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DRAFT ENVIRONMENTAL IMPACT REPORT ON

MEDUPI FLUE GAS DESULPHURISATION (FGD) RETROFIT PROJECT

DEA REF: 14/12/16/3/3/3/110

ZC Report No: 12949-46-Rep-003

Submitted to:

Eskom Holdings SOC Limited
P O Box 1091
Johannesburg
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19 February 2018 12949

YOUR COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT (DEIR)

The DEIR was submitted for public review and comment for a period of 40 days. In accordance with Section 56(6) of the 2010 EIA Regulations, a registered Interested and Affected Party (I&AP) may submit comments on the DEIR, and these comments should be submitted to Zitholele Consulting on the details provided.

The Draft Environmental Impact Report (DEIR) is available for comment from **Monday, 19 February 2018**. This DEIR has been distributed to the Organs of State, and copies thereof are available at strategic public places in the project area (see below).

VENUE	CONTACT DETAILS
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Lephalale Public Library cnr Joe Slovo & Douwater Road Lephalale	Mrs Johanna Ndoweni Tel.: 014 762 1453
Marapong Community Library 143 Chris Hani Street Marapong	Mr Sophonia Petja Tel.: 014 768 3927 Email: sophoniapetja@gmail.com
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ELECTRONIC COPIES	
Zitholele Consulting Website	http://www.zitholele.co.za/environmental/ under heading "EIA for Medupi FGD" and sub-heading "DEIR – February 2018"
Eskom Website	http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx under the heading "Medupi FGD"
Mathys Vosloo / Lebo Petlane	Available on CD on request via email Tel.: 011 207 2060 E-mail: fgd@zitholele.co.za

You may comment on the DEIR by:

- Completing the comment sheet;
- Writing a letter, or producing additional written submissions; and
- Emailing, faxing or calling the public participation office.

Due Date for comment on the DEIR is Thursday, 05 April 2018

SEND YOUR COMMENTS to:

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EXECUTIVE SUMMARY

Medupi Power Station is a greenfield coal-fired power station that forms part of the Eskom New Build Programme. Medupi Power Station has an installed generation capacity of 6 x 800 MW units and utilises a supercritical boiler and turbine technology designed to operate at higher temperatures and pressures, which allows for better efficiency of the power station. The result is an improvement of approximately 2 percentage points on the plant efficiency which equates to a reduced coal consumption of approximately 1 million tons per annum.

Electricity is generated in coal-fired power stations through combustion of coal. Coal is composed, primarily, of carbon along with variable quantities of other elements, chiefly hydrogen, sulphur, oxygen, and nitrogen. When coal is burned, the sulphur combines with oxygen to form, amongst other, sulphur dioxide (SO_2) and sulphur trioxide (SO_3). Due to the detrimental impact of high SO_2 concentrations associated with coal fired-power stations stringent air quality regulations have been implemented worldwide to combat the emissions sulphur oxides (SO_x).

Flue Gas Desulfurization (FGD) is a technology used to remove SO_2 from flue gases of fossil-fuel power plants, and from the emissions of other sulphur oxide emitting processes. Medupi Power Station is designed and constructed to be wet FGD ready, utilising limestone as a sorbent as per its Environmental Authorisation.

The Scoping Phase commenced in 2013 and was concluded in August 2015 with submission of a Scoping Report to the Department of Environmental Affairs (DEA), which was subsequently accepted with Plan of Study approved. During the execution of the Impact Assessment phase that followed, deviations on the development packaging were necessary to streamline the EIA application process for the Medupi FGD in order to fast track the application for authorisation and licensing of the FGD retrofit. Two bridging documents were prepared and submitted to I&APs to inform stakeholders of the proposed changes to EIA scope.

Subsequent to the aforementioned changes the EIA scope includes assessment of the construction and operation of a rail yard/siding to receive Limestone and transport gypsum via rail, the installation of diesel storage facilities within the FGD and rail yard footprint, the construction and operation of the wet FGD system as well as associated infrastructure required for operation of the FGD system, the handling, treatment and conveyance of gypsum and effluent, the construction and operation of a Waste Water Treatment Plant (WWTP), and the management, handling, transport and storage of salts and sludge generated through the waste water treatment process at a temporary waste storage facility.

Specialists were appointed to undertake the relevant assessments to identify and assess impacts, and propose appropriate mitigation and management measures for the identified impacts. The specialist studies commissioned include an Air Quality Impact Assessment, Noise Impact Assessment, Geology and Soils Assessment, Geotechnical Assessment, Geohydrology Impact Assessment, Surface Water Assessment, Traffic Impact Assessment, Terrestrial Ecological (Fauna, Flora, incl. Avifauna) and Wetland Impact Assessment, Social Impact Assessment, Heritage Impact Assessment, and Waste Assessment. A number of studies were previously undertaken for the Medupi Power Station footprint, and as a result some of the commissioned

studies were tasked to assess these existing reports and data in order to provide a specialist opinion on the potential impact significance of identified impacts.

Possible feasible and reasonable alternatives associated with the FGD Retrofit project was considered, however, no feasible alternatives were identified for location of the FGD system and rail yard infrastructure. Furthermore, technology alternatives relating to the use of dry FGD, Wet FGD and Wet FGD with gas cooling technology installed to reduce water consumption by the FGD system were considered. It was concluded that due to high maintenance costs, specific characteristics of the ash, and availability of space within the existing power station footprint, the wet FGD system with gas cooler was not feasible at the Medupi Power Station.

The no-go option is to continue the operation of the Power Station without the FGD retrofit. However, this will result in the MPS operating in contravention of the conditions of its Air Emissions License. To remain compliant to legislation, the MPS would need to shut down operation. This would have a catastrophic impact on the South African economy and the stability of electricity supply to southern Africa. It can therefore be considered that the No-Go Option is fatally flawed for these reasons.

The FGD system, rail yard and associated infrastructure will be situated within the authorised development footprint of the Medupi Power Station as a whole. It was therefore noted that the FGD retrofit activities, besides the proposed area where the rail yard and associated structures will be constructed, will occur predominantly within an impacted footprint. This development area has already been rezoned for industrial and economic purposes in light of the development of the Medupi Power Station on this specific site.

AS a result of the development of the Medupi Power Station, existing pollution management measures such as clean and dirty water separation infrastructure, is already installed within the MPS footprint. This already provides some assurance that possible impacts originating from the FGD system and associated infrastructure will be managed within the existing pollution management system.

The specialist and impact assessments concluded that the potential impacts on geotechnical aspects, noise levels, heritage, archaeology and palaeontology, and traffic was expected to be minor and can successfully be mitigated to acceptable levels with proposed mitigation.

Assessment of the proposed air quality impacts has demonstrated what was anticipated, i.e. that implementation of the FGD system would significantly reduce the SO_2 emissions at the MPS to very low levels. However, within the MPS operations the FGD system will be a major consumer of water. This however is offset by a water allocation from MCWAP Phase 1 and 2.

The potential impact on local communities and social aspects is expected to have an overwhelmingly positive impact. Reduction of SO_2 levels once the FGD system is operational is the primary positive impact that will result in better quality of life in the regions. Additionally, indirect positive impacts resulting from growth in the local economy and greater employment opportunities will be significant.

Overall the impact of the installation of the FGD system, rail yard and associated infrastructure will have a Moderate to High impact on the local biodiversity, and to a lesser degree, wetlands in close

proximity to the FGD. Although loss to intact vegetation types and habitat will be permanent for the life of the power station, impacts on fauna can be mitigated to more successfully to a greater extent.

The negative impacts associated with impacts on biodiversity and wetlands can be successfully mitigated to within acceptable levels, with the development contributing to the overwhelming positive impacts associated with the reduction in SO_2, significant benefits to the local economy and quality of life for local residents, Therefore, taking all of the findings, conclusions and considerations mentioned in this Draft Environmental Impact Report into account it is the reasoned opinion of the EAP that the proposed activities be authorised.

The EAP recommends the following general conditions to be included in the Environmental Authorisation (EA):

- The EA will be subject to the implementation of mitigation measures and conditions stipulated within the EMPr and this DEIR.
- Construction must commence within a period of 5 years
- EA will be valid for the life of the Medupi Power Station, subject to revisions and amendments through legislated procedures as the need arise.
- Eskom must continue to investigate water saving measures for its power generation fleet.
- Eskom must continue to investigate mechanisms for waste reduction or minimisation, especially relating to the re-use of ash and gypsum. This has the potential to unlock further economic benefits for local communities living near power stations.

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ABBREVIATIONS

ADF	Ash Disposal Facility
AEL	Atmospheric Emissions License
BMH	Bulk Material Handling
CaCl2	Calcium Chloride
CaF2	Calcium Fluoride
CO	carbon monoxide
CFB	Circulating Fluidized Bed
CCCW	Closed Cycle Cooling Water
CA	Competent Authority
CI	Conservation Important
CBA	Critical Biodiversity Area
dB	decibels
DMS	Degrees, Minutes and Seconds
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DM	District Municipality
DEIR	Draft Environmental Impact Report
DEMPr	Draft Environmental Management Programme
ESA	Early Stone Age
EI	Ecological Importance
ES	Ecological Sensitivity
ESA	Ecological Support Area
EAP	Environmental Assessment Practitioner
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMC	Environmental Monitoring Committee
EO	Environmental Officer
FFP	Fabric Filter Plant
FEIR	Final Impact Assessment Report
FGD	Flue Gas Desulfurization
FEPA	Freshwater Ecosystem Priority Area
FSL	Full Supply Level
Pty	Golder Associates Africa
GN	Government Notice
CaSO4•2H2O	gypsum crystals
HIA	Heritage Impact Assessment
HGM	Hydro-geomorphic
ID	Induced Draft
PM2.5	Inhalable particulate matter with an aerodynamic diameter equal to or less than 2.5 µm
IDP	Integrated Development Plan
IAIA	International Association for Impact Assessments
IEC	**International Electrotechnical Commission**
IFC	International Finance Corporation
LSA	Late Stone Age
LOS	Level of Service
CaCO3	Limestone
LM	Local Municipality
MgSO4	Magnesium Sulphate
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MPS	Medupi Power Station

MVA	Mega Volt Amp
MW	megawatt
MM5	Mesoscale Model version 5
mbgl	meters below ground level
MSA	Middle Stone Age
Mm3/a	million cubic metres per annum
mya	million years ago
MCWAP	Mokolo Crocodile Water Augmentation Project
NAAQ	National Ambient Air Quality
NAAQS	National Ambient Air Quality Standards
NDP	National Development Plan
NEMA	National Environmental Management Act
NEMA	National Environmental Management Act, No 107 of 1998
NEM:WA	National Environmental Management Waste Act, No. 59 of 2008
NEM:AQA	National Environmental Management: Air Quality Act, No 39 of 2004
NWMS	National Waste Management Strategy
NSS	Natural Scientific Services
NSRs	Noise Sensitive Receptors
SOx	oxides of sulphur
PoS	Plan of Study
PCD	Pollution Control Dam
PES	Present Ecological State
ROD	Record of Decision
SWP	Save Working Procedures
SEWs	**Semi-Ephemeral Washes**
SDBIPs	Service Delivery and Budget Implementation Plans
SIA	Social Impact Assessment
SLM	Sound Level Meter
SACNASP	South African Council for Natural Scientific Professionals
SANS	South African National Standards
SAWS	South African Weather Services
SDF	Spatial Development Framework
SWMS	Storm Water Management System
SIP	**Strategic Infrastructure Projects**
SO2	sulphur dioxide
SO3	sulphur trioxide
ToR	Terms of Reference
PM10	Thoracic particulate matter with an aerodynamic diameter of equal to or less than 10 µm
t/a	tons per annum
TOC	Total Organic Carbon
TIA	Traffic Impact Assessment
TFR	Transnet Freight Rail
VIA	Visual Impact Assessment
V	volt
WDF	Waste Disposal Facility
WML	Waste Management License
WWHC	Waste Water Hydrocyclone
WWTP	Waste Water Treatment Plant
WMA	Water Management Area
WRCS	Water Resource Classification System
WULA	Water Use License Application
WBPA	Waterberg-Bojanala Priority Area
WFGD	Wet Flue Gas Desulphurisation
WHO	World Health Organisation
ZLD	Zero Liquid Discharge

1 INTRODUCTION

1.1 Environmental Impact Assessment Content Roadmap

The purpose of this roadmap is to serve as a guide to indicate how the requirements of the Environmental Impact Assessment (EIA) process, as stipulated in the National Environmental Management Act, 107 of 1998 and the EIA Regulations of 2010 (GN543), have been complied with by linking the sections or chapters in this Environmental Impact Report (EIR). **Table 1-1** below provides a roadmap of where the requirements of GN543 are addressed in this DEIR.

Table 1-1: Environmental Impact Report Document Roadmap

GN 543 No.		Description	Relevant DEIR Part
31(2)(a)		Details of -	
	(i)	The EAP who compiled the report; and	Section 1.6
	(ii)	The expertise of the EAP to carry out an environmental impact assessment;	
31(2)(b)		A detailed description of the proposed activity;	Chapter 6: Project Description Table 5-1: Description of Listed Activities
31(2)(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 -	Section 6.2
	(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;	N/A
31(2)(d)		A description of the environment that may be affected by 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;	Chapter 8
31(2)(e)		Details of the public participation process conducted in terms of sub-regulation (1), including -	Chapter 3 and Section 4.5, Appendix F
	(i)	Steps undertaken in accordance with the plan of study;	Chapter 3, Section 4.1 and 4.2
	(ii)	A list of persons, organisations and organs of state that were registered as interested and affected parties;	Appendix F
	(iii)	A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and	Appendix F
	(iv)	Copies of any representations and comments received from registered Interested and Affected Parties (I&APs);	Appendix F, Comments from EIR phase will be included in FEIR
31(2)(f)		A description of the need and desirability of the proposed activity;	Chapter 2

GN 543 No.		Description	Relevant DEIR Part
31(2)(g)		A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	Chapter 7
31(2)(h)		An indication of the methodology used in determining the significance of potential environmental impacts;	Section 11.1
31(2)(i)		A description and comparative assessment of all alternatives identified during the environmental impact assessment process;	Chapter 7
31(2)(j)		A summary of the findings and recommendations of any specialist report or report on a specialised process;	Chapter 10
31(2)(k)		A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;	Chapter 10 and Chapter 11
31(2)(l)		An assessment of each identified potentially significant impact, including -	Chapter 11
	(i)	Cumulative impacts;	
	(ii)	The nature of the impact;	
	(iii)	The extent and duration of the impact;	
	(iv)	The probability of the impact occurring;	
	(v)	The degree to which the impact can be reversed;	
	(vi)	The degree to which the impact may cause irreplaceable loss of resources; and	
	(vii)	The degree to which the impact can be mitigated.	
31(2)(m)		A description of any assumptions, uncertainties and gaps in knowledge;	Chapter 9
31(2)(n)		A reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Chapter 14
31(2)(o)		An environmental impact statement which contains -	Chapter 13
	(i)	A summary of the key findings of the environmental impact assessment; and	
	(ii)	A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	
31(2)(p)		A draft EMPr containing the aspects contemplated in Regulation 33;	Appendix H
31(2)(q)		Copies of any specialist reports and reports on specialised processes complying with Regulation 32;	Appendix G
31(2)(r)		Any specific information that may be required by the competent authority; and	Appendix C, D and E
31(2)(s)		Any other matters required in terms of sections 24(4)(a) and 24(4)(b) of the Act.	N/A

1.2 Project Background

This project focuses on the environmental authorisation process for the Medupi Power Station Flue Gas Desulphurisation (FGD) Retrofit project. In the sub-sections below, background is provided about the Medupi Power Station (MPS), which is currently in construction.

1.2.1 Medupi Power Station (MPS)

Medupi Power Station is a greenfield coal-fired power station that forms part of the Eskom New Build Programme. Medupi Power Station is the fourth dry-cooled based-load power station in South Africa, following Kendal, Majuba and Matimba Power Stations.

Medupi Power Station is located about 15km west of the town of Lephalale in the Limpopo Province. Refer to **Figure 1-1** for the locality map indicating the position of the Medupi Power Station within the Lephalale Municipal area. The Power Station is situated on 883 hectares that was historically operated as a game and livestock farm (Bohlweki Environmental, 2006).

Medupi Power Station has an installed generation capacity of 6 x 800 megawatt (MW) units and utilises a supercritical boiler and turbine technology designed to operate at higher temperatures and pressures, which allows for better efficiency of the power station. The result is an improvement of approximately 2 percentage points on the plant efficiency which equates to a reduced coal consumption of approximately 1 million tons per annum.

Due to the low availability of water in the area, the station is dry cooled and is anticipated that it will use approximately 0.16 litres of water per kWh of electricity produced. This is expected to increase by an additional 0.2 litres of water per kWh when the Flue Gas Desulphurisation (FGD) plant is retrofitted later on.

Each generation unit produces gases that is channelled via ducts called flues to one of 2 chimneys where these gases, also referred to as flue gases, are released into the atmosphere. Each chimney receives flue gasses from three (3) generating units simultaneously.

The power station is currently under both construction and operational phase, with units 4, 5 and 6 already commissioned and operational while construction of units 1, 2 and 3 is ongoing.

