiated a site selection study and an EIA process for the development of two new coal-fired power stations in the Waterberg, Limpopo, in the vicinity of Lephalale. While Eskom had identified the broad geographic region at a strategic level, the specific sites within the region had not been identified. As part of the EIA process, the EIA team, assisted by Eskom, undertook the identification of potential sites within the identified region, in order to ensure that the EIA process could commence from a robust and defendable starting point.

The process of identifying potential sites within the region included a site visit to the area under consideration and a workshop with Eskom personnel. The purpose of this Chapter is to document the process that led to the identification of candidate site alternatives for further investigation in this EIA process.

3.2 SELECTION OF POTENTIAL SITES

3.2.1 DETERMINING THE BOUNDARIES OF THE WATERBERG REGION

As outlined in **Chapter 2** above, the Waterberg region was identified as the potential source of coal for two coal-fired power stations, based on the availability of the coal, coal quality, depth to the coal resource and ease of mining. In order to determine the boundaries of the Waterberg region, a suite of criteria and existing, published data were used to delineate the boundaries of the region, including national borders.

Eskom's mandate is to provide electricity to South Africa, through amongst other things, building and operating power stations in the country. Consequently, even though the Waterberg coalfield stretches to the north and west, into neighbouring Botswana, Eskom will only consider the locations within South Africa. The national border therefore formed the northern and western borders of the Waterberg region.

The coal resources of South Africa are under the control of the DME, and are considered to be a strategic resource for the future of the country. The South African coal reserves in the Waterberg mainly occur within a band bordered by the South Africa-Botswana border in the west (the coal extends into Botswana), the Zoetfontein fault in the north and the Eenzaamheid fault in the south (see **Figure 3.1**). The coal field in the Waterberg is also divided by a north south fault, the Daarby fault. This divides the coal field into shallow coal on the west of the fault, which could be mined by open cast methods, and deep coal on the east which could be mined by underground mining methods. The sterilisation of a coal resource through development on top of it is considered to be unacceptable, especially when the life of the development is in the order of 50 years, such as in the case of a power station. Consequently, it was agreed that the power station could not be established on top of any coal reserves, and that the area to the south of the east-west trending Eenzamheid geological fault was the most suitable area for further consideration, being off-coal.

According to Eskom, currently the maximum feasible and efficient distance over which a coal conveyor of this nature can be operated is approximately 30 km; with the longest conveyor belt in South Africa presently in operation being about half this length. Transporting coal greater than 30 km is likely to have a significant effect on the price of electricity, as well as increased land requirements, security risks, operational reliability concerns, dust management, coal degradation, health risks, visual and other environmental impacts, thus compromising efficiency. Distances greater than this therefore require alternative transport mechanisms, such as road or rail, thereby increasing the transportation cost by up to three times as well as increasing environmental risks.

As the source of coal for the proposed power station has not been finalized a distance within 30 km from the boundary of the various offered coal resource was considered. The area of overlap of all these 30 km boundaries could be supplied by any of the coal resources, or from multiple resources within the area of shallow coal, as described above.

Based on the above factors, the boundaries of the region within which sites would be identified were delineated as follows (see hatched area in **Figure 3.1**):

- *Northern boundary:* The Eenzaamheid fault which is closely followed by the road (DR1675) from Lephalale to Steenbokpan.
- *Southern boundary:* The 30 km arc closest to the Eenzaamheid fault.

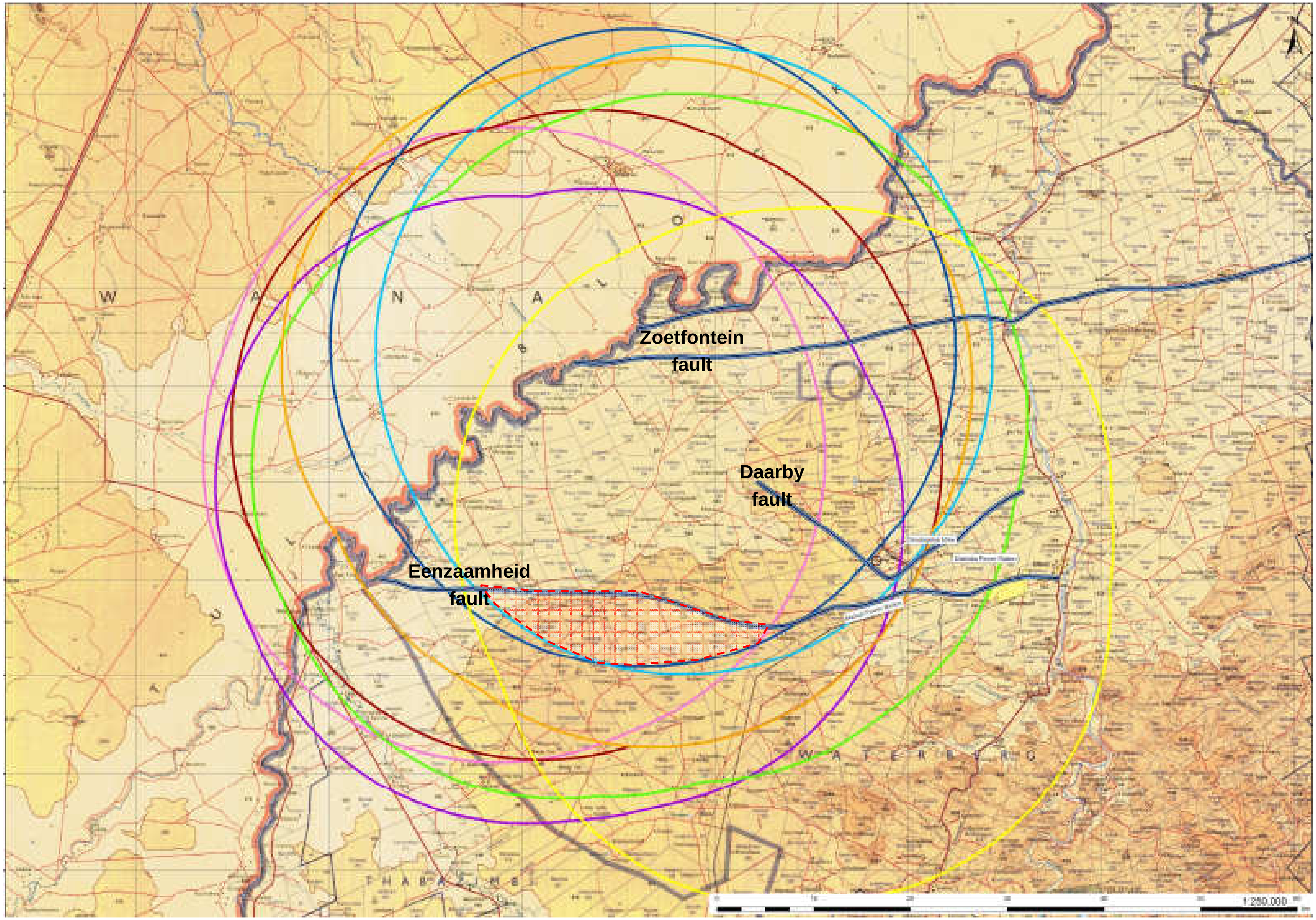

Figure 3.1 Map showing the eight geographic coal locations and 30 km lines

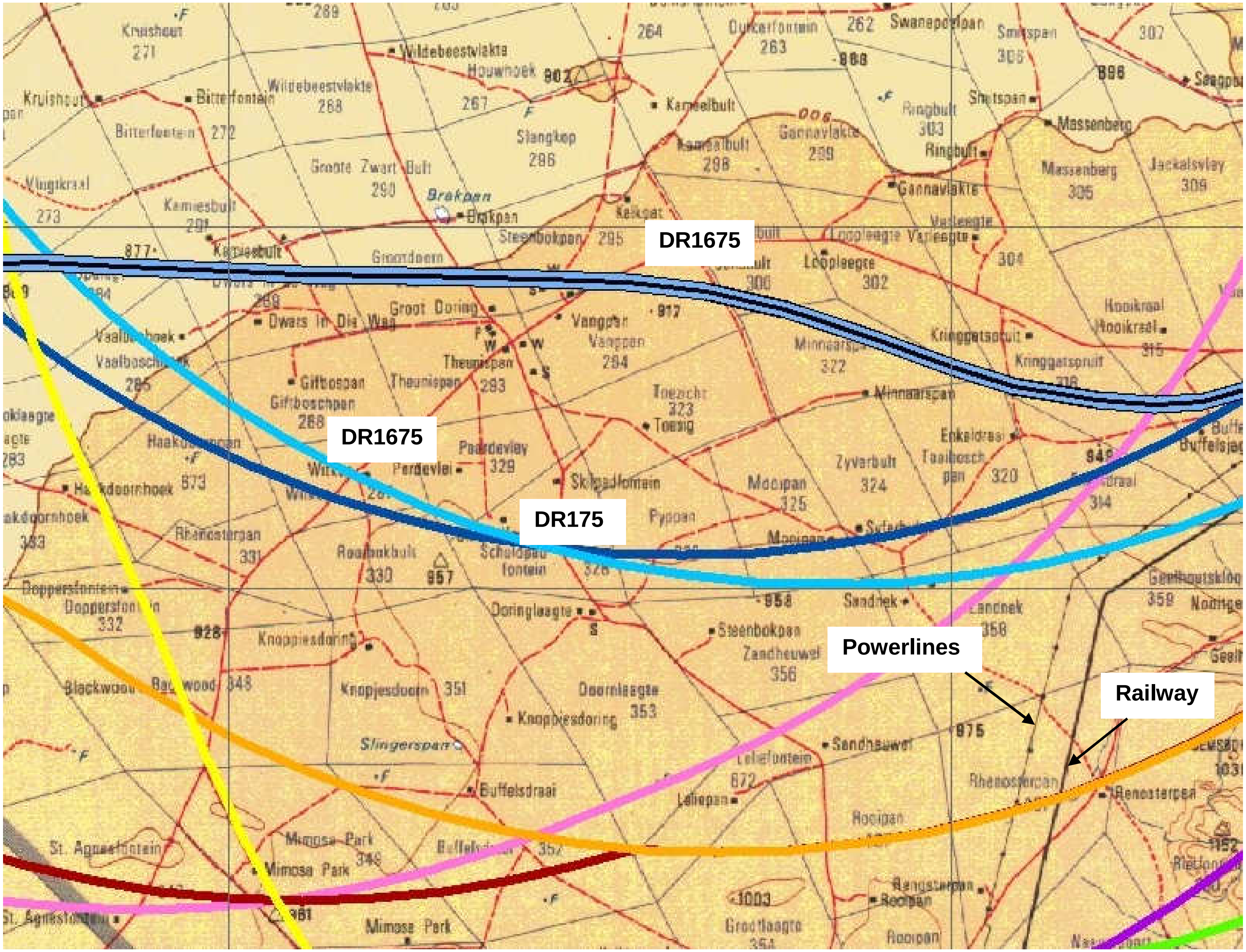

Figure 3.2 Map showing the area in which sites were identified

3.2.2 SELECTION OF POTENTIAL SITES

With the area of intersection identified, potential sites within this area were identified by considering a range of potential criteria. These included size of the sites, potential boundaries, buffer zones and other infrastructure. These are described below.

a) Required size of site

It was agreed that the initial identification of sites should consider the footprint of the power station and ancillary infrastructure (such as a WWTW, a demineralisation plant, etc) requiring at least 2 000 ha and a permanent above-ground ashing facility, requiring 3 000 ha adjacent to the power station area. Consequently sites needed to be at least 5 000 ha in extent. Although this area is larger than that required for previous power station projects, the larger size would avoid the numerous problems associated with locating the infrastructure on the site during the EIA and detailed design processes.

b) Boundaries

In the delineation of sites, boundaries such as major roads (tarred), railways, major powerlines and farm boundaries were considered. Other boundaries considered, but that did not influence the sites as there were no differences between the sites, include rivers and topography. By avoiding boundaries where possible potentially significant ecological impacts (e.g. impacts on aquatic ecology) can be limited and design issues (e.g. moving roads) can be minimised. Furthermore, by following farm boundaries, where reasonable, the number of landowners impacted by any one site would be limited and it would be less likely that the sites would divide individual farms.

c) Buffer zones around residential areas

A buffer zone was allowed around the Steenbokpan settlement, located to the west of Lephalale, in order to minimize noise and air pollution impacts on the settlement. As flue gas desulphurization was proposed for the power stations, the air quality impacts are expected to be fairly contained downwind of the power stations.

d) Other infrastructure

Other infrastructure besides the boundaries noted in (b) above were considered. In particular the proposed Delta substation which is to be constructed on the Zandnek

Farm (see **Figure 3.3**) was considered, specifically with respect to the proposed power stations' ash dumps in relation to the substation.

e) Identification of potential sites within the Waterberg region

Based on the above criteria, a total of three sites were identified (see **Figure 3.3**) within the regional boundary defined above.