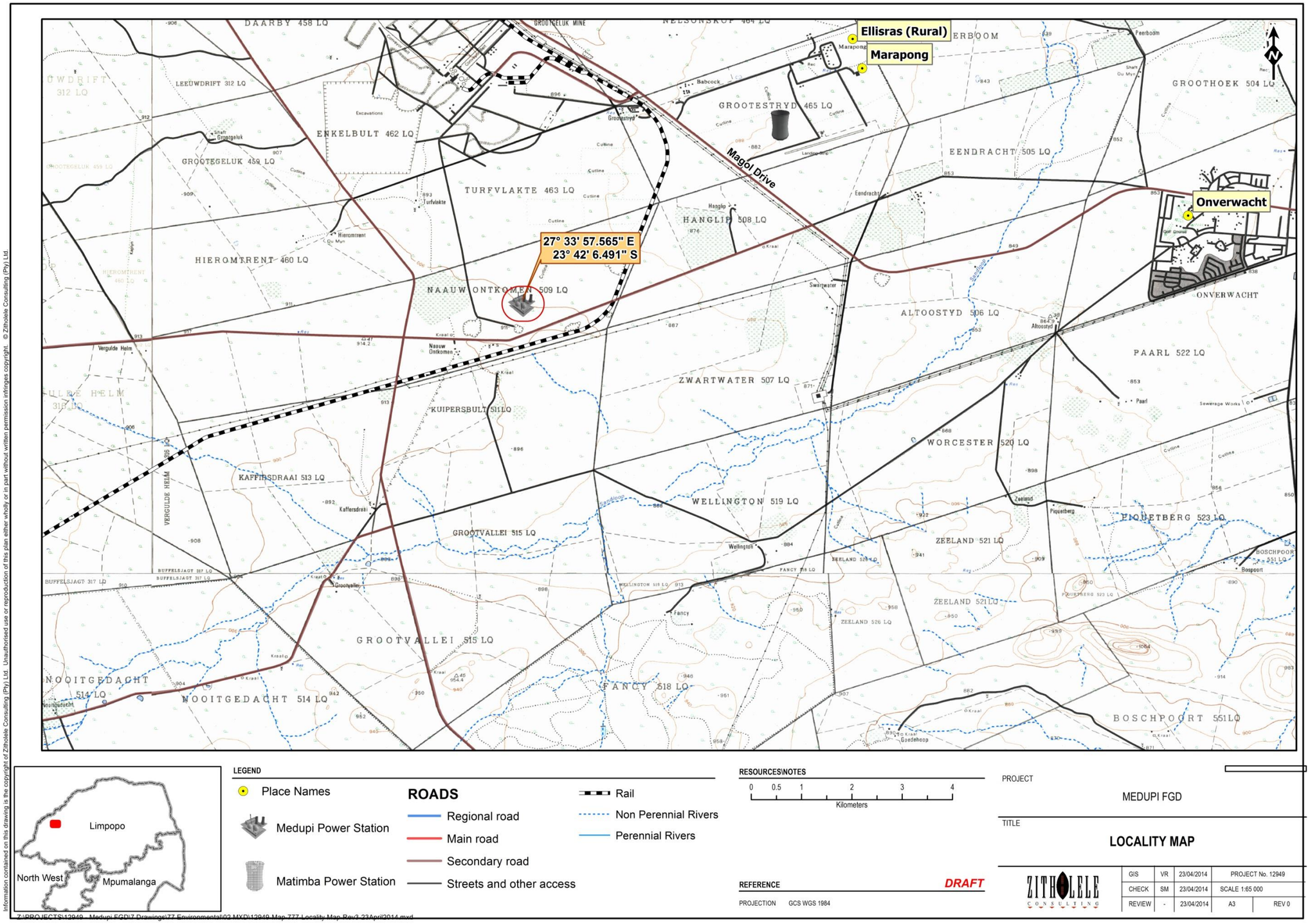


Figure 1-1: Project Locality Map

1.2.2 Generation of SO_2 at the coal-fired power station

Electricity is generated in coal-fired power stations through combustion of coal. Coal is composed, primarily, of carbon along with variable quantities of other elements, chiefly hydrogen, sulphur, oxygen, and nitrogen. When coal is burned, the sulphur combines with oxygen to form oxides of sulphur (SO_x), which include sulphur dioxide (SO_2) and sulphur trioxide (SO_3) (Eskom Holdings SOC Limited, 2017).

SO_2 contributes to the formation of acid rain, which damages forests, crops, buildings, fences and acidifies lakes, streams, and rivers, making them unsuitable for aquatic plant and animal life. In addition, inhalation of high concentrations of SO_2 irritates the nose, throat, and airways to cause coughing, wheezing, shortness of breath, or a tight feeling around the chest.

Stringent air quality regulations have been implemented worldwide to combat the emissions of SO_x. Since the major emission of SO_x is by coal-fired power stations, removing sulphur from the flue gas is a common technique for reducing these emissions (US EPA, 2016).

The six generation units at Medupi Power Station have been designed and constructed to accommodate the installation of wet limestone Flue Gas Desulphurisation technology which is a sulphur dioxide (SO_2) abatement technology. Each of the six generating units of the Power Station operates independently.

1.2.3 Flue Gas Desulphurisation

Flue Gas Desulfurization (FGD) is a technology used to remove SO_2 from exhaust flue gases of fossil-fuel (coal) power plants, and from the emissions of other sulphur oxide emitting processes. Medupi Power Station has been designed and constructed to be wet FGD / wet scrubbing ready, utilising limestone as a sorbent (as per its Environmental Authorisation).

In wet FGD systems, the flue gas normally passes first through a fly ash removal device, which may be either an electrostatic precipitator or a wet scrubber, and then into the SO_2-absorber that removes SO_2 from the flue gas through wet scrubbing. The sorbent that will be utilised for Medupi FGD Retrofit Project is Limestone ($CaCO_3$).

Wet scrubbing is a process where spray towers spray water in the form of water dropplets into the scrubbing chamber, thereby allowing a reaction between the water and SO_2 in order to entrain the SO_2 into water, which is then collected. The remaining flue gas thereafter returns to the chimney stack and is released into the atmosphere with a much reduced SO_2 content.

An important design consideration associated with wet FGD systems is that the flue gas exiting the absorber is saturated with water and still contains some SO_2. These gases are highly corrosive to any downstream equipment such as fans, ducts, and stacks. Since the

SO_2 is an acid gas the typical sorbents or other materials used to remove the SO_2 from the flue gases are alkaline.

1.2.4 Existing infrastructure at Medupi Power Station (MPS) associated with FGD system

The Medupi Power Station units have been designed, and constructed, with provisions incorporated into the space and equipment designed to accommodate the installation of the wet limestone FGD system. Each of the six generating units of the Power Station operates independently, while common facilities for all 6 generation units are provided for electricity, water, coal supply and coal combustion waste disposal.

Each generating is constructed with fabric filters and Induced Draft (ID) fans. The fabric filters remove most of the particulates from the coal combustion process and the ID fans provide necessary draft to overcome system resistance. The ID fans were designed to accommodate additional system resistance expected due to the installation of the FGD equipment (Harris, 2014).

The ID fans currently discharge flue gas directly to the chimney from each of the three (3) generating units linked to each chimney. The FGD system will include additional dampers and ductwork to divert the flue gas to the FGD absorbers and then return it to the chimney. The chimney flues are lined with corrosion-resistant liners to handle saturated flue gas expected from the operation of the FGD systems.

The inside diameter of the existing flues is adequate to cater for the flue gas volumes, while the existing chimneys will be reused with minor modification. The liner associated with the chimneys has sufficient transitional velocity for condensation re-entrainment to withstand the calculated worst-case design so that re-entrainment of moisture droplets will not occur.

1.3 Existing authorisations, licences and approvals

The Medupi Power Station received an environmental authorisation and other relevant licenses for construction and operation. One of these licences, the Atmospheric Emissions License (AEL), which was received in 2012, had conditions which require that the SO_2 emissions from the Power Station be reduced by more than 90%. This is one of the key reasons for the initiation of the FGD retrofit.

All existing authorisations, approvals and licences received for the Medupi Power Station are summarised in **Table 1-2** below.

Table 1-2: Existing authorisations, approvals and licences issued for the Medupi Power Station

Authorisations / Permits / Licenses	Authority	Reference	Applicable legislation/ code of practice
Medupi Power Station Record of Decision (ROD)	DEA	12/12/20/695	ECA (73 of 1989); GNR 1182 & 1183
Afguns Road ROD	DEA	12/12/20/1179	NEMA (107 of 1998); EIA Regulations 2006; GNR385, 386 &387
Raw Water Dam & Pipelines ROD	DEA	12/12/20/1139	NEMA (107 of 1998); EIA Regulations 2006; GNR385, 386
Raw Water Dam & Pipelines ROD Amendment	DEA	12/12/20/1139	NEMA (107 of 1998); Environmental Authorisation
Environmental Authorisation Raw water Dam & Pipeline	DEA	12/12/20/2069	NEMA (107 of 1998); Environmental Authorisation; EIA Regulations 2010; GN R. 544
Telecommunications Mast ROD	DEA	12/12/20/1228	NEMA (107 of 1998); EIA Regulations 2006; GNR385, 386
Environmental Authorisation for the Coal Stockyard on Ash Dump site	DEA	14/12/16/3/3/1/531	NEMA (107 of 1998) as amended
Ash Dump Waste License	DEA	12/9/11/L50/5/R1	NEM:WA (59 0f 2008)
Environmental Authorisation for the Pollution Control Dams and associated infrastructure	DEA	14/12/16/3/3/2/666	NEMA (107 of 1998)Listing Notice 1 and 2 (GNR 544 - item 12 and 545 item 3, 15)
Coal stockyard (coal supply conveyor alignment)	DEA	12/12/20/695	NEMA (107 of 1998) as amended
Amended Medupi Atmospheric Emission License	LEDET	12/4/12L-W2/A3	NEM:AQA (39 of 2004)
Integrated Water Use License for the Medupi Power Station, August 2017	DWS	01/A1042/ABCEFGI/5213	NWA (36 of 1998)
Water Use License for additional dams and C&I	DWS	07/A42H/IG/6425	NWA (36 of 1998)
Eskom ash dumps designs: Medupi ash dump 1-2 year, Excess Coal Stockyard, temporary coal storage area and temporary effluent containment paddock	DWS	Letter 348-859600	NWA (36 of 1998)
Kroomdraai borrow pit permit	DMR	114/2009	MPRDA as amended
Grootvlei borrow pit permit	DMR	113/2009	MPRDA as amended
Tree removal permit (Eenzamheid)- Ash Site	DAFF	200 - 163625	National Forest Act (84 of 1998) as amended
Tree removal permit (Eenzamheid)- Haul Road	DAFF	200 - 163626	National Forest Act (84 of 1998) as amended
Tree removal permit (Turvlakte, Naauw Ontkomen, Hangklip, Kroomdraii, Kuipersbuilt and Grootvallei) - Medupi Power Station	DAFF	200 - 163627	National Forest Act (84 of 1998) as amended

1.4 Overview of Medupi FGD Retrofit Project

The current environmental authorisation process aims at describing the FGD retrofit process, identifying potential impacts of this process and providing management and mitigation recommendations. Throughout the Environmental Impact Assessment (EIA) under the National Environmental Management Act (NEMA) (Act 107 of 1998 as amended), information on the design, activities and impacts was investigated and documented to inform public comment and authority decision making. The environmental authorisation process was carried out in three phases:

1. The Project Inception;
2. Scoping Phase;
3. Impact Assessment Phase.

The process is currently in the Impact Assessment Phase, the objective of which is to assess significance of impacts generated to the environment and propose mitigation. During this phase specialist consultants undertake investigative work to rate the significance on an impact and to identify an effective mitigation initiative, and ascertain the efficacy of the mitigation to residual environmental impacts.

1.5 Proponent

Eskom Holdings SOC Limited (referred to hereafter as Eskom) is the largest South African utility that generates, transmits and distributes electricity. Eskom supplies approximately 95% of the country's electricity, as well as about 45% of the electricity used in Africa. The utility is the largest producer of electricity in Africa, is among the top seven utilities in the world in terms of generation capacity and among the top nine in terms of sales. Eskom plays a major role in accelerating growth in the South African economy by providing a high-quality and reliable supply of electricity.

To meet the growing demands for electricity in South Africa, Eskom has re-commissioned three mothballed power stations, upgraded existing facilities and built new infrastructure, including transmission lines and two renewable energy plants.

Additionally, Eskom initiated the building of additional power stations, including Medupi Power Station, Kusile Power Station and the Ingula Pumped Storage Scheme, as part of the new build programme to cater for the anticipated future electricity demands. The Eskom capacity expansion budget was estimated at R385 billion up to 2013 and is expected to grow to more than a trillion rand by 2026. Through the capacity expansion programme Eskom will double its capacity to 80 000MW by 2026.

To reduce the impact of emissions from power stations on air quality Eskom is:

- Constructing a FGD Plant at the Kusile Power Station as part of the development of the Kusile Power Station;

- Retrofitting an FGD Plant at the Medupi Power Station concurrently to the construction of the Medupi Power Station (this project);
- Retrofitting some of the existing power stations with better particulate emission reduction technologies; and
- Investigating the retrofit of desulphurisation technology at other power stations.

1.6 Details of Environmental Assessment Practitioner

Eskom appointed Zitholele Consulting (Pty) Ltd. to undertake the regulatory Environmental Authorisation (EA), amendment of existing Waste Management License (WML) Application and Water Use License Application (WULA) processes for the proposed Medupi FGD Retrofit Project. These processes are being undertaken independently as separate processes. This document deals with the Environmental Impact Assessment process for the proposed Medupi FGD Retrofit Project

Zitholele Consulting (Pty) Ltd. is an empowerment company formed to provide specialist consulting services primarily to the public sector in the fields of Water Engineering, Integrated Water Resource Management, Environmental and Waste Services, Communication (public participation and awareness creation) and Livelihoods and Economic Development. Zitholele Consulting (Pty) Ltd has no vested interest in the proposed project and hereby declares its independence as required in terms of the EIA Regulations. **Table 1-3** provides the Environmental Assessment Practitioner (EAP) details.

Table 1-3: Details of the Environmental Assessment Practitioner

Name and Surname	Mathys Vosloo
Highest Qualification	Phd Zoology
Professional Registration	Pr.Sci.Nat. (400136/12)
Company Represented	Zitholele Consulting (Pty) Ltd.
Physical Address	Building 1, Maxwell Office Park, Magwa Crescent West, Waterfall City, Midrand
Postal Address	P O Box 6002, Halfway House, 1685
Contact Number	011 207 2079
Facsimile	086 674 6121
E-mail	mathysv@zitholele.co.za

1.6.1 Expertise of Environmental Assessment Practitioner

Dr Mathys Vosloo graduated from the Nelson Mandela Metropolitan University with a PhD in Zoology in 2012, after successfully completing a MSc in Zoology and BSc (Hons) in Zoology. Dr Vosloo is a member of the International Association for Impact Assessments (IAIA) and is a registered professional natural scientist (*Pr. Sci. Nat*.) in the field of Ecological Science with the South African Council for Natural Scientific Professionals (SACNASP) since 2012.

Dr Vosloo has been involved in electricity generation, transmission and distribution projects and their potential impacts on the environment for a large part of his career. Mathys has gained extensive experience in managing integrated environmental authorisation processes

and has successfully managed large projects through the phases of EIA in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and National Environmental Management Waste Act, 2008 (Act No. 59 of 2008). Mathys has also been involved in Water Use Licensing as a component of integrated authorisation processes.

Mathys has a comprehensive understanding of the relevant environmental legislation and works intimately with specialist consultants to ensure that potential impacts are accurately identified, assessed and mitigated. With his experience in similar projects, Dr. Vosloo is ideally positioned to manage this environmental authorisation process with integrity and independence, while advising the client toward alternatives that have less potential for environmental impact. Dr Vosloo' CV is attached to this report as **Appendix B**.

2 NEED AND DESIRABILITY OF THE PROJECT

2.1 Environmental and Health Motivation

One of the most significant air quality impacts of coal-fired electricity generation is the emission of SO_2 to the atmosphere. SO_2 reacts with other compounds in the environment to form particles that are a risk to human health. These small particles penetrate the tissue of the lungs and can cause emphysema and bronchitis and can aggravate existing heart disease (UN Environmental Protection Agency; 2014). Evidence has been documented of a connection between short term SO_2 exposure and adverse respiratory symptoms including bronchoconstriction and aggravated asthma.

At Medupi Power Station the uncontrolled SO_2 emissions for the design coal will be about 3,405mg/Nm^3, dry at 6% O_2. The Air Quality Act currently stipulates that the SO_2 emissions limit for existing plants is 3,500mg/Nm^3 at 10% O_2 by 31st March 2015, and 500mg/Nm^3 at 10% O_2 by 1st April 2020. The Eskom Air Quality Strategy currently stipulates that emissions should comply with 20% below legislated SO_2 emissions limit. This relates to a required compliance of 2800mg/Nm^3 at 10% O_2 by 2015, and 400mg/Nm^3 at 6% O_2 by 2020.