The three sites identified were divided into areas suitable for a power station and an associated area suitable for an ash dump (generally outside the 30 km line to the coal areas). This allowed sufficient area for the proposed power station and infrastructure (an area of at least 2 000 ha) and for the ash dump (an area of at least 3 000 ha).

The three sites include the following farms:

Site A (total area of approximately 8 328 ha)

- Proposed Power Station Alternative A
  - Minnaarspan Farm No. 322
  - Zyferbult Farm No. 324
  - Taaiboschpan Farm No. 320
- Proposed Ash Dump Alternative A
  - Zandheuwel Farm No. 356
  - Leliefontein Farm No. 672
  - Portion of Doornlaagte Farm No. 353

Site B (total area of approximately 7 377 ha)

- Proposed Power Station Alternative B
  - Pyppan Farm No. 326
  - Mooipan Farm No. 325
- Proposed Ash Dump Alternative B
  - Knopjesdoorn Farm No. 351
  - Portion of Doornlaagte Farm No. 353
  - Schuldpadfontein Farm No. 328
  - Rooibokbult Farm No. 330
  - Portion of Paardevley Farm No. 329

Site C (total area of approximately 8 122 ha)

- Proposed Power Station Alternative C
  - Dwars-in-die-Weg Farm No. 289
  - Gifboschpan Farm No. 288
  - Witkop Farm No. 287
- Proposed Ash Dump Alternative C
  - Rooiboklaagte Farm No. 283
  - Haakdoornpan Farm No. 673
  - Haakdoornhoek Farm No. 333
  - Vaalboschhoek Farm No. 285

The three sites for the two power stations are currently larger than 5 000 ha. This is due to the sites being based on, amongst other things, existing farm boundaries.

3.2.3 OTHER CONSIDERATIONS

Other factors that were considered, but that did not significantly differ between the areas under consideration and therefore did not influence the site selection process, included topography, vegetation type, sensitive fauna, wetlands, ground water and landuse.

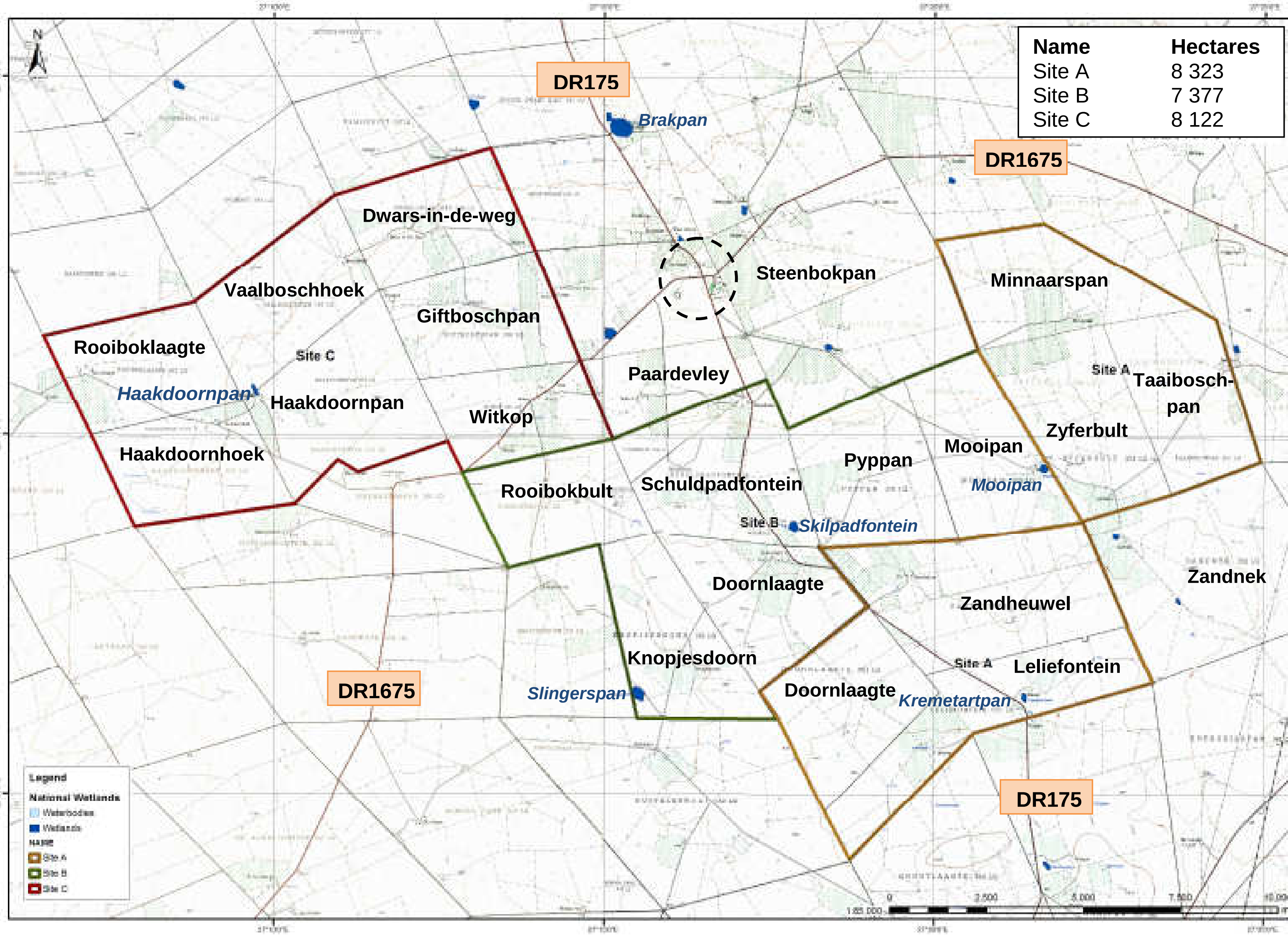

Figure 3.3 Proposed sites

4 THE PROPOSED ACTIVITY

This chapter considers the need for the proposed project, briefly outlines the nature of the proposed activities and then considers and screens the various project alternatives in order to focus the EIR phase on the feasible alternatives.

4.1 THE NEED FOR THE PROPOSED ACTIVITY

The need for the proposed project is described in detail in **Chapter 2**. However, the salient points are reiterated in this section in order to contextualise the proposed activity.

Strategic planning processes by DME, NERSA and Eskom concluded that South Africa requires additional capacity to meet projected demand. This would consist of base load and peaking electricity generating capacity. Amongst other initiatives, Eskom is pursuing the return-to-service of its three mothballed Simunye Power Stations, namely Camden (recommissioning complete), Komati and Grootvlei (both in the process of recommissioning).

Eskom is also investigating a suite of further options, including pulverised fuel (coal) power plants, pumped storage schemes, gas fired power stations, nuclear plants, as well as renewable energy options like wind and solar projects. While coal is, and will remain for the foreseeable future, the major energy source, Eskom plan to reduce coal's current approximately 90 % share of the energy mix to below 70 % by 2026. To achieve this, a much higher proportion of nuclear energy (currently 4 %) is envisaged by 2026, while additional renewable energy options (about 2 % by 2026) will also be pursued. Eskom already has environmental and other approvals for a Wind Energy Facility on the West Coast, and a 100 MW Concentrated Solar Thermal plant in the Northern Cape is currently in the approval stages. In addition, pumped-storage schemes and gas-turbine power stations will be built to meet peak demand, while electricity imports from neighbouring countries (to a maximum of the reserve margin) will also be negotiated.

Consequently, Eskom is currently constructing coal-fired power stations in Lephalale (Medupi Power Station) and in Witbank (Kusile Power Station) and is proposing additional power stations in the Waterberg and the Northern Free State[13].

4.2 DESCRIPTION OF THE PROPOSED ACTIVITY

The project comprises the design, construction, commissioning, operation and decommissioning of two coal-fired power stations and their associated infrastructure. Each power station would comprise six boiler/turbine sets with a nominal electricity generation

[13] It must be noted that the proposed power station in the Northern Free State has already gone through the EIA process, and a decision from the Environmental Authority is expected shortly.

capacity of approximately 5 400 MW (900 MW per unit[14]). Apart from the power station buildings themselves, the ancillary infrastructure would include the following:

- Coal and sorbent stock yard;
- Coal, ash, sorbent and gypsum conveyors;
- A High Voltage (HV) yard within the power station precinct;
- Water and wastewater treatment facilities;
- Ash and spent sorbent disposal systems and dump site;
- Gypsum storage facility
- Access roads;
- Maintenance, medical, administration, services, control buildings;
- Water supply for construction phase;
- Raw water pipeline and reservoirs;
- Dams for storage of "clean" and "dirty" water;
- Railway lines and sidings for sorbent supply;
- Transmission lines (to the proposed Delta substation and to be deviated within sites);
- Power supply for the construction phase (substation, transmission and distribution lines);
- Borrow pits (on site);
- Communication mast/telecommunication facilities;
- General and hazardous storage and handling facilities;
- Batching plant (including concrete and asphalt); and
- Construction worker accommodation.

The flow diagrams below (**Figure 4.1** and **Figure 4.2**) illustrate the process by which electricity is produced.

The power stations would be fuelled by coal, supplied from a source within approximately 30 km of the proposed power stations' sites. The initial coal supply (for commissioning and early operation) may have to be sourced from an existing colliery whilst a new mine is being commissioned.

Coal would be transported via conveyor belts from the colliery to the coal stockyard, where it would be stockpiled. The stockpile is typically divided into strategic, seasonal and live stockpile areas. Coal from the stockpile is then fed to the power station by means of conveyor belts. The coal is pulverised in a milling plant to form 'pulverised fuel' and, with a combination of air, blown into the boiler where it is burnt.

Heat released from burning the pulverised fuel is used to heat water to produce steam within a network of boiler tubing. The final superheated steam exiting the boiler is used to drive turbines coupled to generators, which generate electricity through the use of electromagnets which spin within large copper coils. The generated electricity is then transformed from 22 kV to 400 kV and fed via the HV yard into the transmission network. Once the steam's energy has been exhausted, it is condensed and the water is returned to the boiler to start the process again.

[14] The station capacity rating is dependent on the selected technology based on various Original Equipment Manufacturer (OEM) proposals, which would be acquired during the technical and commercial evaluation process.

The cooling system can use either wet or dry cooling, the dry cooling option being either direct or indirect.

The ash produced through the combustion of the coal is removed from the bottom of the boiler and from the flue gas (via electrostatic precipitators or bag filters) and sent to an ash-dumping facility using a dry stacking technology. Electrostatic precipitators and bag filters can achieve similar removal efficiencies to meet the legislative requirements. As the environmental consequences of these technologies do not differ substantively, it is proposed to consider both briefly in the EIA, although the ultimate decision on which to adopt is likely to be made on life-cycle costs and operational considerations.

The power stations would include technology to remove oxides of sulphur (SO_X) from the flue gases, referred to as Flue Gas Desulphurisation (FGD), utilising a lime or limestone sorbent. FGD technology is capable of removing 90 % or more of the SO_X from the flue gas, and a system with at least 90 % efficiency would be installed at the proposed power stations.

Oxides of nitrogen (NO_X) would be controlled through the installation of low NO_X burners, which reduce concentrations of NO_X emitted to the atmosphere. This is likely to result in emissions that comply with the applicable standards and therefore further NO_X emission abatement technologies will not be considered in the study.