The flue gas desulphurisation process proposed for retrofit at the power station will reduce the SO_2 emissions by more than 90%. This brings the emissions to below the environmental protection threshold and reduces the impacts of the power station on the environment.

2.2 Socio-Economic Motivation

It must be noted that the Medupi Power Station is funded by the World Bank. In complying with one of the conditions of the World Bank loan agreement, Medupi Power Station must effectively reduce SO_2 emissions. The Medupi Power Station is part of an integral building plan to ensure that Eskom can meet the electricity demand projected for the future. Eskom must double its capacity to 80 000MW by 2026 for this purpose (Eskom website; 2014).

Medupi Power Station will increase the current Eskom generation capacity by 4 800MW. This is crucial to addressing the electricity demand in South Africa. Without the addition of the new power stations, such as Medupi and Kusile, the demands for electricity will not be met. This will significantly impact on the provision of basic services to a large percentage of the South African population.

Electricity brown-outs and black-outs have considerable social effects, which are most devastating on the low-income populations. These include compromise of health and safety to vulnerable communities. Furthermore, the loss of consistent electricity supply has massive repercussions on industry and economics of the country. Short and medium term unreliable electricity supply may have devastating impacts to large and small businesses due to loss in production and damage to equipment. This in turn will have a definite implication on our country's economy.

The reduction in SO_2 emissions by the FGD will mitigate potentially significant health impacts associated with SO_2 emissions. This is an important motivation for FGD, in terms of human health and welfare for the communities residing especially near the Medupi Power Station.

2.3 Need and Desirability

In accordance with the Regulation 31(2)(f) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment Regulations published in Government Notice No. R.543, this part of the Environmental Impact Report provides a detailed account of the Need and Desirability of the proposed Medupi FGD Retrofit project.

In considering the need and desirability of the proposed project, the strategic concept of the project along with the broader societal needs and public interest has been taken into account. In the Guideline on Need and Desirability (DEA, 2010) a number of questions formulated to guide the identification of the Need and Desirability of a proposed development are provided. The information provided in **Table 2-1** affords answers specific to the project at hand for each of the guiding questions contained in Section 5 of the Guideline on Need and Desirability (DEA, 2010).

Table 2-1: Assessment of the Need and Desirability of the Medupi FGD Retrofit Project

No.	Question	Description	Answer
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant authority?	Medupi Power Station was approved and is currently in construction phase. Therefore, it is evident that industrial development to promote economic growth and improvement to human welfare, in terms of provision of electricity, is an acceptable land use to the authorities for the period that the Medupi Power Station will operate. The Flue Gas Desulphurisation retrofit project is supplement to the Medupi Power Station to mitigate emissions to an acceptable level.	Yes
2.	Should the development, or if applicable, expansion of the town / area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time.	Since the Flue Gas Desulphurisation Project is a supplement to the existing and approved Medupi Power Station in order to mitigate emissions from the operation of the power station, it is imperative that the Flue Gas Desulphurisation retrofit is implemented and operational at the power station 6 years after the power station becomes operational.	Yes
3.	Does the community / area need the activity and the associated land use concerned (is it a societal priority)?	The Flue Gas Desulphurisation retrofit is proposed to mitigate the potential health impacts of the Medupi Power Station emissions on the airshed and the local/affected communities. Therefore, the community does indeed need this project to go-ahead as a societal priority in order to protect human welfare.	Yes
4.	Are the necessary services with adequate capacity currently available or must additional capacity be created to cater for the development?	Electricity will be made available by Eskom itself to power the FGD system at the Medupi Power Station. Sewage and waste water treatment infrastructure will be constructed as part of the development to cater for these services. Potable water will furthermore be procured via the existing raw water treatment plant associated with Medupi Power	Yes

No.	Question	Description	Answer
		Station, hence potable water for use within the station will be available. Sufficient raw water is currently available to operate the entire Medupi Power Station, as well as 3 of the 6 absorber units associated with the FGD system through Eskom's current water allocation from Mokolo Crocodile Water Augmentation Project (MCWAP) phase 1. Additional water, however, is required for the operation of the outstanding 3 absorber units associated with the Flue Gas Desulphurisation retrofit project. Eskom is currently undertaking the water use licence application process for the additional water requirements which will be abstracted via the MCWAP phase 2 to the Department of Water and Sanitation.	
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)?	This supplement to the Medupi Power Station is provided for within the municipal infrastructure planning and the project is a mitigation activity linked to the authorised power station. No additional development is required as all aspects of the retrofit will occur within and in close proximity to the Medupi Power Station and will be directly related to the operation of the Medupi Power Station.	Yes
6.	Is this project part of a National programme to address an issue of National concern or importance?	This project is a part of the Eskom project to address current and future electricity demand within Southern Africa. Ingula Pump Station, Kusile Power Station and Medupi Power Station are the key generation developments within the Eskom "build programme" to secure electricity supply for the next 50 years and has been identified as a Strategic Infrastructure Projects (SIP) (SIP 9: Electricity Generation to support socio-economic development) in terms of the Infrastructure Development Act, No 23 of 2014, and the National Development Plan (NDP).	Yes

Based on the answers that have been provided in **Table 2-1** it is evident that ample consideration has been given to the need and desirability of the proposed project. The determination of the need and desirability project also served as further confirmation that all reasonable measures have been taken to determine the best practicable environmental option.

3 PLAN OF STUDY (SCOPING PHASE)

3.1 Introduction

The Medupi Power Station has received environmental authorisation in 2007. The AEL was received by the Power Station in 2012 and stipulated conditions requiring the SO_2 emissions from the Power Station to be reduced by more than 90%. This is one of the key reasons for the initiation of the FGD retrofit.

Eskom appointed Zitholele Consulting in 2013 to act as independent Environmental Assessment Practitioner and undertake the EIA for the retrofit of the Medupi FGD system. Zitholele undertook a scoping phase during which a number of aspects related to the development of the Medupi FGD were considered. The Scoping Phase concluded with the submission of a Scoping Report to the Department of Environmental Affairs (DEA), which was subsequently accepted with Plan of Study approved, thus setting the scene for the environmental impact reporting phase to follow.

The approved Plan of Study is summarised in the following sections.

3.2 Proposed Plan of Study

The Plan of Study (PoS) for the EIR phase identified specialist studies that would be undertaken, detailed terms of reference for each specialist study, the proposed impact assessment methodology to be used, proposed public participation process that would be followed during the EIR phase, as well as the steps that will be followed during the EIR phase up to the submission of the Final Impact Assessment Report (FEIR) and announcement of the Competent Authority's decision.

A summary of the proposed actions relating to the proposed specialist studies as discussed in the PoS are provided below.

3.2.1 Utilisation of existing specialist studies

Considering that existing studies were undertaken for environmental aspects within the MPS footprint where the FGD infrastructure is earmarked to be constructed, the Plan of Study proposed that original specialist studies be utilised for the purposes of the FGD EIA process. These existing studies included:

- Soils, land capability and agricultural potential;
- Geology and Geotechnical investigations (Phase 1 geotechnical investigations);
- Surface water resources (aquatic) and wetlands (including wetlands delineation);
- Groundwater resources.
- Noise pollution;
- Visual impact;

- Ecology (Terrestrial flora and fauna and Avifauna assessment);
- Heritage impact studies;
- Traffic impact studies; and
- Socio-economic investigations.

Only summaries of these studies could be obtained and not details studies received. As such these studies could not be utilised. Due to process delays these studies moved out of the 5 year validity period and could therefore not be utilised.

3.2.2 Proposed specialist studies

Detailed terms of reference were provided in the PoS for the following specialist studies:

1. Waste Classification: The waste classification study would include the classification of ash, FGD gypsum, FGD WWTP sludge, and FGD WWTP Crystalliser Solids.
2. Socio-economic Impact Assessment for the proposed Medupi Flue Gas Desulphurisation Retrofit project. The focus of this SIA is on the impacts that the project is expected to have on the local socio-economic environment.
3. Ecology Assessment for Rail Yard and Limestone off-loading area: This would include assessment of floristic and faunal species composition, assemblages, communities, red data probabilities and general environmental attributes.
4. Air Quality Assessment for the assessment of the impact of the FGD system on the surrounding air quality and sensitive receptors.

3.2.3 Specialist studies related to the proposed waste disposal facility

The proposed waste disposal alternatives would be investigated in the EIR Phase of the project and as such the specialist studies that would be required would be site-specific and could not be confirmed at the conclusion of the Scoping Report. The Scoping Report thus concluded that additional specialist studies would be required specific to the location alternatives for the new disposal facility/ies. All required specialist studies would be carried out at the three alternative sites in order to inform the selection of the preferred site and the impact assessment on the preferred site.

3.3 Acceptance of Scoping Report and approval of Plan of Study

The Department of Environmental Affairs (DEA) received the FSR on 12 June 2015 and acknowledged receipt of the report on 26 June 2015. After assessment of the FSR and PoS, the DEA accepted the FSR and approved the PoS on 28 July 2015. Specific conditions associated with the acceptance included:

- All comments and proof of correspondence with relevant stakeholders must be submitted together with the FEIR;

- Should no comments be received, proof of attempts to obtain comments must be submitted together with the FEIR;
- Application form must be amended to include applicable waste listed activities as per GN R.921;
- FEIR to include one A3 regional map and locality maps that illustrate different proposed alignments and above ground storage of fuel;
- An application for Environmental Authorisation must be subject to the provisions of the National Heritage Resources Act, No 25 of 1999, and a letter from the pertinent heritage authority will be required; and
- Two copies of the EIR and at least one electronic copy (CD/DVD) of the complete final report must be submitted to the DEA.

4 PROCESS FOLLOWED DURING EIR PHASE

The Environmental Impact Reporting Phase commenced after acceptance of the Scoping Report and approval of PoS. During the execution, deviations on the development packaging were necessary to streamline the EIA application process for the Medupi FGD. These aspects shaped the EIR phase of the project which is discussed in the following sections.

4.1 Deviation from project packaging

Following the delay in the project schedule experienced during the compilation of the Screening Report, the proponent reached a decision in July 2016 to review the scope of the current EIA in order to fast track the application for authorisation and licensing of the FGD retrofit. The decision took the project schedule into account as well as commitments of the power station to other authorisation and license conditions, most notably the condition for the MPS to have the FGD infrastructure installed and operational 6 years after commissioning the first generation unit.

This section discusses the process of streamlining the EIA scope effected between July 2016, subsequent to acceptance of the FSR and approval of the PoS, and prior the release of the Draft Environmental Impact Report (DEIR) in February 2018.

4.1.1 Bridging Document 1

Due to the addition of an additional site to the screening process and changes to the EIA scope, a Bridging Document was prepared towards the end of 2016 and released to I&APs in November 2016 for information and comment. The Bridging Document is attached as **Appendix F-1** to this DEIR. The purpose of this document was:

1. To update all I&APs on relevant activities that had taken place between the end of the Scoping Phase (August 2015) and August 2016; and
2. To inform all registered I&APs of the changes in the scope of the EIA.

The Bridging Document highlighted the following changes in project scope:

- **New Disposal Facility:** Since the existing ADF at the MPS could only accommodate disposal of waste for the first 20 years of operational life, an additional facility was required to accommodate the remaining 30 years of power station operation. A new disposal facility for the disposal of gypsum, ash, FGD salts and FGD sludge for year 21 to year 50 post commissioning was required and the scope added to the EIA scope. Site screening was undertaken as discussed in **section** Error! Reference source not found. above.
- **Splitting of Integrated EIA:** Due to the requirement of the MPS to comply with the conditions of the AEL by April 2025, the installation of the appropriate FGD technology is time critical, and the application for an integrated authorisation must be accelerated in

order for the power station to remain compliant to the AEL conditions. The inclusion of future waste/ash disposal facility was creating challenges with respect to timeous project execution. A decision was, therefore, made to split the EIA into two (2) separate environmental authorisation processes, namely the future waste/ash disposal facility and the FGD-complex. The assessment of a new waste disposal facility for the disposal of gypsum, ash, FGD salts and FGD sludge were resultantly removed from the EIA scope and would be undertaken as a separate process under a new application and reference number. This process will follow Eskom's procurement processes to appoint an independent Environmental Assessment Practitioner to undertake the process. The assessment of the FGD-complex would continue under the current application.

- **Removal of existing ADF from EIA scope:** During the splitting of the EIA, it was recognised that the existing ADF already has a WML and thus the disposal of gypsum with ash at the authorised ADF would require amendments to the current WML. Therefore, it was decided to remove the existing authorised ADF from the scope of this EIA process. As a result, an amendment application will be submitted to have the existing WML amended to accommodate the disposal of gypsum at this facility.
- **Water Use Licence Application for this EIA:** A Water Use License Application (WULA) Process for all water uses associated with this EIA scope and application is currently underway. However, this WULA will not include the water use license for the abstraction of water from MCWAP Phase 2 take-off point. The abstraction water use license will be done separately as Eskom will be applying for the bulk water license that includes both water requirements for Medupi and Matimba. Eskom plans to submit the bulk water use license application with DWS before end of April 2018.
- **Environmental authorisation for the water supply pipeline from MCWAP Phase 2 take-off to Medupi Power Station Water Reservoir:** A separate environmental authorisations (EIA and WULA) will be undertaken for the transportation of water from MCWAP Phase 2 take-off point to Medupi Power Station raw water reservoirs. Zitholele Consulting has not been appointed to undertake this process. Therefore, this is not part of this application.

Bridging Document 1 concluded that the scope of this Integrated EIA process would not include assessment of the impacts of a new off-site waste disposal facility nor assess impacts associated with the disposal of gypsum together with ash on the existing authorised ADF. A separate WML amendment process was undertaken by Zitholele to assess such impacts. Zitholele Consulting would undertake a WULA for water uses associated with the FGD infrastructure, railway yard and water uses triggered due to the disposal of gypsum and ash together on the existing ADF.

4.1.2 Bridging Document 2

Towards mid-2017, some additional refinements to the EIA process were proposed. Resultantly, it was decided to draft a second Bridging Document to update all I&APs on the progression of the project since the first document in November 2016. A second Bridging Document was prepared towards the end of 2017 and released to I&APs in November 2017

for information and comment. This Bridging Document is attached as **Appendix F-2** to this DEIR. This document had three key objectives:

1. To update all I&APs on relevant activities that have taken place between the first bridging report and November 2017.
2. To update all registered IAPs of amendments to the Ash Disposal Facility Waste Management Licence (ADF WML) and licencing processes and updated project scope to complete the relevant applications.
3. To inform all registered IAPs on the way forward regarding the EA processes underway and expected timelines to completion and submission of the Final Environmental Impact Report (FEIR) and WULA to the authorities.

This Bridging Document highlighted the following changes in project scope:

- **Updates to specialist studies for WML amendment process:** The surface water and wetland study identified the need to reduce the approved footprint of the existing ADF in order to reduce potential impacts to the tributaries of the Sandloop River system, located to the south of the current ADF; and raise the height of the facility to optimise the facility. Resultantly, a flood line assessment was updated with fine-scale contour data, the ADF design was revisited to reduce the footprint, undertake amendment of the wetland specialist report and undertake a Visual Impact Assessment (VIA) to assess the impact of raising the authorised ADF height to 72m, from 60m.
- **Changes to the Integrated EIA application:** The scope of the Integrated EIA included assessment of the FGD infrastructure, temporary storage of WWTP solid waste (salts and sludge), temporary trucking of WWTP solid waste from the temporary storage facility to an appropriately designed and authorised off-site waste disposal facility, facilities for storage of limestone, construction of pollution control facilities and associated infrastructure, and construction of the rail yard. In order to further streamline the EIA process for the FGD system and in light of when detailed design information becomes available, a decision was made to remove the WML component relating to the storage of salts and sludge at a waste storage facility from the integrated EIA process. It is therefore proposed that the storage of hazardous waste, WWTP salts and sludge, would be registered in terms of Schedule C of GN 921 (list of waste management activities) of the NEM:WA. Management of these wastes in terms of Schedule C would require compliance with the relevant requirements and standards stipulated in the Norms and Standards for Storage of Waste (GN 926 of 29 November 2013). This registration process would therefore be undertaken independently of this EIA process, and resultantly does not form part of this EIA application going forward. This process will consider and assess the applicable NEMA activities in support of this registration process. The integrated EIA/WML application has therefore effectively changed to a standard EIA application.
- **Management of wastewater and effluent runoff from PCDs:** Activities relating to the storage of effluent, wastewater or sewage were removed from the NEM:WA and List of waste management activities (GN 921) subsequent to the last amendments to the

regulations. Assessment and management of the Pollution Control Dams (PCDs) now fall under the ambit of the NWA. This process will consider and assess the applicable NEMA activities in support of this registration process. Management and operation of the PCD will therefore invoke a water use and will be included in the current WULA being undertaken. The PCD will furthermore be designed to comply with GN 704 of 4 June 1999: Regulations on use of water for mining and related activities aimed at the protection of water resources.

The 2nd Bridging Document therefore concluded that the application for a WML for the operation and management of hazardous waste storage facilities for salts and sludge was no longer required and would be authorised through a registration process in terms of the Norms and Standards for the Storage of Waste. Operation and management of the PCDs would be licenced in terms of the WULA.

4.2 Confirmed scope of EIA application

Since submission of the FSR, a number of changes to the scope of the EIA became necessary. These changes relating to the scope of the EIA application are summarised in the foregoing sections. As a result the confirmed scope of work, this assessment in this DEIR includes assessment of the following activities and infrastructure:

1. Construction and operation of a rail yard/siding to receive Limestone via rail from source defined point at the existing rail network to the Medupi Power Station and proposed rail yard / siding, including a diesel storage facility for locomotives, and associated buildings and infrastructure. A second diesel storage facility will be constructed within the FGD footprint for refuelling of FGD generators;
2. Construction and operation of limestone storage area, preparation area, handling and transport via truck and conveyor to the FGD system located near the generating units of the Medupi Power Station;
3. The construction and operation of the wet FGD system that will reduce the SO_2 content in the flue gas emitted;
4. Construction and operation of associated infrastructure required for operation of the FGD system and required services to ensure optimal functioning of the wet FGD system;
5. The handling, treatment and conveyance of gypsum and effluent from the gypsum dewatering plant. Disposal of gypsum on the existing ADF is not included in this EIA and will be addressed in the ADF WML amendment application.
6. Pipeline for transportation of waste water from the gypsum dewatering plant and its treatment at a WWTP that will be located close to the FGD infrastructure within the Medupi Power Station;
7. Construction and operation of the WWTP;
8. Management, handling, transport and storage of salts and sludge generated through the waste water treatment process at a temporary waste storage facility. In terms of the EIA process impacts related to the management of salts and sludge will be considered in the

EIR. However, licencing of the storage activity and requirements relating to the waste storage facility will be assessed in the WML registration application process.

9. The transportation of salts and sludge via trucks from the temporary waste storage facility to a final Waste Disposal Facility (WDF) to be contracted by Eskom, for the first 5 years of operation of the FGD system. Long term disposal of salts and sludge will be addressed though a separate independent EIA process to be commissioned by Eskom in future.

4.3 Specialist assessments

Specialists were appointed to undertake the relevant assessments to identify, assess impacts and propose appropriate mitigation and management measures for the identified impacts. The specialists were initially contracted to investigate impacts associated with the development of a new waste disposal facility to receive ash, gypsum, and WWTP salts and sludge, however after the screening phase for this proposed facility the scope was removed from the current EIA process and specialists were tasked to assess impacts associated with the current scope provided in **section 4.2** above. Some specialists, subsequently, provided professional opinions of the expected impacts with the already transformed footprint within the MPS, based on previous studies undertaken in these areas. The specialists assessments, or in some cases opinions, that were commissioned include:

- Air Quality Impact Assessment
- Noise Impact Assessment
- Geology and Soils Assessment
- Geotechnical Assessment
- Geohydrology Impact Assessment
- Surface Water Assessment
- Traffic Impact Assessment
- Terrestrial Ecological (Fauna, Flora, incl. Avifauna) and Wetland Impact Assessment
- Social Impact Assessment
- Heritage Impact Assessment
- Waste Assessment

Although a Visual Impact Assessment was undertaken for the WML Amendment application due to the increased height of the ADF, this study did not take into account visual impacts associated with construction of the FGD infrastructure within the MPS or construction of the rail yard as potential visual impacts were deemed negligible because the existing visual character of the Medupi Power Station infrastructure surrounding the proposed infrastructure overshadows the FGD infrastructure.

4.4 Compilation of the DEIR and EMPr

The DEIR was compiled towards the end of 2017 and early 2018 as detailed information relating to the proposed engineering designs and specialist assessment became available. The Environmental Management Programme (EMPr) that is included in the DEIR as an appendix represents a concise document of impacts identified, proposed mitigation and management measures as well as monitoring requirements for the proposed development.

4.5 Public participation during the EIR Phase

This section deals with the Public Participation Process that was undertaken ongoing prior to the release of the DEIR. Due to the volume of the DEIR, the public participation process undertaken during the Scoping Phase was not

4.5.1 Purpose of the PPP

The purpose of the public participation process during the EIR Phase is to source comments and input on the DEIR and Draft Environmental Management Programme (DEMPr) by the public. I&APs are requested to comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

The DEIR includes the latest version of the CRR (**Appendix F**), which lists every issue raised with an indication of where the issue is dealt with in the technical evaluations, and the relevant findings, and also provides responses to the comments submitted. Through the PPP, stakeholders are notified of the availability of the DEIR and DEMPr for review and comments, and afforded an opportunity to engage with the project team at the public meetings to be held during the review period of the DEIR.

4.5.2 Availability of the DEIR and DEMPr

All I&APs registered on the proposed project's database will be notified of the availability of the DEIR and DEMPr, which will be made available at public places utilised during the Scoping Phase. Identified public places are provided in **Table 4-1**. The DEIR and DEMPr are also freely available in electronic format on Eskom's and Zitholele's websites as indicated in Table 4-1 below.

Table 4-1 : Public places where the DEIR is available

Venue	Address	Contact details
Printed Copies		
Lephalale Public Library	Civic Center Onverwacht, Cnr Joe Slovo and Douwater Road, Lephalale	Tel.: 014 762 1484, 014 762 1453 or 014 762 1518
Marapong Community Library	916 Phukubye Street, Marapong	Tel.: 073 210 8954
Lesedi Tshukudu Thusong Centre	Lesedi Tshukudu Thusong Centre, Steenbokpan	Tel.: 082 927 2399
Agri SA /Farmers Association	NTK Building, 1 Jan Louis Botha Avenue, Lephalale	Tel.: 014 763 1888
Electronic Copies		

Venue	Address	Contact details
Zitholele Consulting Website	http://www.zitholele.co.za/environmental/ under heading "EIA for Medupi FGD"	
Eskom website	http://www.eskom.co.za/OurCompany/SustainableDevelopment/EnvironmentalImpactAssessments/Pages/Environment_Impact_Assessments.aspx under the heading "Medupi FGD"	
Mathys Vosloo / Lebo Petlane	fgd@zitholele.co.za to request CD copy	

4.5.3 Invitation to Meetings

A Key Stakeholder Workshop (KSW) will be undertaken with all registered key stakeholders on the project database, including Organs of State (i.e. Government Departments / District & Local Municipalities), NGOs / NPOs Representatives, Representatives from the local Chamber of Commerce and Landowners.

Furthermore, it is proposed that three Public Meetings (PM) be undertaken. PMs are proposed to be undertaken within the Marapong and Leseding local communities to make it as easy as possible for members of these communities that do not have their own transport to be able to walk to the meeting venues. The third PM is proposed in the town of Lephalale. All I&APs are invited to any or all of these public meetings.

The date, venue and meeting arrangements for these meetings will be communicated with all I&APs together with the announcement of the availability of the DEIR for review and comment. The agendas, presentations, attendance registers and minutes for all meetings will be included in the FEIR to serve as a record of these meeting taking place and discussions held at these meetings.

4.5.4 Notification to I&APs of the submission of the FEIR

Once the FEIR and EMPr reports are submitted to the CA, a letter of notification will be sent to registered I&APs, indicating that the reports have been submitted and are available for review and should they want to receive an electronic copy, they can submit their request in writing to the Public Participation Office. The letter will also outline the next steps in the EIA process.

4.5.5 Announcement of Authority Decision

Once the DEA issues a decision, Eskom must, in writing and within 12 days of the date of the decision notify all registered I&APs of the decision. The DEA's reasons for decision, as contained in the copies of the DEA's decision, will be attached to the notice.

In addition to the notification to the registered I&APs, place a notice in the same newspaper(s) used during the foregoing PP Process for the project. The notices will inform I&APs of the DEA's decision and describe where copies of the DEA's decision can be accessed.

5 ENVIRONMENTAL LEGISLATIVE REQUIREMENTS

This part of the EIR is intended to provide a detailed account of all environmental legislation which may have bearing on the proposed project. Attention will be paid to the National Environmental Management Act, No 107 of 1998 (NEMA). NEMA is regarded as South Africa's Environmental Management Framework Act. An overview of sector specific environmental acts which govern specific elements or project activities and the relevance on the proposed project will also be provided. To ensure that Environmental Management Best Practice Principles are adhered to, all guidelines which are relevant to the proposed project activities have also been taken into consideration during the preparation of this EIR. Determining the applicability of all environmental management legislation is also fundamental in ensuring that all required authorisations, licences and permits are applied for and facilitating compliance with the applicable provisions of these Acts.

5.1 The Constitution of the Republic of South Africa, 1996 (Act No. 108 Of 1996)

The Constitution of the Republic of South Africa, 1996 (hereafter referred to as "the Constitution") is the Supreme Law in South Africa. The Bill of Rights is included in Chapter 2 of the Constitution. The Environmental Right is set out in Section 24 of the Constitution and states that –

Everyone has the right –

- to an environment that is not harmful to their health or well-being; and
- to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
- prevent pollution and ecological degradation;
- promote conservation; and
- secure ecologically sustainable development and use of natural resources,
- while promoting justifiable economic and social development.

5.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Act, No. 107 of 1998 (NEMA), as amended, is the primary statute which gives effect to Section 24 of the Constitution. The Environmental Right contained in Section 24 of the Constitution also places responsibility on the EAP, Applicant and Competent Authority to ensure that this right is not infringed upon. The Sector Guidelines for Environmental Impact Assessment (2010) (Government Notice 654[1]) describe

[1] Government Notice 654: National Environmental Management Act (Act 107 of 1998) Implementation Guidelines, Sector Guidelines for Environmental Impact Assessment Regulations, published in Government Gazette 33333, dated 29 June 2010.

several responsibilities which are placed on the EAP, Applicant and Competent Authority to ensure conformance with the statutory Environmental Right.

These responsibilities include:

- All parties to the EIA Process have a duty not to infringe other persons' rights in terms of Section 24 of the Constitution.
- The Applicant must ensure that while the development incorporates measures that prevent or control environmental pollution or degradation, it also maximises the positive environmental impacts.
- There must be an equitable balance between the rights of the applicant and the broader public. In this regard, the consideration of need and desirability is critical as it requires the strategic context of the development to be considered with the broader societal needs and public interest.
- The provisions of the Bill of Rights are binding on decision-makers.
- Decision-makers must ensure that their decisions are in keeping with the environmental right and promote an environment that is not harmful to health or well-being.

5.3 Environmental Impact Assessment Regulations, 2010

Because the Medupi FGD project was initiated and registered with the DEA in 2013, the EIA process is being completed in accordance with the (then active) EIA Regulations of 2010. This set of regulations (GN R 543 – 545) has subsequently been repealed by the EIA Regulations of 2014 (GN R982 – 985), as amended by GNR 325 - 327 (2017). **Appendix A** of the DEIR contains the amended EIA Application Form for the Medupi FGD project.

The Medupi FGD complex includes activities which trigger activities listed in the EIA Regulations Listing Notice 2 (GN R 545), therefore requiring Environmental Authorisation before they may be initiated. The proposed activities prompt a full Scoping and Environmental Impact Reporting Process. Each of the project activities as well as the corresponding listed activity is provided in **Table 5-1**. This table furthermore provides a comparison between the listed activities as presented in the EIA Regulations of 2010 and EIA Regulations of 2014, as amended.

Table 5-1: Description of Listed Activities

Activity listed in GNR 544 – 546 (2010)	Activity listed in GNR 325 & 327 (2017)	Applicability of the project activities to the Listed Activities
GN 544, Activity 9 The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water - (i) with an internal diameter of 0,36 metres or more	**GN 327, Activity 9** The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0,36 metres or more;	Construction of clean and dirty water infrastructure associated with the rail yard and FGD infrastructure is expected to be greater than 360mm and 1km in length.
GN 544, Activity 18	**GN 327, Activity 19**	It is likely that infilling or excavation

Activity listed in GNR 544 – 546 (2010)	Activity listed in GNR 325 & 327 (2017)	Applicability of the project activities to the Listed Activities
The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from: (i) a watercourse.	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	of more than 10m^3 within a watercourse may occur during construction of the rail yard and associated infrastructure.
GN 545, Activity 3 The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	**GN 325, Activity 4** The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	The construction of facilities or infrastructure for the storage, or for the storage and handling, of diesel within the FGD footprint and rail yard.
GN 545, Activity 11 The construction of railway lines, stations or shunting yards.	**GN 325, Activity 12** The development of railway lines, stations or shunting yards.	The construction of a railway tie-in line and yard for purposes of transport of products to the Power Station and waste products from the Power Station.
GN 545, Activity 15 Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.	**GN 325, Activity 25** The clearance of an area of 20 hectares or more of indigenous vegetation.	The total development footprint of the railway yard and associated infrastructure will be greater than 20ha, therefore the clearance of more than 20ha indigenous vegetation will be required.
GN 546, Activity 14(a)(i) The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation (*Exclusions not applicable*), (a) In Limpopo, in (i) All areas outside urban areas	**GN 325, Activity 25** The clearance of an area of 20 hectares or more of indigenous vegetation.	The area where construction of the rail yard and associated infrastructure will occur falls outside an urban area and is likely to result the clearance of 5ha of indigenous vegetation.

5.4 National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)

The National Environmental Management: Air Quality Act, No 39 of 2004 (NEM:AQA) is focused on holistic and integrated effects-based air quality management. It aims to manage adverse impacts of air pollution on the ambient environment and sets standards for pollutant levels in ambient air. At the same time it sets emission standards to minimise the amount of pollution that enters the environment.

Chapter 4 of the NEM:AQA specifically deals with air quality management measures, which are listed and include:

- Declaration of Priority Areas where ambient air quality standards are being exceeded
- Listing of activities that result in atmospheric emissions which may have a detrimental effect on the environment
- Declaration of controlled emitters and controlled fuels
- Implementation of Pollution Prevention Plans or Atmospheric Impact Reports; and
- Requirements for dust, noise and offensive odours.

Chapter 5 specifically deals with the licencing of listed activities through an Atmospheric Emission Licence. The MPS received an AEL for operation of the power station in 2015. An important condition of the AEL was that SO_2 abatement technology should be retrofitted to the power station within 6 years of each generation unit coming into operation. Regulatory requirements applicable to the MPS are discussed in the following sub-sections.

5.4.1 Minimum Emission Standards

Activities associated with the MPS trigger the Listed Activity - Category 1: Combustion Installations in terms of Government Gazette No. 37054 published on 22 November 2013, under the NEM:AQA. Additional Listed Activities that will be undertaken at the Medupi Power Station include Subcategory 2.4: Storage and Handling of Petroleum Products and Subcategory 5.1: Storage and Handling of Coal and Ore, and has also been licenced under the existing AEL.

The minimum emissions standards it is understood that the MPS would have to comply with "existing plant" standards until 1 April 2020, where the more stringent "new plant" standards would be applicable, i.e. compliance with SO_2 levels below 500mg/Nm³ under normal conditions of 10% O_2, 273 K and 101.3 kPa.

5.4.2 National Ambient Air Quality Standards for Criteria Pollutants

The air quality guidelines and standards are fundamental to effective air quality management, providing the link between the source of atmospheric emissions and the user of that air at the downstream receptor site. The ambient air quality standards are intended to provide safe hourly, daily and annual exposure levels for the majority of the population, including the very young and the elderly, throughout an individual's lifetime. The National Ambient Air Quality Standards (NAAQS) were determined based on international best practice for $PM_{2.5}$, PM_{10}, SO_2, NO_2, carbon monoxide (CO), ozone (O_3), lead (Pb) and benzene (C_6H_6), and is presented in Table 5-2 below.

Table 5-2: National Ambient Air Quality Standards

Pollutant	Averaging Period	Concentration (µg/m³)	Permitted Frequency of Exceedance	Compliance Date
Benzene (C_6H_6)	1 year	5	0	1 January 2015
Carbon Monoxide (CO)	1 hour	30000	88	Immediate
	8 hour[(a)]	10000	11	Immediate
Lead (Pb)	1 year	0.5	0	Immediate
Nitrogen Dioxide (NO_2)	1 hour	200	88	Immediate
	1 year	40	0	Immediate
Ozone (O_3)	8 hour[(b)]	120	11	Immediate
$PM_{2.5}$	24 hour	65	4	Immediate till 31 December 2015
	24 hour	40	4	1 January 2016 till 31 December 2029
	24 hour	25	4	1 January 2030
	1 year	25	0	Immediate till 31 December 2015
	1 year	20	0	1 January 2016 till 31 December 2029
	1 year	15	0	1 January 2030
PM_{10}	24 hour	75	4	1 January 2015
	1 year	40	0	1 January 2015
Sulfur Dioxide (SO_2)	10 minutes	500	526	Immediate
	1 hour	350	88	Immediate
	24 hour	125	4	Immediate
	1 year	50	0	Immediate

5.4.3 Waterberg-Bojanala Priority Area

The Medupi Power Station falls within the Waterberg-Bojanala Priority Area. Under the NEM:AQA, airshed priority areas can be declared where there is concern of elevated atmospheric pollutant concentrations within the area. The DEA identified the potential of an airshed priority area in the vicinity of the Waterberg District Municipality (Government Gazette, Number 33600; 8 October 2010). This was later expanded to include the Bojanala Platinum District Municipality, North-West Province (Government Gazette, Number 34631; 30 September 2011) and the Waterberg-Bojanala Priority Area (WBPA) was officially declared on 15th June 2012 (Government Gazette, Number 35435).