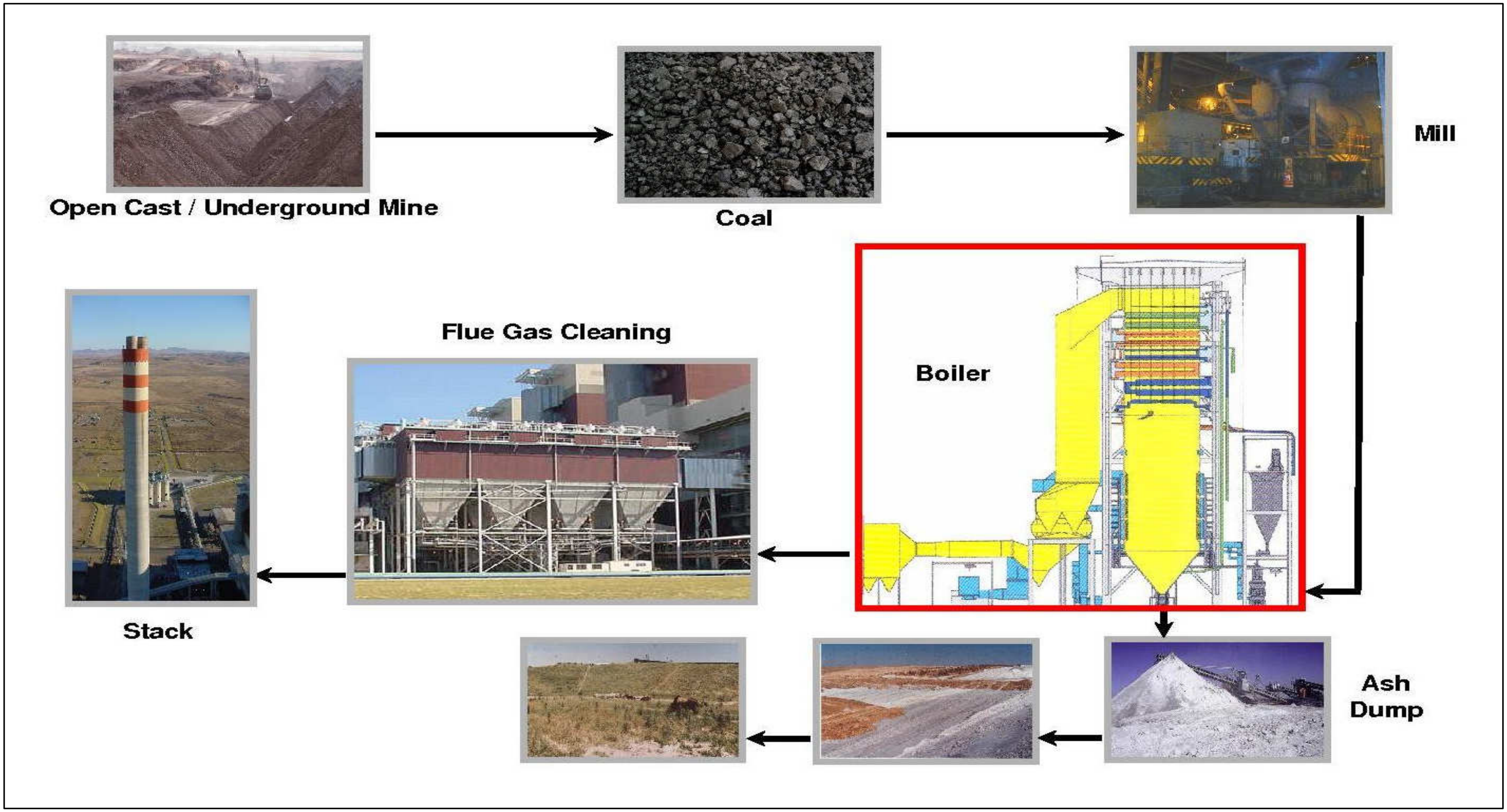

Figure 4.1 Process flow diagram for a coal-fired power station

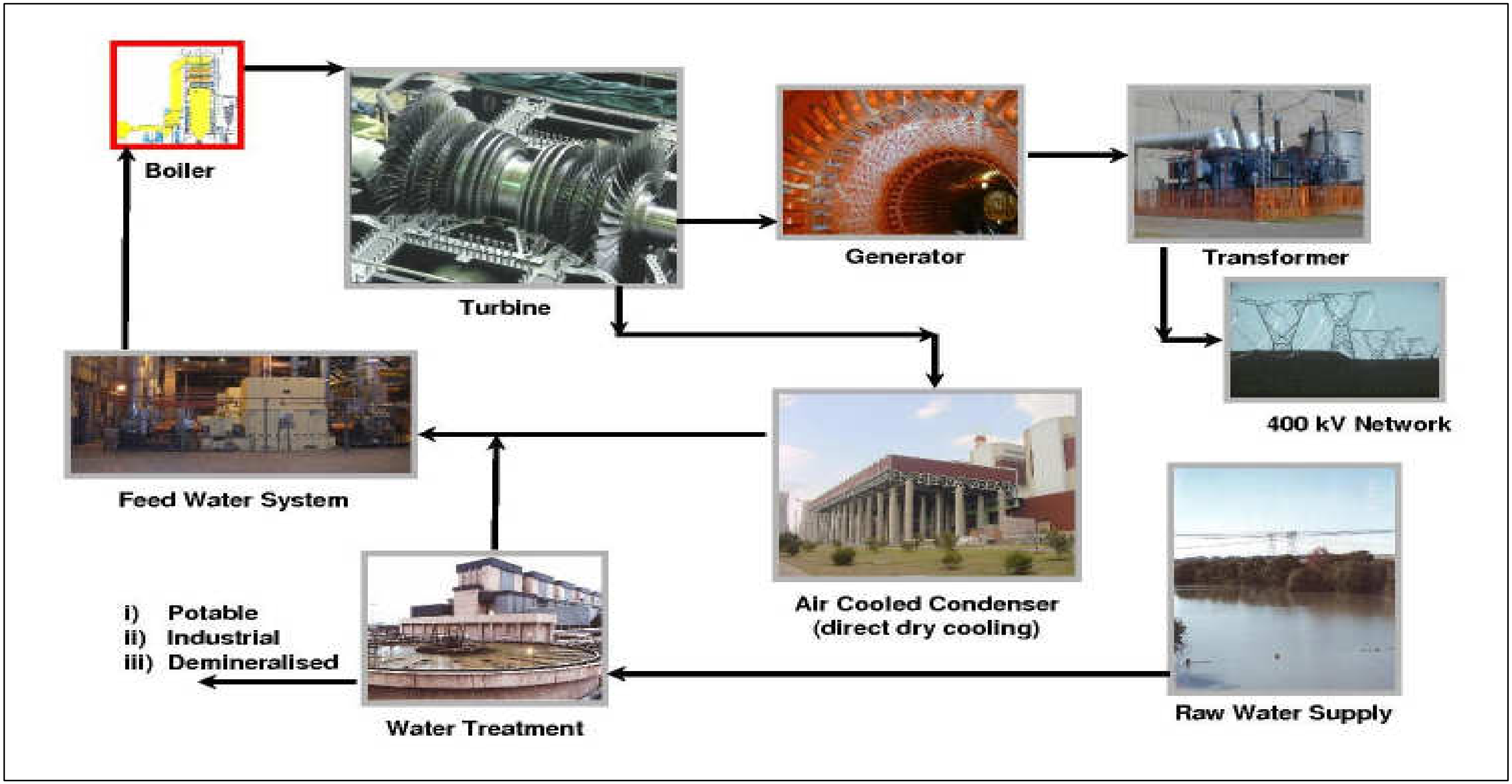

Figure 4.2 Process flow diagram for a coal-fired power station (detailed)

Figure 4.3 below shows the layout of a typical coal-fired station and some of its ancillary infrastructure. The layout would be based on the technical and environmental constraints of the chosen site[15].

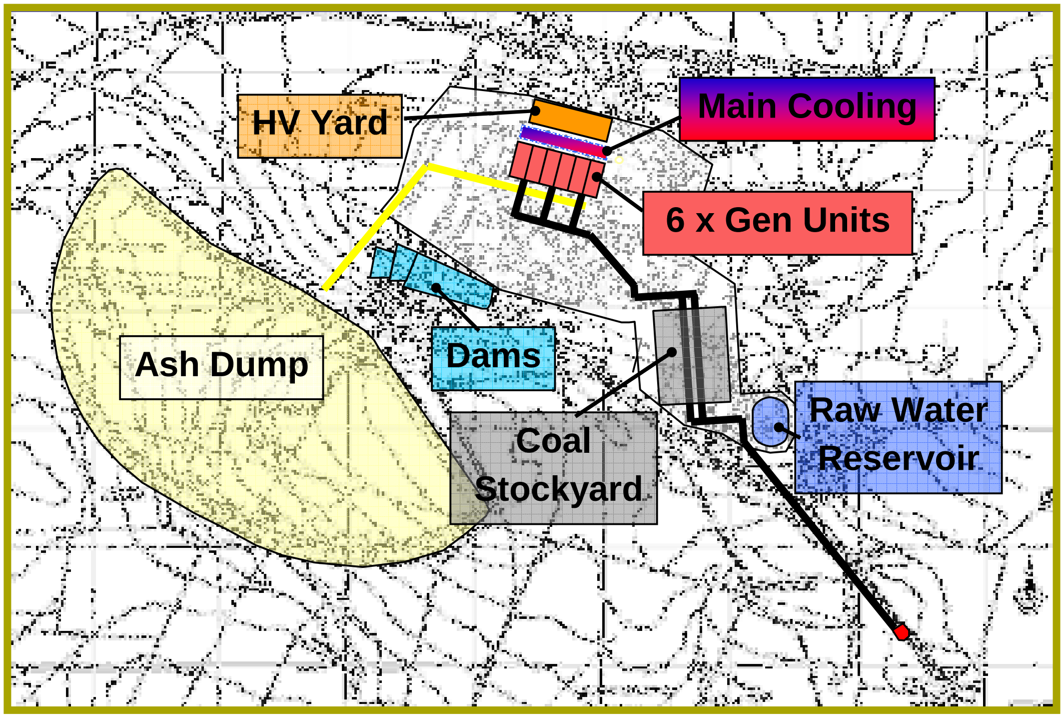

Figure 4.3 Typical layout of a coal-fired power station

Chapter 4

4.3 CONSIDERATION OF ALTERNATIVES

4.3.1 INTRODUCTION

NEMA requires that alternatives are considered during the EIA process. An important function of the Scoping Phase is to screen alternatives to derive a list of feasible alternatives that need to be assessed in further detail in the EIR phase. An alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004). Alternatives could include, amongst others, the following:

- Activity alternatives – also referred to as project alternatives. Requires a change in the nature of the proposed activity. This category of alternatives is most appropriate at a strategic decision-making level.
- Location alternatives – alternative locations for the entire project proposal or for components of the project proposal.
- Process alternatives – also referred to as technological or equipment alternatives. The purpose of considering such alternatives is to include the option of achieving the same goal by using a different method or process.

[15] The layout may be refined by the Technical Design Team at the detailed design phase, after the project has been authorised.

- Site layout alternatives – Site layout alternatives permit consideration of different spatial configurations of an activity on a particular site.

The above categories of alternatives are the ones most pertinent to this EIA process, and will be explored in detail below. The purpose of this section of the report is to identify (scope) and describe all potential alternatives and determine which alternatives should be carried through to the EIA Phase of the project for further assessment.

4.3.2 ACTIVITY ALTERNATIVES

Fundamentally different alternatives for achieving the project's goal are normally assessed at a strategic level. In this regard, as mentioned in **Section 1.1** above, the proposed project to establish two coal-fired power stations has come out of extensive policy and plan level investigations, undertaken by DME, NERSA and Eskom. Alternative methods of generating electricity are identified in the IEP, NIRP and ISEP planning processes. Furthermore, high-level environmental criteria were integrated in the NIRP and ISEP, focusing on environmental life-cycle assessments, site-specific studies, water-related issues and climate change considerations. Consequently, this Scoping Report only considers project level alternatives related to the two proposed new coal-fired power stations in the Waterberg and does not evaluate any other power generation options.

The 'no-go' alternative is the option of not establishing new coal-fired power stations at the proposed sites in the Waterberg. As described in **Section 1.1** above, the electricity demand in South Africa is placing increasing demand on the country's existing power generation capacity. South Africa is expected to require additional baseload generating capacity by 2014 and beyond, dependent on the average growth rate. The 'no-go' alternative is likely to result in these electricity demands not being met, with the concomitant potentially significant negative impacts from an economic and social perspective for South Africa and is not explicitly assessed in the EIR phase. It is however, implicitly assessed in the EIR as it effectively represents the baseline or *status quo* against which all of the potential impacts will be assessed.

4.3.3 SITE LOCATION ALTERNATIVES

Once the need for the new coal-fired power stations was established, Eskom undertook a process to identify broad geographic regions within which to site the new power stations. As outlined in **Section 2.3** above, the Waterberg was identified for the development of new coal-fired power stations. Ninham Shand, with support from Eskom undertook a process to define the boundaries of the Waterberg region, and to delineate candidate sites. This resulted in three sites being identified and all were recommended for further detailed investigation during the EIA process. This process is described in detailed in **Section 3.2** of this Scoping Report

4.3.4 PROCESS ALTERNATIVES

Process alternatives relate to alternative technologies that could be implemented at a new coal-fired power station, and include combustion, cooling and atmospheric emission control technology alternatives and ash disposal alternatives. Each of these is discussed below.

a) Combustion technology alternatives

There are a suite of combustion technology options potentially available for new coal-fired power stations. Eskom is proposing to utilise pulverised fuel technology. This and other potential combustion technologies are described below.

i) Pulverised fuel combustion boiler

With pulverised fuel combustion technology, the coal is first pulverised into a very fine dust, and then blown into the boiler where it is burned much in the manner of a combustible gas.

It should be noted that all of Eskom's existing coal-fired generation employs pulverised fuel technology, as does that of the vast majority of the rest of the world. It is the only technology which is proven for plant of this magnitude.

ii) Fluidised bed combustion boiler

A fluidised bed is a layer of solid particles kept in turbulent motion by bubbles of air being forced into the bed from below. Coal is added and burned in this bed. The coal burnt in a fluidised bed combustion (FBC) boiler is generally low grade coal, which is theoretically, less costly. Heat transfer to the water and steam in the tubes takes place from the hot solids and gases. Using a limestone bed can capture the sulphur in the coal to produce calcium sulphate as a waste product. As the bed operates at less than 900^{o}C, thermal nitrogen oxide emissions are reduced.