The Waterberg-Bojanala Priority Area Air Quality Management Plan: Baseline Characterisation was released for public comment on the 7th August 2014 (SAAQIS, 2014, access date: 2014-08-21). The Baseline Characterisation of the WBPA reported that power generation activities contribute 95% of SO_2, 93% of NO_2 and 68% of the particulate emissions across the Waterberg District Municipality.

5.5 The National Environmental Management Waste Act, 2008 (Act No. 59 of 2008)

All Waste Management Activities are regulated by the National Environmental Management Waste Act, No. 59 of 2008 (NEM:WA), as amended, and the regulations thereunder.

In order to regulate waste management activities and to ensure that they do not adversely impact on human health and the environment, the NEM:WA introduced a licensing process for the assessment and authorisation of waste management activities. A list of waste management activities that are likely to have a detrimental effect on the environment (GN 921 of 29 November 2013) was promulgated in terms of the NEM:WA, which included a number of amendments to date with the latest amendment effected on 24 July 2015 through the promulgation of GN R633.

5.5.1 List of waste management activities that have, or are likely to have, a detrimental effect on the environment (GN 921 of 29 November 2013)

All waste management activities which are listed in Government Notice (GN) 921, as amended, requires authorisation from the Competent Authority (CA) before these activities may proceed. GN 921 furthermore group waste management activities in this list according to the potential environmental harm that may result from the activity and as a result waste management activities were divided between 3 schedules.

Schedule A contain waste management activities that require a Basic Assessment Process to be undertaken in an integrated fashion with an application for a WML, while Schedule B contain waste management activities that require an EIA and Scoping processes to be undertaken together with an application for a WML. The third schedule, Schedule C, contain waste management activities that is subject to the conditions and specifications of promulgated Norms and Standards developed to prevent serious environmental harm from known impacts associated with each waste management activity.

Conformance with the stipulated Norms and Standards in Schedule C therefore avoids the need to apply for a WML with the CA. The proponent will however need to demonstrate conformance with the stipulations of these Norms and Standards through a registration process with the CA prior to constructing the waste facility.

5.5.2 Norms and standards for the classification, assessment and disposal of waste to landfill

Norms and standards for the classification, assessment and disposal of waste to landfill were promulgated in 2013 in 3 separate notices to manage the disposal of waste to landfill:

- GN R. 634: NEM:WA: Waste Classification and Management Regulations
- GN R. 635: NEM:WA: National norms and standards for the assessment of waste for landfill disposal
- GN R. 636: NEM:WA: National norms and standards for disposal of waste to landfill.

Owing to the nature and composition of the gypsum, sludge and salts, these by-products of the FGD process were classified in terms of the NEM:WA: Waste Classification and Management Regulations (GN R634 of 23 August 2013).

5.5.3 Norms and standards for the storage of waste

National norms and standards for the storage of waste were also promulgated in 2013 in GN R. 926 (29 November 2013), which provided norms and standards for the storage of hazardous and general waste. In terms of GN R. 926 a WML would not be required for waste storage facilities that conform to the stipulations and conditions in these norms and standards, however the waste activity and storage facility would need to be registered before commencement of the proposed waste activities with the relevant authorities.

5.5.4 Applicability of the NEM:WA

During the course of the EIA process the site screening assessment to investigate feasible alternative waste disposal sites for a new waste disposal facility indicated that most of the sites had challenges that would require extensive interventions, wchih would compromise delivery of this application. As a result the proponent reached the decision to remove the assessment and authorisation of the new waste disposal facility from the scope of this EIA process.

Furthermore, the disposal of gypsum together with ash on the existing authorised waste disposal facility west of the MPS would be licenced through an amendment application to the existing WML.

Due to the decision to remove the assessment of a new waste disposal facility for ash, gypsum, and WWTP salts and sludge from the scope of this EIA process, the management of the storage facility for the storage of salt and sludge would be undertaken through a registration process of the proposed waste storage facility in terms of GN R. 926, although triggered NEMA listed activities will be addressed in this application.

The licencing of proposed waste disposal and storage activities and facilities is resultantly removed from this EIA process although any activities associated with the waste facility will still be considered and included in terms of the NEMA Listed Activities..

5.6 The National Water Act, 1998 (Act No. 36 of 1998)

The activities associated with the proposed Medupi FGD Retrofit project trigger a number Water Uses that are defined in Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) (refer to Table 5-3). Accordingly, these Water Uses may not be undertaken without being granted a Water Use License from the DWS.

In accordance with Sections 40 and 41 of the NWA (1998), a Water Use License Application Process will be carried out. The resultant documents from the WULA process will include completed WULA forms as well as a Technical Report. These documents will be submitted to DWS for review and decision making. Although a joint PPP is followed for the WULA within the EIA Phase, these two processes constitute separate applications and submissions are made to the respective Competent Authorities.

Table 5-3: Description of Water Uses

Water Use	Applicability
Section 21 (c)	Construction activities associated with FGD system and rail yard carried out within the 500 m buffer of the water resources.
Section 21 (i)	
Section 21 (g)	Disposal of ash and gypsum into the ADF located on Eenzaamheid farm; storage of limestone at the limestone yard and gypsum at the gypsum storage facilities; disposal of runoff from the limestone and gypsum storage areas into the dedicated pollution control dams; using wastewater to undertake dust suppression on the ash disposal facility; temporary storage of waste materials before disposal at the licensed hazardous waste site outside Medupi Power Station; disposal of runoff from the ash and gypsum dump into the pollution control dams.

5.7 Additional Legislative Requirements

Several additional legislation and guidelines may have a bearing on the proposed Medupi FGD Retrofit project. Although authorisation in terms of these various acts may not necessarily be mandatory the requirements of these acts have been considered.

Table 5-4: List of additional applicable legislation

Act, Policies, Programmes and Guidelines	Relevance to project
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Relevant sections include Section 34: Structures. Structures which are older than 60 years may not be demolished without a permit issued by the relevant provincial Heritage Resources Authority. No structures older than 60 years were recorded in the Heritage Impact Study.
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Relevant sections include Section 35: Archaeology, palaeontology and meteorites. The findings of the Heritage Impact Study indicated that the possibility of finding fossils of a specific assemblage zone either in outcrops or in bedrock on the site could not be ruled out. It is likely that the fossils may be present on the site and the probability of finding fossils during the excavation phase is high. Any archaeological or paleontological objects that are found on the site, must be reported to the provincial Heritage Resources Authority. The discovered archaeological or paleontological objects may not be removed from its original position and damaged, destroyed or altered prior to a permit being issued by the heritage resources authority.
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Relevant sections include Section 36: Burial grounds and graves. Any graves that are discovered may not be destroyed, damaged, altered, exhumed or removed from its original position without a permit issued by SAHRA or a provincial heritage resources authority.
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Relevant sections include Section 38(1)(c): Heritage Resource Management. As the proposed development area may exceed 5000 m^2, with the submission of the Heritage Impact Assessment to SAHRA, the responsible heritage resources authority has been notified of the project and provided with information relating to the project. Authorisation to proceed with the development is required from SAHRA.
Hazardous Substance Act, 1973 (Act No. 15 of 1973)	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances, e.g. the storage and handling of diesel on site.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	Relevant sections include Section 53(1) and Section 53(2). The National Environmental Management: Biodiversity Act, No 10 of 2004 (NEM:BA) is aimed at protecting threatened ecosystems amongst other. This list is

Act, Policies, Programmes and Guidelines	Relevance to project
	published in Government Gazette 34809, 09 December 2011 (GN 1002: National list or ecosystems that are threatened and in need of protection). No listed threatened ecosystems are located within the proposed development footprint of the MPS or FGD.
National Environmental Management Protected Areas Act, 2003 (Act. 57 of 2003)	The NEM:PAA is focussed on the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes, and addresses, inter alia: • The protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; • The establishment of a national register of all national, provincial and local protected areas; • The management of those areas in accordance with national standards; • Inter-governmental co-operation and public consultation in matters concerning protected areas.
Water Services Act, 1997 (Act 108 of 1997).	This Act provides for, among other things, the effective water resource management and conservation.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	Relevant sections include Section 6. Provisions included in the act regarding the implementation of control measures for alien and invasive plant species must be adhered to. This act furthermore allows the control and prevention of veld fires through prescribed control measures.
National Forests Act (No 84 of 1998) and regulations	Relevant sections include Section 7. No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette.
	Relevant sections include Sections 12-16. These sections deal with protected trees, with the Minister having the power to declare a particular tree, a particular group of trees, a particular woodland, or trees belonging to a particular species, to be a protected tree, group of trees, woodland or species. In terms of section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.
Infrastructure Development Act, 2014 (Act No. 23 of 2014)	Relevant sections include Sections 7 – 8, and Schedule 1 and 3. This act provide for the facilitation and co-ordination of public infrastructure development of significant economic or social importance to the Republic, and to ensure that infrastructure development in the Republic is given priority in planning, approval and implementation. This Act identifies the development of power generation facilities as Strategic Infrastructure Projects (SIP) that must be fast-tracked to ensure realisation of socio-economic benefits.
National Road Traffic Act (Act No. 85 of 1993) (NRTA) and National Road Traffic Regulations, 2000 (GN R225, 17 March 2000) (NRTR)	Relevant sections include Chapter VIII of NRNR. Notwithstanding the conformance relating to driver fitness, vehicle fitness, adherence to road traffic signals and vehicle load transport regulations, Chapter VIII of the NRTR stipulated regulations for the transportation of dangerous goods and substances by road. Fuel, chemicals and hazardous substances will be transported to and from the MPS during construction and operation phases.
National Key Points Act, 1980 (Act 102 of 1980)	Provides for the protection of significant state assets, relative to national security. The act furthermore regulates the flow of information regarding Key Point activity and allows measures to be implemented to maintain the security of a Key Point. MPS is a national Key Point and the relocation of the security fence is required to accommodate the rail yard.

Act, Policies, Programmes and Guidelines	Relevance to project
Fencing Act (No 31 of 1963)	Relevant sections include 17. Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to protection of flora.
Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)	Relevant sections include Section 8. General duties of employers to their employees.
	Relevant sections include Section 9. General duties of employers and self-employed persons to person other than their employees.
Hazardous Substances Act (No 15 of 1973) and regulations	Regulates the classification, use, operation, modification, disposal or dumping of hazardous substances.
National Development Plan 2030 (NDP)	The National Development Plan aims to eliminate poverty and reduce inequality by 2030, through amongst others, accelerated economic growth. Security in power supply is critical for this to happen therefore development of the Medupi Power Station is key.
NEM:WA: National Waste Management Strategy (GN 344 of 4 May 2012)	The objects of the NEM:WA and National Waste Management Strategy (NWMS) are structured around the steps in the waste management hierarchy, which is the overall approach that informs waste management in South Africa. The waste management hierarchy consists of options for waste management during the lifecycle of waste, arranged in descending order of priority: waste avoidance and reduction, re-use and recycling, recovery, and treatment and disposal as the last resort. It is therefore necessary to consider the re-use and recycling of all waste produced by MPS, especially marketable wastes such as gypsum.
Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003)	This Act repealed the former Lebowa, Gazankulu, Venda and Northern Province Acts and the Nature Conservation Ordinance (Ordinance 12 of 1983). It provides the lists for Protected and Specially Protected species under Schedule 2, 3 and 12 as well as the stipulation for permit applications to remove these species. In addition it gives protection measures for the terrestrial and aquatic biota and systems. Schedule 9 lists aquatic plant species that are prohibited in the province.
Lephalale Local Municipality Final Integrated Development Plan (IDP) 2017/2018	The Integrated Development Planning is regarded as a tool for municipal planning and budgeting to enable municipalities to deliberate on developmental issues identified by communities. The Lephalale LM IDP recognises the vast socio-economic benefits that could be generated from the development and operation of the MPS. However, the development of the power station has also put tremendous pressure on the Municipality for the provision of more potable water, electricity, expansion of waste water treatment systems, and provision of acceptable transportation routes.
Lephalale Local Municipality Draft Spatial Development Framework (SDF) – May 2017	The Lephalale LM Draft SDF recognises the importance of the construction of the MPS and has highlighted the need to develop a multi modal transport network to optimise the movement of people and goods between nodes in the province to amongst other, the MPS.
Lephalale Local Municipality By-laws	Relevant bylaws include Waste Management By-law and Waste Management By-laws Offences and Fines.
White Paper on Environmental Management Policy for South Africa (1998)	Through this Policy, Government undertakes to give effect to the many rights in the Constitution that relate to the environment.
National Biodiversity Strategy and Action Plan (NBSAP)	The development of the NBSAP is part of South Africa's obligations as a signatory to the CBD, and was compiled by the Department of Environmental

Act, Policies, Programmes and Guidelines	Relevance to project
	Affairs and Tourism (DEAT 2005). Through the NBSAP it is recognized that biodiversity cannot be conserved through protected area networks only. All stakeholders, from private landowners and communities to business and industry must get involved in biodiversity management. The NBSAP highlights, in particular, that South Africa's rivers are poorly protected and that the present status of many of these freshwater ecosystems is disturbing. To ensure further protection and sustainability of South Africa's wetlands, the DWS (DWAF at the time) initiated the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP) and River Health Programme (RHP)
National Aquatic Ecosystem Health Monitoring Program (NAEHMP) & River Health Program (RHP)	The NAEHMP is a national programme managed by DWS's Resource Quality Services with support from the Water Research Commission (WRC), the Council for Scientific and Industrial Research (CSIR) and various regional and provincial authorities. The overall purpose of the NAEHMP is to provide ecological information for South African rivers and the broader aquatic ecosystems required to support the rational management of these systems. The best-known component of the NAEHMP is the RHP.
National Freshwater Ecosystem Priority Areas (NFEPA)	The NFEPA project is a multi-partner project between CSIR, South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water Affairs (DWA), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The NFEPA project aims to: • Identify Freshwater Ecosystem Priority Areas (hereafter referred to as 'FEPAs') to meet national biodiversity goals for freshwater ecosystems (through systematic biodiversity planning); and • Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers.
National Water Resource Strategy (NWRS) 2	The NWRS2 (DWA 2013) builds on the first NWRS published in 2004. The purpose of the NWRS2 is to ensure that national water resources are protected, used, developed, conserved, managed and controlled in an efficient and sustainable manner towards achieving South Africa's development priorities in an equitable manner over the next five to 10 years.
Limpopo Conservation Plan version 2, 2013	This conservation plan is consistent with NEMA principles and the NEMBA. It is designed to support integrated development planning and sustainable development by identifying an efficient set of CBAs that are required to meet national and provincial biodiversity objectives, in a configuration that is least conflicting with other land uses and activities. Where alternatives are available, the CBAs are designed to avoid conflict with existing IDPs, EMFs and SDFs in the region by favouring the selection of sites that are least conflicting with other land-uses.

To ensure that a best practice approach was adopted for the EIA Process and to ensure that the EIR provides sufficient information require by the DEA to reach a decision, the following guidelines have been considered in the compilation of this Environmental Impact Report:

- National Environmental Management Act, 1998 (Act 107 of 1998) Implementation Guidelines Sector Guidelines for Environmental Impact Assessment Regulations Government Notice 654 of 2010, published in Government Gazette 3333, dated 29 June 2010.

- National Environmental Management Act, 1998 (Act 107 of 1998) Publication of Need and Desirability Guideline in terms of the Environmental Impact Assessment Regulations, 2010, Government Notice 792 of 2012, Government Gazette 35746, dated 05 October 2012.
- Department of Water Affairs & Forestry, 1998. Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste.
- DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria
- Department of Environmental Affairs, 2011. A user-friendly guide to the National Environmental Management: Waste Act, 2008. South Africa. Pretoria.
- DEAT (2004) Criteria for determining Alternatives in EIA, Integrated Environmental Management, Information Series 11, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

6 PROJECT DESCRIPTION

6.1 Introduction

Eskom's Air Quality Strategy (Eskom Holdings SOC Limited, 2015) established a SO_2 emissions target of 400mg/Nm^3 at 6% O_2 for power stations commissioned between 2002 and 2017. This target complies with the minimum emissions standards stipulated by the National Environmental Management: Air Quality Act (Act 39 of 2004), which requires a concentration of 500mg/Nm^3 at 10% O_2. The Air Quality Strategy further recommended that the Medupi Power Station be fitted with a flue gas desulphurisation technology in order to comply with the emissions standards set.

In response to the Eskom Air Quality Strategy and funder requirements, the Medupi Power Station units have been designed, and constructed, with provisions incorporated into the space and equipment design to accommodate the installation of the wet limestone FGD system.

The Medupi FGD retrofit is designed to accommodate varying coal qualities ranging from design coal with low sulphur content up to "worst" coal quality with a higher sulphur content. The actual limestone composition that will be utilised is not yet defined as sourcing is still underway, but the process caters for the worst-case scenario limestone quality (with a 85% $CaCO_3$).