This technology has been available for some years with a number of units throughout the world. However this technology is internationally unproven in unit sizes greater than 300 MW. To obtain the economies of scale required for this project, the individual station unit sizes need to be between 600 MW and 1 000 MW.
Based on the above, FBC is not being considered as a viable option for this power station and accordingly will not be considered further in the EIA.

iii) Coal gasification technologies

Coal gasification involves the creation of a combustible synthesis gas (syngas) through the partial oxidisation of coal. The syngas can then be used as fuel for power generation

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or other applications. Integrated coal gasification combined cycle (IGCC) power plants and underground coal gasification (UCG) are two such technologies.

IGCC power plants convert the coal to gas and then burn the gas to create electricity. UCG technology partially oxidises the coal *in situ* before the syngas is extracted and co-fired with coal to generate electricity. Eskom has established a UCG demonstration plant at the Majuba power station and the gas that is currently produced is being flared. Eskom is investigating the up scaling of the demonstration plant and the development of a commercial plant. However, neither of these technologies is commercially proven for plant of the desired magnitude (i.e. 600 to 1 000 MW units).

Based on the above, coal gasification technology is not considered to be a viable option for these power stations, and accordingly will not be considered further in this EIA.

b) Steam temperature and pressure alternatives (range)

The resultant heat from the combustion in the boiler is used to convert water into steam, which is used to drive a turbine coupled to a generator. The boilers would operate within OEM design parameters, the most important of which being pressure and temperature. Each of the six boilers would heat water to produce steam within a pressure and temperature range of 24 MPa – 26 MPa and 540°C – 570°C respectively. There is no significant impact on cost across this range although operation at the higher pressure and temperature range allows for increased efficiency (reduction in coal consumption and associated emissions by some 5 % to produce the same amount of energy).

c) Cooling technology alternatives

As mentioned in **Section 4.2** the steam used to drive the turbine has to be condensed back into water on exiting of the turbine to enable the thermodynamic cycle to repeat itself. A primary (main) cooling process is required to facilitate the condensation of steam in the circuit.

Cooling options include wet cooling, and direct or indirect dry cooling, and are explained below. Note that FGD is not included in the description of the cooling options below. FGD would increase the water consumption of the power stations and this will be considered later in the EIA phase.

i) Indirect wet cooling

Wet cooled systems utilise a circulating cooling water system, which absorbs heat during the steam condensation process and expels the heat to the atmosphere by the evaporation of some of the cooling water through the cooling towers. A wet cooling system uses approximately 1.8 l water per kWh sent out, ie some 78 million m^3 per annum for a 5 400 MW power station. Wet cooling uses approximately nine times the volume of water as is used by dry cooling. As South Africa is a water scarce country and wet cooling uses far greater volumes of water than dry cooling, wet cooling will not be considered as an alternative in this EIA.

ii) *Indirect dry cooling*

An indirect dry-cooling system works similarly to the wet-cooled system, with the primary difference being that the heat is dissipated in the cooling towers via water-to-air heat exchangers, rather than evaporation of the cooling water. Dry cooling uses approximately < 0.2 l of water per kWh sent out. A significant advantage of dry-cooling technology is the conservation of water, which is critical in a semi-arid country like South Africa. Another advantage is the lack of wet plumes (steam) from the cooling towers (see **Figure 4.5**). However, with dry-cooling, the turbine output deteriorates significantly at higher ambient temperatures, decreasing the amount of energy sent out of the process. A reduction of 60 MW could be expected over an ambient temperature increase of 25°C.

iii) *Direct dry cooling*

In a direct dry-cooling system, the steam is condensed directly by air in a heat exchanger and the condensate is returned to the boiler in a closed loop. The air flow for the condensation process is induced solely by mechanical fans, rather than through the updraft induced by cooling towers. As stated above, dry cooling utilises approximately < 0.2 l of water per kWh sent out. A further advantage of direct dry cooling is the lack of cooling towers, which reduces the visual impact and capital cost of the project (see **Figure 4.5**).

DWAF is cognisant of future expansions in mining and industry in the Lephalale area and is planning for this through a bulk water transfer scheme. However, Eskom is committed to minimising the utilisation of scarce water resources and therefore wet cooling is not considered environmentally desirable and will not be considered further in this EIA. However, the implications of both indirect and direct dry cooling will be considered in further detail in the EIA.

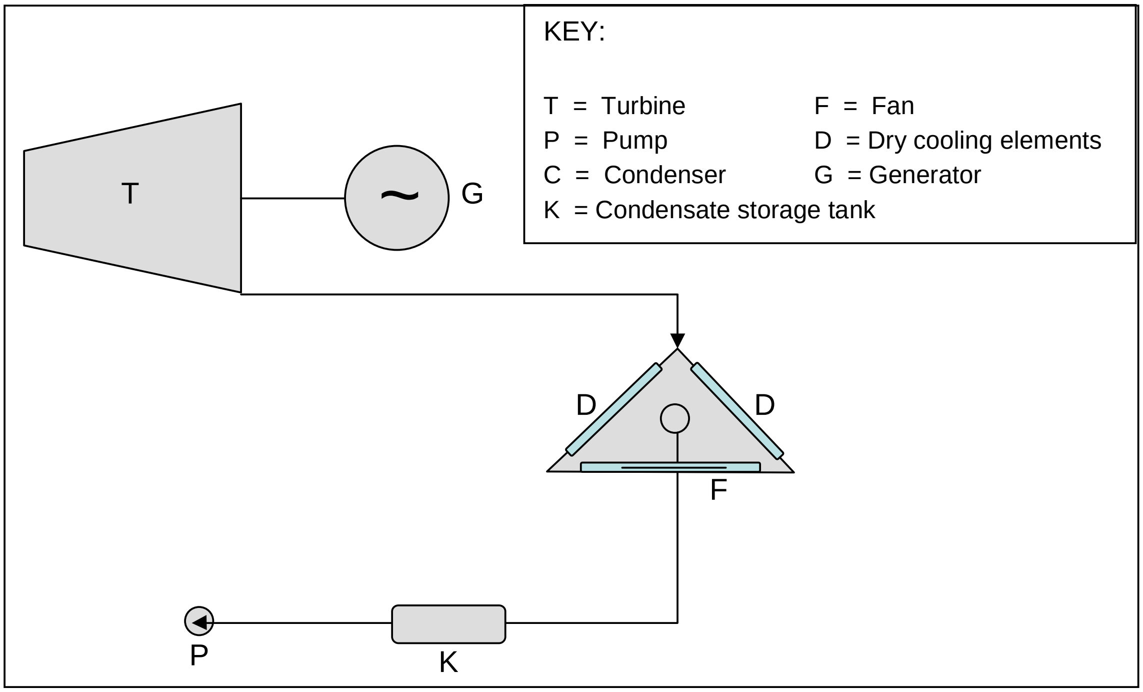

Figure 4.4 Schematic of the direct dry cooling process

Figure 4.5 Photograph showing a power station with indirect dry cooling technology