The development of the Medupi FGD system has been ongoing over a number of years, with a number of engineering specialists and service providers designing different aspects of the overall FGD system. As a result several documents have been compiled dealing with specific aspects, structures or infrastructure associated with the FGD system as a whole. A list of the relevant documents and reports that that were considered in this report are provided below:

- Harris, 2014. Medupi FGD Retrofit Conceptual Design Report. Unique Identifier 200-61771, Reference No.: 174330.40.1000. Eskom Holdings SOC Limited, 966pp
- Harris, 2014. Medupi FGD Retrofit Basic Design Report. Eskom Holdings SOC Limited, 105pp
- Black and Veatch, 2014. Medupi Power Station 6 x 800 MW (GROSS) Units Wet Flue Gas Desulfurization (FGD) Retrofit: Project Design Manual, 129pp
- Bosch Holdings Consortium, 2015. Basic and Detailed Design of Medupi Rail Yard and Offloading Facility, Project No.: P1184-099-1. Eskom Holdings SOC Limited, 124pp
- Harris, 2014. Medupi FGD Retrofit Technology Selection Study Report, Unique Identifier 474-10175, Reference No.: 178771.41.0050. Eskom Holdings SOC Limited, 23pp
- Knight Piésold Consulting, 2017. Medupi Power Station: Conceptual design of stormwater management, sewage infrastructure and access roads between boiler edge slab and road no.3 (ring road west) and design of the new gypsum offtake infrastructure

slab, associated drainage, and access roads, KP Ref No.: 303-00828/01 and Eskom Ref No.: 200-605353. Eskom Holdings SOC Limited, 130pp

- Aurecon, 2017. Medupi FGD Retrofit: Stormwater Design Report, Rev B. Document Ref. No.: 500332-0000-REP-WD-0001., Pretoria: Aurecon, 8pp
- Aurecon, 2017. Medupi FGD Retrofit: Water Balance Report, Rev B. Document Ref. No.: 200332-0000-REP-WW-0001., Pretoria: Aurecon, 17pp

The proposed Medupi FGD system does not only encompass the construction and operation of the FGD plant, but also include a number of associated services and infrastructure aimed at managing the transportation and handling of input material required to make the system work. The FGD process also deals with the management of waste and by-products resulting from the operation of the FGD plant and associated infrastructure.

To illustrate the basic concept of the FGD process a simple diagram is presented in **Figure 6-1**. The *FGD system* shown by the centre rectangle represents the infrastructure directly involved in the reduction of SO_2 levels. To the left of the *FGD system*, the FGD process receives **input material in the form of water and limestone**. The FGD process uses these input materials, amongst others, to "treat" **flue gas high in SO_2**, which is represented by the red rectangle below *FGD system*. Through the FGD process the SO_2 content of the flue gas is reduced significantly and **flue gas low in SO_2**, represented by the green rectangle above *FGD system* is released to the environment. The FGD process however produces **waste products as output** that must be handled, stored, transported and disposed. As a final step the FGD process must therefore cater for the management and disposal of the waste products in an environmentally responsible manner.

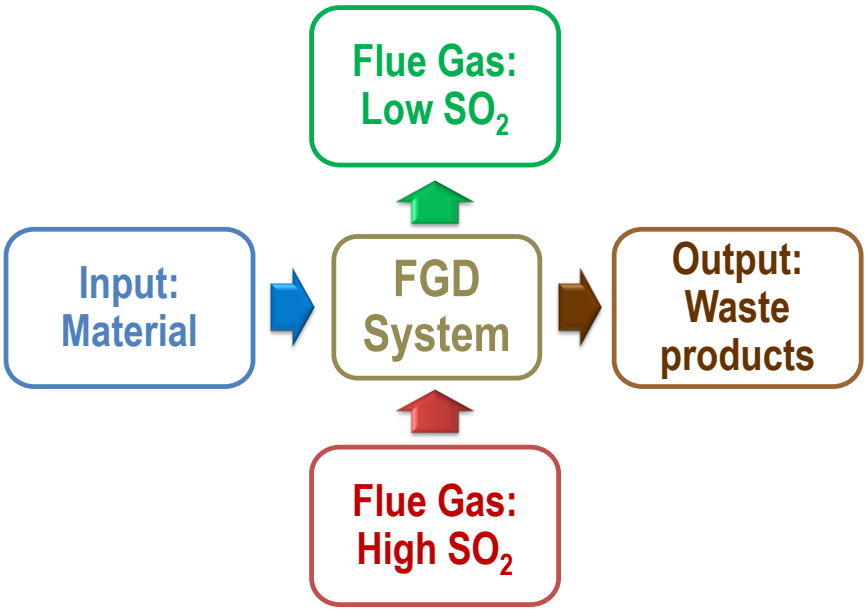


Figure 6-1: Simple diagram of FGD process

Box 1: The FGD process simplified and contextualised

A simplified process is described in **Box 1** below to contextualise the FGD processes for non-technical stakeholders.

6.2 Study area defined

The development site is located within the existing Medupi Power Station footprint. A detailed description of the development site is provided in **Table 6-1** below.

Table 6-1: Description of the project development site

Province	Limpopo	
District Municipality	Waterberg District Municipality	
Local Municipality	Lephalale Local Municipality	
Ward number(s)	Ward 4	
Nearest town(s)	Lephalale	
Farm name(s) and number(s)	Eenzaamheid 687 LQ	Naauw Ontkomen 509 LQ
Portion number(s)	Portion 0	Portion 0
Surveyor-general 21 digit site reference numbers	T0LQ00000000068700000	T0LQ00000000050900000
Current Land Use	Industrial	Industrial
Property Owner	Eskom Holdings SOC Limited	Eskom Holdings SOC Limited

The proposed development site has the following battery limits within the MPS property boundary, i.e. within the farm portions Eenzaamheid 687 LQ and Naauw Ontkomen 509 LQ.

Figure 6-2: Development footprint for the FGD Retrofit project

The development footprint for the proposed FGD system, Rail Yard and associated infrastructure is shown in **Figure 6-2**. The development footprint corner points are shown as points A – D, while the development footprint shape centre point, which was calculated by determining the centroid point, is shown as point E in **Figure 6-2**. The Latitude and longitude coordinates, in Degrees, Minutes and Seconds (DMS), are provided in **Table 6-2** below.

Table 6-2: Coordinates for the Medupi FGD Development Footprint within MPS

Development footprint point	Latitude (DMS)	Longitude (DMS)
Corner Point A	23°42'34.88"S	27°32'40.66"E
Corner Point B	23°42'6.17"S	27°33'41.45"E
Corner Point C	23°42'35.61"S	27°33'59.47"E
Corner Point D	23°42'59.82"S	27°32'35.65"E
Shape Centre Point E (Centroid)	23°42'42.03"S	27°33'15.92"E

6.2.1 Rail yard and associated infrastructure

The extent of the rail yard development area including associated infrastructure are defined as follow:

- The northern extent of the proposed rail yard development area is defined as the existing overland ash conveyor belt starting from the existing ash transfer house 8 in the east to last ash conveyor transfer house before the ADF.
- The eastern extent of the proposed rail yard development area is the approximate point where the existing ash transfer house 8 and existing railway mainline between Thabazimbi and Lephalale coincide.
- The southern extent of the proposed rail yard development area is defined by the existing railway mainline between Thabazimbi and Lephalale, from the existing ash transfer house 8 in the east to the an existing access road crossing over the railway line approximately 1.7km to the west of existing transfer house 8.
- The western extent of the proposed rail yard development area extends from the existing access road crossing over the railway line at the south eastern extent of the existing ADF for approximately 750m northeast to the last ash conveyor transfer house before the ADF.

Proposed gypsum and limestone conveyor belt system will cross the existing overland ash conveyor to complete the conveyance system in order to link the proposed rail yard with the FGD infrastructure within the Medupi Power Station footprint. The battery limits described above essentially form a scalene triangular shaped area and is shown in **Figure 6-3**.

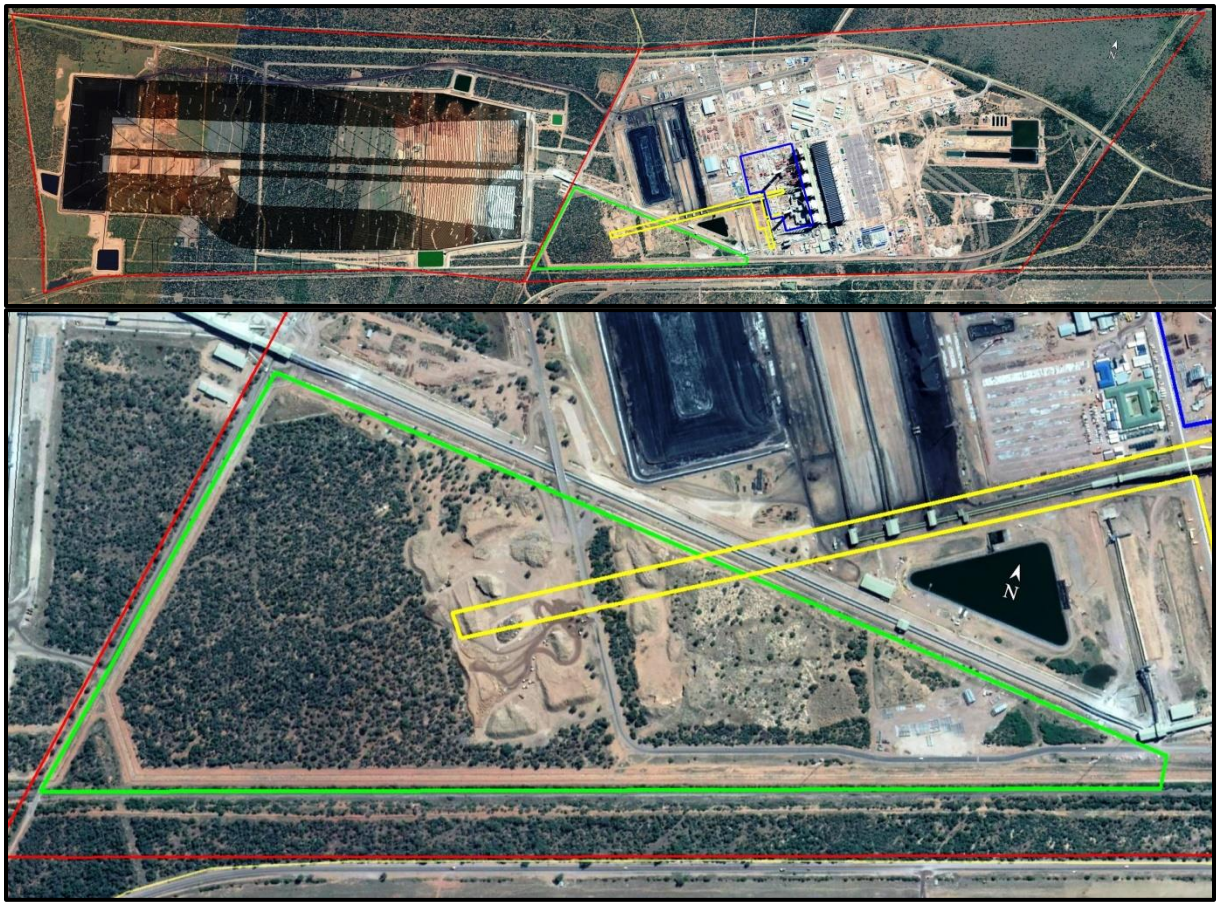


Figure 6-3: Proposed rail yard development area, including limestone and gypsum handling and associated infrastructure (green outline) between the MPS and existing ADF

6.2.2 FGD system and associated infrastructure

The FGD infrastructure is located within the footprint of the MPS. The area is currently under construction and totally transformed as can be seen in **Figure 6-4**.

The extent of the FGD infrastructure development area including associated infrastructure are defined as follow:

- The northern extent of the FGD infrastructure development area is characterised by an internal road, identified as North Street, and extends from the intersection with the internal road Ring Road West at the western extent for approximately 435m east to generation unit 1.
- The eastern extent of the FGD infrastructure development area is defined by the western front of the 6 generation units of the MPS. It is at this eastern extent where the FGD absorbers will be retrofitted to each Generation Unit.
- The southern extent of the FGD infrastructure development area aligns loosely with the southern extent of Generation Unit 6 and extends from Unit 6 westward along the inclined coal conveyor belt feeding the generation units up for approximately 230m westward to an internal road Ring Road West.

- The western extent of the FGD infrastructure development area follows Ring Road West a short distance northward after which it turns to the west up to the coal conveyor belt. From here it runs northward along and cross the northern coal conveyor belt where it turns to the left and extends to Ring Road West all the way to North Street.

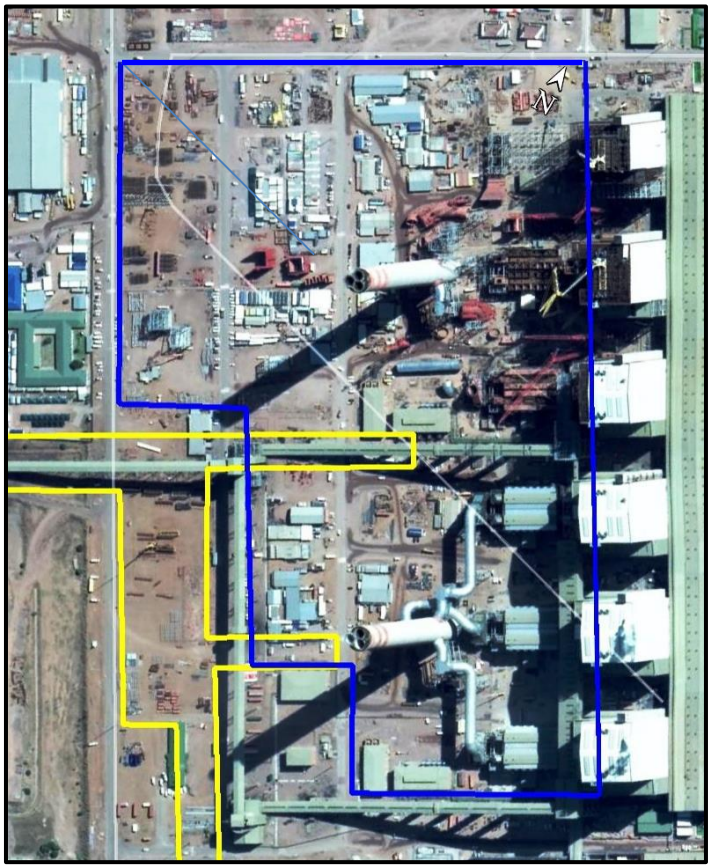


Figure 6-4: Proposed FGD development area (blue outline) within the MPS footprint

The approximate outline of the FGD infrastructure development area is spatially represented in **Figure 6-4**, as shown by the blue outline.

6.2.3 Conveyor alignment area

The conveyor alignment area that links the proposed rail yard infrastructure with the FGD infrastructure is represented by the yellow outlined area in **Figure 6-5**. This infrastructure follows the existing coal conveyor belt alignment from the rail yard in the west to the FGD plant in the east to deliver limestone for use in the FGD process.

Dewatered gypsum from the gypsum dewatering building is transported via conveyor southward to link with the overland ash conveyor system for disposal of gypsum on the existing ADF. Alternatively, it can be loaded onto vehicles at the transfer station prior to conveyance to the ADF.

In the event that a commercial offtaker of gypsum is secured, dewatered gypsum can be conveyed northwards to follow the existing coal conveyor belt back to the rail yard for temporary storage or loading onto locomotives for transport via rail.

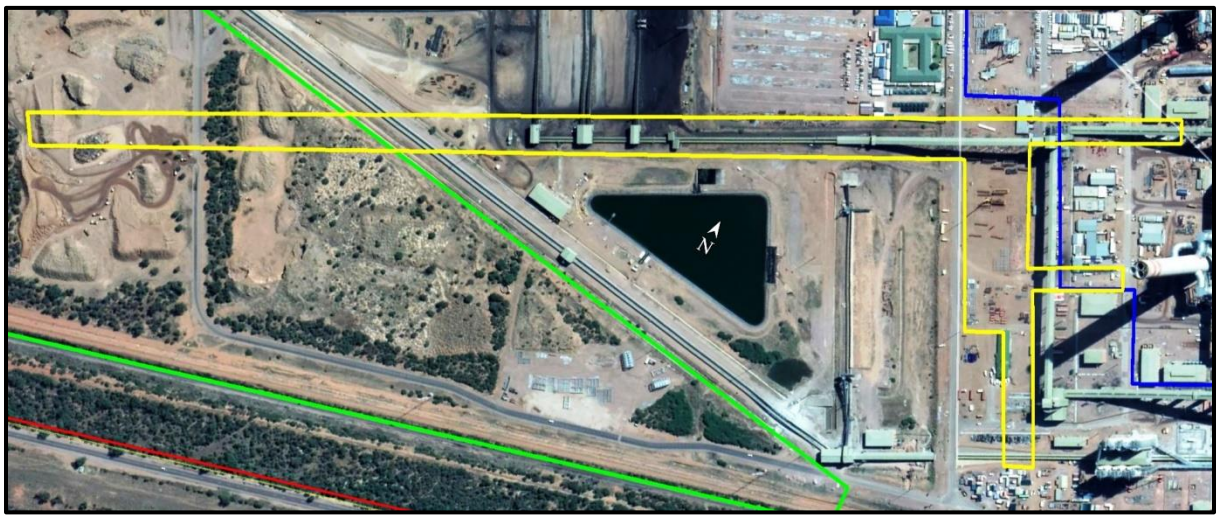


Figure 6-5: Conveyor alignment area linking the rail yard and FGD

6.2.4 Zone of influence of proposed development

Although the proposed infrastructure is confined to a development area within the MPS property boundary and footprint, the zone of influence of potential impacts that may result from the construction and operational activities associated with FGD retrofit may have a wider influence on the surrounding environmental and socio-economic environment. This may for example be the case where potential air quality impacts may extend beyond the Medupi Power Station footprint and impact surrounding communities. This zone of influence is characterised and contextualised during the specialist impact assessments that will be discussed in subsequent sections of the DEIR.