Figure 4.6 Photograph showing a power station with direct dry cooling technology

iv) *Stack-in-tower system of indirect dry cooling*

In a stack-in-tower system of indirect dry cooling, steam is condensed in a water cooled condenser (see **Figure 4.7**) and warm cooling water is cooled in a water-to-air heat exchanger (see **Figure 4.8**) in a closed loop. This system is more efficient than other direct cooling technologies when the ambient temperature is higher and it also produces less noise than direct air cooling.

Figure 4.7 Photograph showing a power station with the dry cooling tower of the Stack-in-Tower system of indirect dry cooling technology

Figure 4.8 Photograph showing a power station with the water-to-air heat exchangers of the Stack-in-Tower system of indirect dry cooling technology

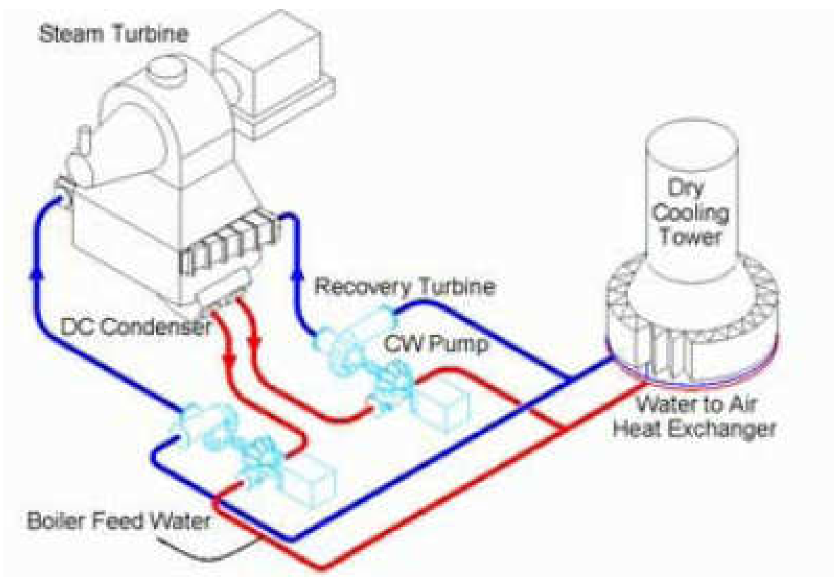

Figure 4.9 Schematic of the stack-in-tower system of indirect dry cooling system

The system is particularly useful when flexibility in cooling tower siting is required, and further can result in lower ground level concentration of airborne pollutants, having a positive on ambient air quality and community health.

As South Africa is a water scarce country and wet cooling uses far greater volumes of water than dry cooling, wet cooling will not be considered as an alternative in this EIA. Due to the significant improvements to that can be achieved by the indirect, direct and the stack-in-Tower system of dry cooling technologies, it is proposed that all three technologies are considered in further detail in the EIA.

d) Ash disposal alternatives

There are three methods of disposing of ash (coarse and fly ash)[16]; namely above-ground ashing, in-pit ashing and back-ashing. These three options are described below.

i) *Above ground ashing*

Ash and FGD byproducts are is conveyed to an ash dump, within the power station precinct, where it is stacked and spread. The ash dump would have to be able to accommodate the likely total volume of ash and FGD byproducts are that would be generated throughout the power station's life-spans i.e. some 300 million tons which would cover a footprint of approximately 2 500 ha. The ash dump would be continuously rehabilitated over time, using accepted rehabilitation methods. Rehabilitation measures include, reshaping, application of topsoil and revegetation with an acceptable grass species. Further detail will be provided in the EIR.

ii) *In-pit ashing*

The ash and FGD byproducts are from the power station would be dumped directly into the pit of the open-cast coal mine which supplies coal[17] to the power station. The overburden[18] and topsoil are placed onto the ash before the land is rehabilitated.

iii) *Back-ashing*

The primary difference between in-pit and back-ashing is that in back-ashing, the overburden is returned to the pit of the open-cast mine, prior to the ash and byproducts being dumped. Topsoil is then placed onto this and the ash dump would be continuously rehabilitated over time, using accepted rehabilitation methods.

In-pit and back-ashing would have to be undertaken in consultation with the relevant mining house supplying the coal to the power station and would only become potential options in the future, after any open cast mining operation has been completed or space is available in parts of the mine to allow these forms of ash disposal. In this instance above ground ashing facilities would therefore be required for the period prior to back- or in-pit ashing being possible. Consequently, this EIA process will only consider above-ground ashing within the power station precinct as the means of ash-disposal. However, it is recommended that the EIA process for the colliery investigate in-pit and back-ashing, as these may be preferable to above-ground ashing in the medium to long term.

[16] Note that large amounts of FGD byproducts will be co-disposed with the ash.
[17] The only other open cast mine in the area is the Grootegluk open cast mine which is still operational, and as such it is unsuitable for in-pit ashing. There are no other suitable areas available.
[18] Overburden is the layer of surface material that is removed prior to mining of the coal.

4.3.5 SITE LAYOUT ALTERNATIVES

Site layouts (one or more) will be developed for each of the three sites. These would take the form of a guide as to where the main components of the power station would be located, rather than a detailed layout of the power station precinct. The development of these layouts will be based on *inter alia* the following criteria:

- Technical constraints
  - Spatial orientation requirements of certain plant;
  - Topographical constraints of dams;
  - Layout relative to other existing infrastructure, such as power lines and roads; and
  - Geotechnical considerations.

- Environmental constraints
  - Topographical constraints, including surface and groundwater;
  - Local air quality implications;
  - Aquatic and terrestrial constraints (presence of wetlands, rivers, protected plant communities); and
  - Aesthetics and neighbouring land use.

The site layouts will be developed during the EIR phase, and will be presented and assessed in the Draft EIR.