6.3 Structured overview of proposed FGD system

Medupi Power Station will be retrofitted with a wet limestone forced oxidation FGD system, in which limestone ($CaCO_3$, sorbent) reacts with gaseous SO_2 to form gypsum crystals ($CaSO_4 \cdot 2H_2O$), as a by-product.

During this process, as eluded to in Box 1, the FGD system will be dependent on a number of associated infrastructure and processes to receive and store limestone, prepare the limestone for use in the FGD system, divert flue gas from the 6 power generation units to the FGD system where it is scrubbed to extract SO_2, and is finally released to the environment. Lastly the waste and by-products from the FGD system is transported to storage areas prior to disposal or removal to a registered landfill site.

In order to better understand this intricate and complex system a basic process diagram is included in **Figure 6-6** below to aid understanding of how the system works and what inputs and outputs are associated with each stage of the process. As such, an overview of each of

the process “blocks” is provided below to contextualise each of the key processes and infrastructure requirements that forms part of the overall FGD system. The FGD system is represented by nine (9) process blocks as follows:

Block 1: Limestone is purchased off-site and is transported to the Medupi Power Station by rail. The limestone is offloaded at the proposed rail siding to be located south-west of the 6 power generation units within the Medupi Power Station footprint. The rail siding is a component of this environmental authorisation process. The initial deliveries will be by road, until the rail is commissioned.

Block 2: Limestone is prepared on site at an allocated facility. Preparation includes handling, stockpiling, milling and transportation via elevated pipe network.

Blocks 3: All the blocks numbered as “3” indicate the inputs to the absorber. These include the untreated flue gas from the power station, process water and oxidation air to facilitate the reaction, and the limestone which is the reagent. All of these are introduced to the absorber in appropriate states and volumes for the removal of sulphur from the flue gas.

Block 4: Represents the absorber where the reaction takes place to remove the sulphur from the flue gas. This reaction results in some output products (waste and by-products) that require treatment, re-use or disposal.

Block 5: Treated flue gas, with a much reduced sulphur content, is expelled from the system through the stacks (also referred to as chimneys) of the Medupi Power Station. The reaction will have reduced the sulphur content by up to 95% in order for the flue gas to comply with the minimum emissions requirements of 500mg/Nm^3 at 10% O_2.

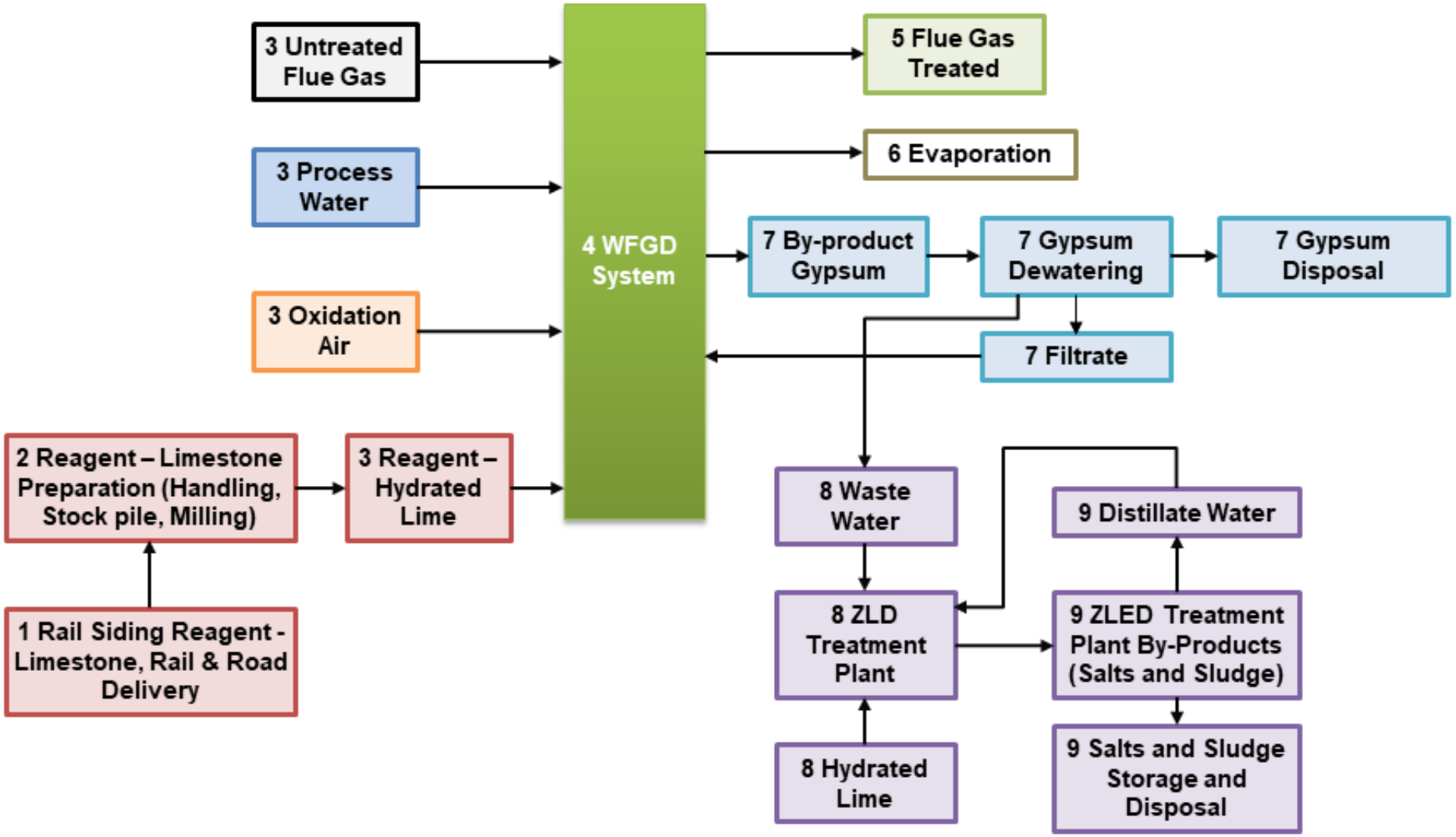


Figure 6-6: Basic Flow Diagram of Medupi FGD Process

Block 6: Some of the water utilised during the reaction is evaporated and lost by the system.

Blocks 7: Gypsum is formed as a by-product of the chemical reaction with the limestone. The gypsum exist the absorber (Block 4) in the form of a slurry, which needs to be dewatered in order to minimise loss of water from the system and to prepare the gypsum for re-use and/or disposal. The water or filtrate that is separated from the gypsum is reused within the process by returning it to the absorber as make-up water. The dewatered gypsum will be in crystallised state and will be stored for re-use or disposed of at a Class C Disposal Facility at the power station, together with the ash from the power generation process.

Blocks 8: Waste water is generated during the Gypsum dewatering process (Block 7) and is transported to a Waste Water Treatment Plant (WWTP) where lime is added in order to treat the waste water. This process produces by-products that will be either re-used or disposed in an environmentally responsible manner.

Blocks 9: By-products of the WWTP include a distillate, which is reused within the FGD process, and salts and sludge, which are Type 1 wastes and require disposal at an appropriately licenced facility. The salts and sludge will be disposed of at an existing Class A disposal facility (Holfontein, as an example) as a temporary measure, while a new Class A disposal facility located close MPS is investigated, designed, appropriately licenced and constructed.

A detailed description of each of the process blocks and associated infrastructure that forms part of the FGD system is provided in the sections that follow.

6.4 FGD System component: Railway siding (Block 1)

Block 1 of the Medupi FGD basic process diagram represents the construction and operation of a railway yard and siding west of the MPS between the power station and existing ADF. The rail yard will primarily handle bulk limestone, which will be used as a sorbent in the retrofitted FGD plant. The rail yard will provide a facility for the loading of bulk gypsum from the adjacent temporary storage area, which will be despatched from the rail yard depending on market demand (Bosch Holdings Consortium, 2015).

All information pertaining to the proposed railway siding was obtained from the *Basic and Detailed Design Report for the Medupi rail yard and offloading facility* compiled by the Bosch Holdings Consortium in 2015.

6.4.1 Rail yard overview

The scope of the new rail yard is to provide the MPS with a rail yard solution and rail operations that will ensure that the yard is capable of receiving and offloading approximately 1 200 000 tons per annum (t/a) of Limestone, and to be able to load and despatch approximately 400 000 t/a of Gypsum that has been generated through the FGD process and temporarily stored at the Gypsum Storage Facility adjacent to the rail yard, prior to dispatch (Bosch Holdings Consortium, 2015).

The proposed yard is situated just north of the existing Transnet Freight Rail (TFR) mainline which runs between Thabazimbi and Lephalale. The consideration of the railway yard site selection was governed by the following factors:

- The decision to use the existing rail way network to deliver limestone to the power station.
- The position and layout of the proposed FGD plant.
- Available space within the existing Medupi Power Station fence boundaries.
- The availability of existing services such as potable water, fire water and storm water drainage structures.

The location of the proposed siding take-off point is situated at kilometre point 107+128m on the Thabazimbi – Lephalale railway. A runoff line will be constructed from the TFR mainline into the Medupi Rail Yard, to allow the mainline train to rapidly exit the mainline and thus not to cause delays to train operation on the mainline. The rail yard will provide sufficient track to shunt 30 CAR wagons from the tippler and place them onto the departure line within the yard (Bosch Holdings Consortium, 2015).

The yard layout is in linear type configuration with six lines parallel to each other, and split into two separate yards and sections linked by means of a locomotive run-around line (**Figure 6-7**). The rail yard is designed to accommodate the simultaneous staging of two trains consisting of 60 type CAR wagons within the limestone yard and two trains consisting of 50 type CAR-wagons within the gypsum yard (Bosch Holdings Consortium, 2015).

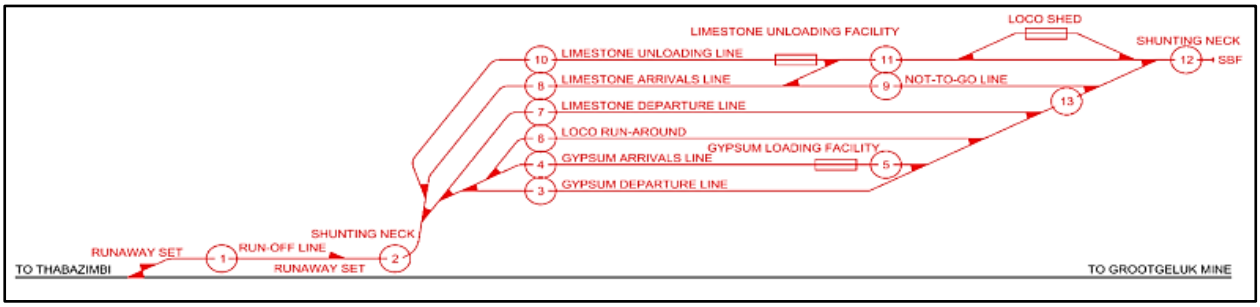


Figure 6-7: Schematic drawing of proposed railway line and yard configuration

It is anticipated that rail yard will include the following structures and infrastructure:

- Rail infrastructure;
- Administration building and operations tower for Eskom and TFR employees;
- Diesel locomotive workshop, utilities rooms and ablutions;
- Fuel Storage Area;
- Security office and infrastructure;
- Limestone offloading facility (Tippler building);
- Gypsum loading facility;
- Conveyor infrastructure;

- Sewerage and effluent management infrastructure; and
- Associated infrastructure (water, storm water, roads, lighting).

These structures and infrastructure are presented in the site layout drawing of the proposed rail yard which is attached as **Appendix D-1.** Relevant structures and infrastructure associated with the rail yard development is discussed in short in the sections that follow.

6.4.2 Limestone requirements and origin

Limestone will be purchased off-site and transported to the Medupi Power Station by rail and/or road. It is anticipated that limestone will be transported via existing rail/road network to the MPS from either Lime Acres in the Northern Cape, or Pienaarsrivier or Marble Hall in Limpopo. Confirmation of the Limestone source was not available at the time of compilation of the Environmental Impact Report (EIR).

6.4.3 Rail infrastructure

The rail infrastructure proposed to be installed within the rail yard is shown in the schematic drawing presented in **Figure 6-7**.

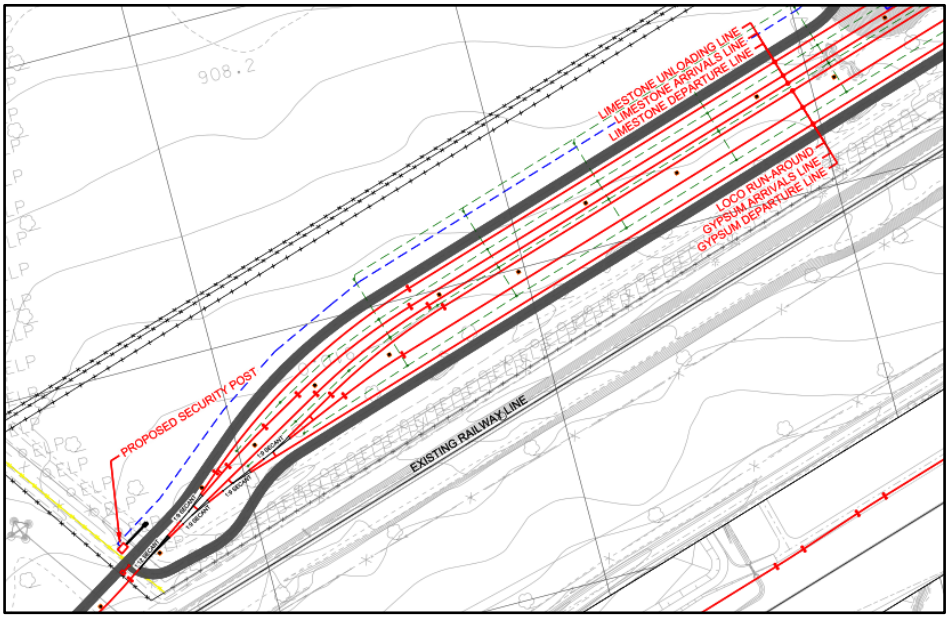


Figure 6-8: Proposed alignment and layout of the rail infrastructure

The general arrangement and layout of the rail infrastructure is shown in **Figure 6-8** and include the following:

- Limestone offloading line, shunt locomotive shed and shunting neck;
- Limestone arrivals line;
- Limestone departure line;
- Locomotive run-around line;
- Gypsum arrivals line with loading facility; and

- Gypsum departure line.

Figure 6-8 represents an excerpt from the General Arrangement Drawing of the proposed rail infrastructure provided in **Appendix D-2.**

6.4.4 Administration and operations tower

The proposed administration building will be located north east of the proposed new limestone offloading facility (tippler building) within the proposed rail yard (**Figure 6-9**). The administration building will allow for a staff contingent of 18, ablution and change room facilities, kitchen, entrance foyer, offices and operations tower. The rail yard operations room to be elevated to provide a view of the tippler building.

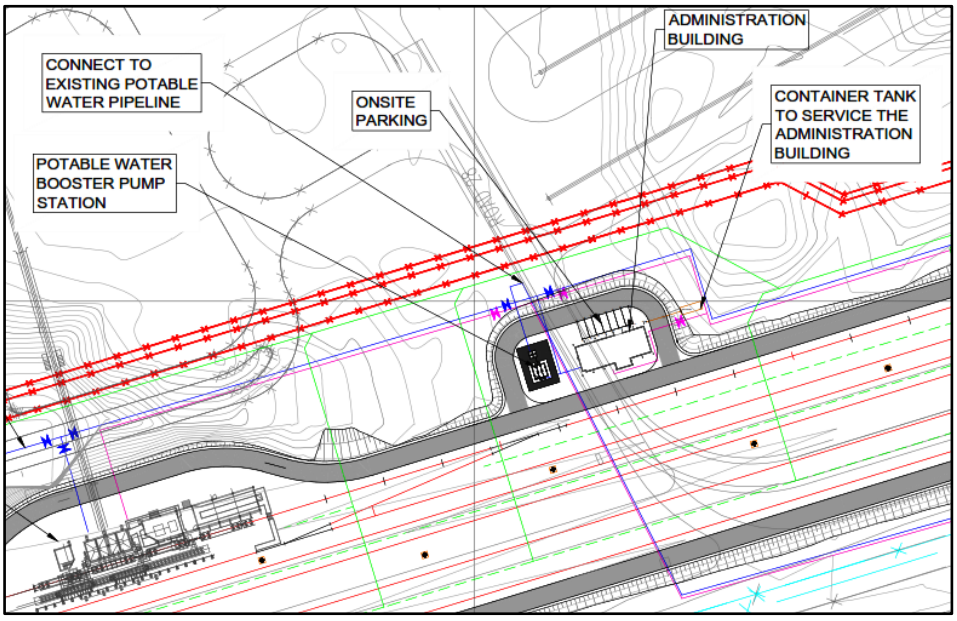


Figure 6-9: Proposed administration building and water booster pump station

Figure 6-9 represents an excerpt from the Site Layout Plan Drawing of the proposed rail infrastructure provided in **Appendix D-1**.

6.4.5 Diesel locomotive workshop, utilities rooms and ablutions

A diesel locomotive workshop area, including utilities rooms and ablution facilities, will be constructed toward the eastern extent of the rail yard (**Figure 6-10**). This area will be located south of the proposed Pollution Control Dam (PCD) 210. This workshop area will have approximately 600m² service area for the shunting locomotive and has various offices and store rooms (180m²) attached to one end of the building.

Fluids that will be stored in small quantities within the workshop building will include Benzene class 1 flammable liquid, trichloro-ethylene, carbon tetrachloride, engine oil, viscous oils, hydraulic oil, grease, battery acid and radiator fluid. With the exception of Benzene these fluids are all high flash point non-flammable products.

This building will typically fall under SANS classification D3 Low Risk Industrial therefore safety considerations for the storage of these fluids include a local standalone foam deluge system to provide fire protection to cover the benzene storage area.

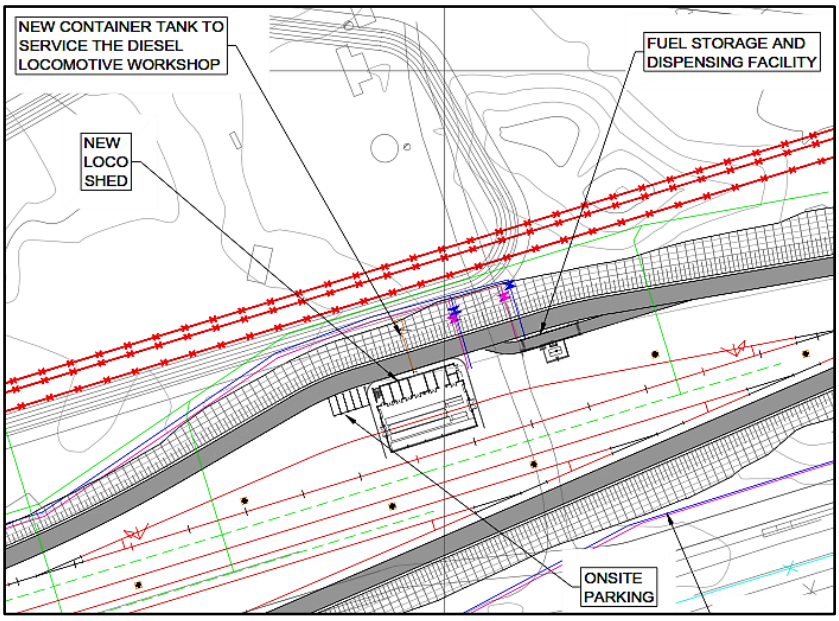


Figure 6-10: Proposed diesel locomotive workshop and fuel storage area

Figure 6-10 represents an excerpt from the Site Layout Plan Drawing of the proposed rail infrastructure provided in **Appendix D-1**.

6.4.6 Fuel Storage and Dispensing Facility

A Fuel Storage and Dispensing Facility will be located adjacent to the diesel locomotive workshop area where refuelling of the shunt locomotive will take place (**Figure 6-10**). This structure will consist of an open bunded area of approximately 6m wide x 10,5m in length for location of the diesel storage tank, which will be located in the centre of the bunded area. Diesel fuel is considered combustible but not flammable and the diesel storage tank will have a maximum installed storage capacity of 14 000 litres in one or two above-ground horizontal storage tanks. A covered road tanker decanting area will be located alongside the bunded area.

A second fuel storage area will be located close to the FGD complex area within the MPS and will contain a second diesel tank with a maximum installed capacity of 14 000 litres, which will be similarly bunded. This fuel tank will service the Emergency Generator at the FGD plant.

A third diesel tank will be located in the FGD common pump building with a capacity significantly less than the two larger tanks. It is anticipated that the maximum installed capacity of all diesel storage tanks will not exceed 28 000 litres.

The dispensing structure will be located immediately adjacent the fuel storage facility, and will consist of a concrete slab 4m wide x 10,5m long. The area will be covered by a

monopitch clad structural steel roof, supported on steel columns. Foundations for the columns will be located below the floor slab level.

6.4.7 Security office and infrastructure

The security office will be located adjacent the fence line at the western extent of the proposed rail yard where the proposed rail infrastructure ties in with the existing rail network (**Figure 6-11**). The existing three tier national key-point security fence will be moved from its current position to the northern boundary of the rail way yard in order to restrict direct access to the MPS from the railway yard due to National Key-point Security concerns. The existing service road fence will be used as the boundary fence to the rail yard.

Figure 6-11 represents an excerpt from the Site Layout Plan Drawing of the proposed rail infrastructure provided in **Appendix D-1**.

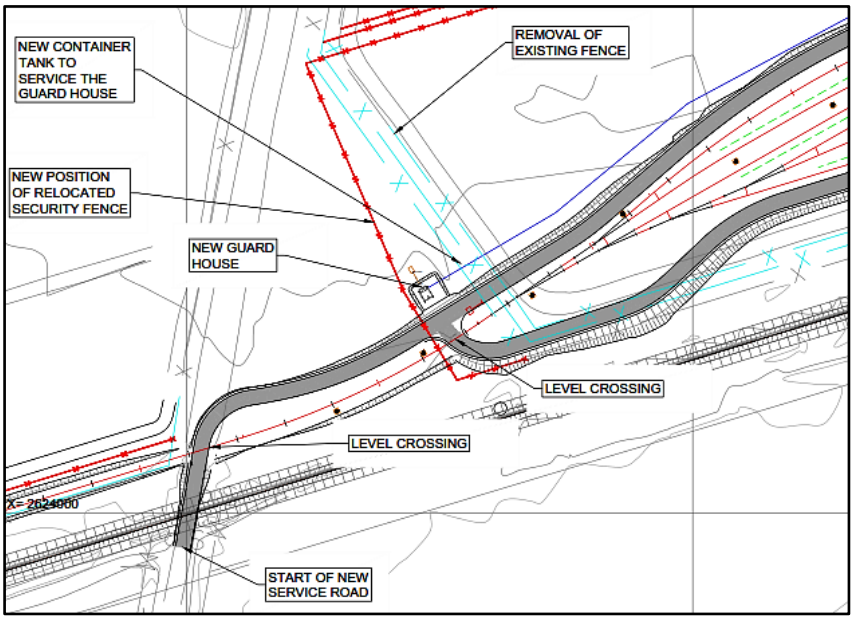


Figure 6-11: Proposed security office and relocated security fence

6.4.8 Sewerage infrastructure

The security office, locomotive workshop and administration building will be served with ablution facilities with a sewerage conservancy tank system each (**Figure 6-12**). The security office will be constructed with a 3200ℓ conservancy tank, while the administration building and locomotive workshop building will be constructed with an 8500ℓ capacity conservancy tank each. The container tank option is proposed due to the general site topography, distance from the network and limited information regarding the existing sewers. Draining of the conservancy tanks will occur every two weeks by means of a tank truck (Honey Sucker).

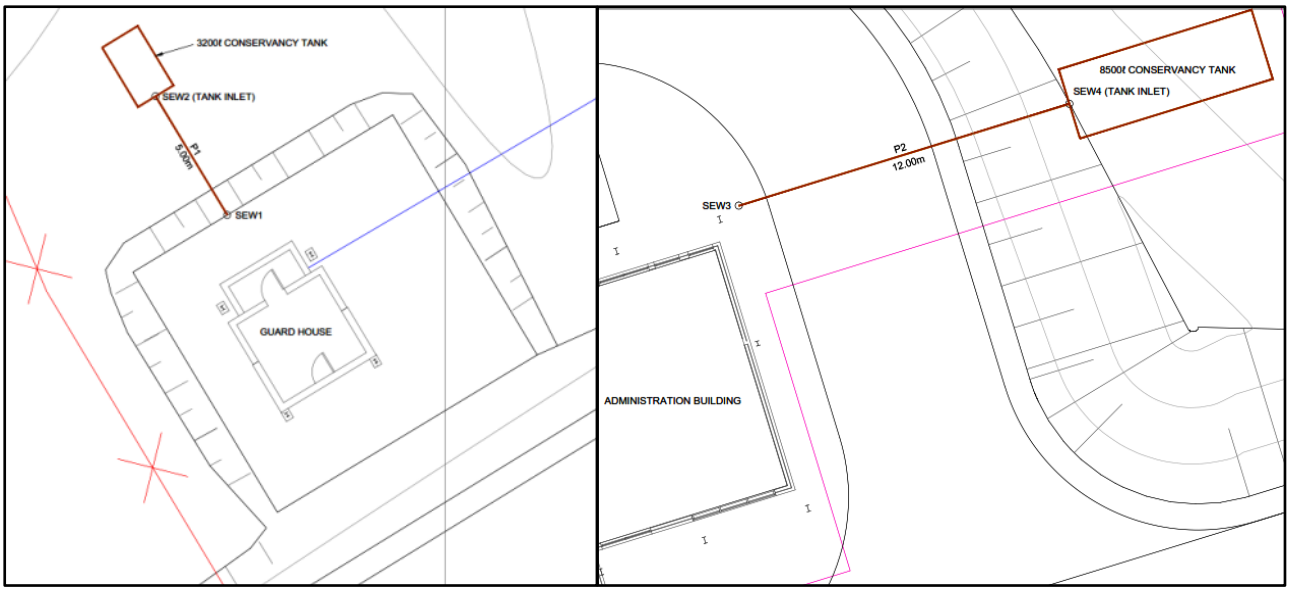


Figure 6-12: Conservancy tank sewerage systems located at the security office and administration building

Figure 6-12 represents an excerpt from the Sewer Layouts and Long Sections Drawing of sewerage infrastructure located within the proposed rail infrastructure provided in **Appendix D-3**.

6.4.9 Limestone offloading and conveyance

The limestone offloading infrastructure that will be associated with the railway yard will include the following infrastructure:

- Limestone rail offloading and receiving building, which will include the construction of a Tippler building to offload limestone from the locomotive cars (**Figure 6-13**);
- Limestone truck offloading and receiving area, located north of the limestone rail yard offloading facility and directly west of the limestone storage area;
- Limestone underground link conveyor 1 (**Figure 6-14**), which will transport limestone from the rail offloading facility to the Limestone transfer house 1;
- Limestone transfer house 1, which will transfer limestone received from the limestone underground link conveyor, and the Limestone Truck Off-loading Facility (**Figure 6-15**), to the limestone stacking conveyor; and
- Emergency limestone offloading area at the Limestone Stockpile itself, including associated access road network. Emergency offloading of lime from trucks will be done directly onto the limestone stockpile.

The Tippler building and infrastructure is shown in **Figure 6-13**. The Tippler is essentially a large cylinder or C-shaped metal structure into which locomotive cars are pushed. Once inside the Tippler the individual locomotive car is clamped and rotated to “tip” over the content of the car into a receiving structure called a hopper located below the tippler. A clip of a tippler machine and how it works can be viewed on the Youtube website at

https://www.youtube.com/watch?v=KDTgYb9qv3U (www.youtube.com, accessed on 09 January 2017).

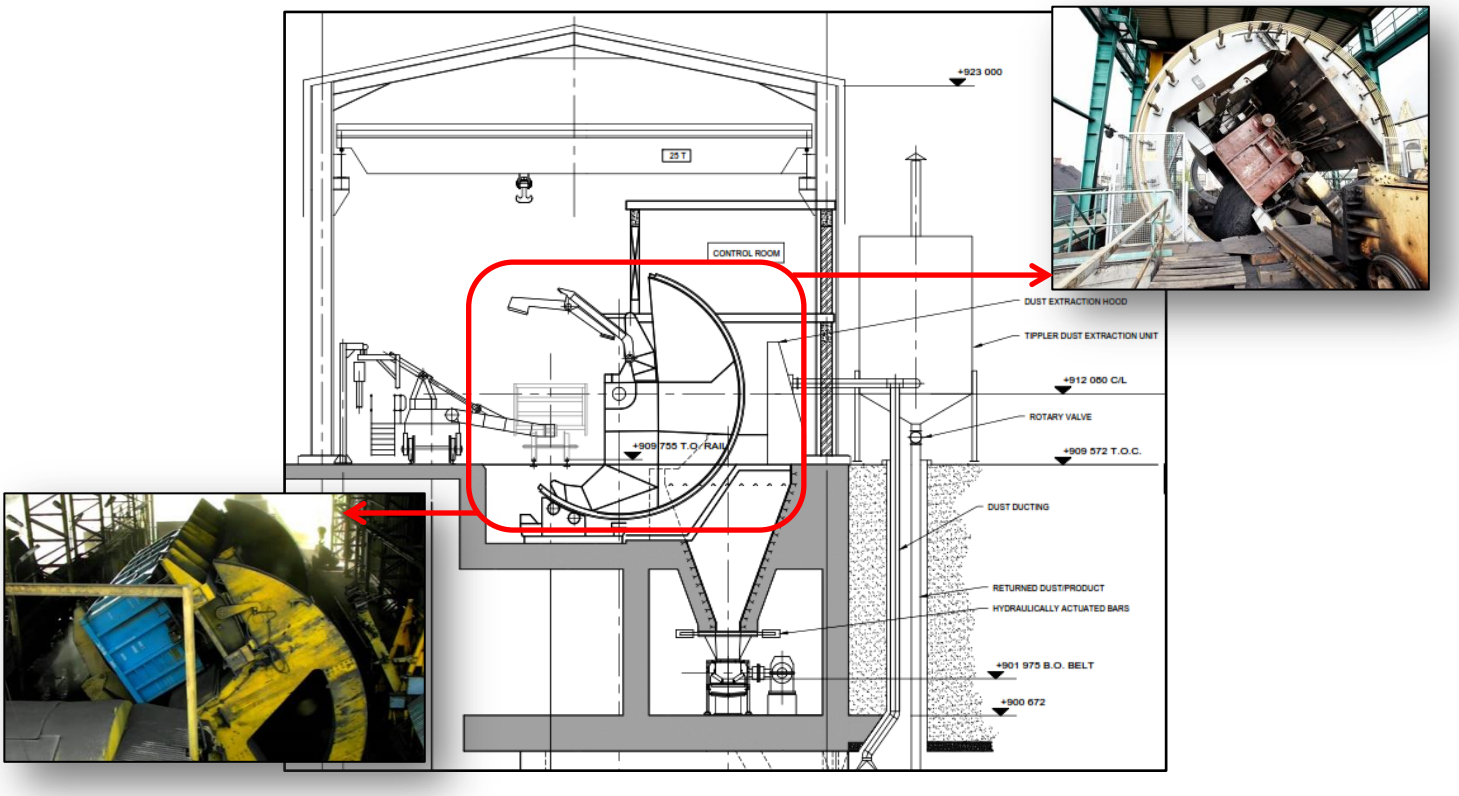


Figure 6-13: Tippler, hopper and vault layout of the limestone offloading area

The proposed limestone material handling system will receive limestone delivered via rail wagons or trucks, and transport the material via conveyor to the limestone stockpile area. Locomotive cars containing limestone transported to the Tippler will be lifted into the air and rotated by the Tippler, which will dump the limestone into the feed hoppers below the tippler. The Tippler building will require excavation of up to 15m below ground to house the necessary hopper and conveyer infrastructure. Belt feeders will feed via a chute onto the inclined belt conveyor, in the vault beneath the tippler.

Limestone will be conveyed from the tippler vault (below ground) via an inclined concrete tunnel, which daylights as the conveyor climbs at the specified gradient, supported by a steel structure mounted to the tunnel concrete floor at approximately 2.5m intervals. Thereafter, the conveyor will be supported by a conveyor gantry structure at ground level. As the conveyor leads into the transfer house, it rises above the ground, supported by small box girders with walkways on both sides and span between steel trestles. The steel trestles will be located at approximately 15m centres, and will be founded on concrete foundations on engineered layerworks.

The limestone will be stockpiled and evaluated before it is conveyed to the limestone silos located in the reagent preparation area.

Figure 6-13 represents an excerpt from the Tippler and Vault Layout Drawing provided in **Appendix D-4** and show semi-circular shape of the Tippler to the right of the locomotive car.

The V-shapes structure to the right and below the Tippler represents the Hopper that guides the dumped limestone onto the limestone feeder conveyor.

Figure 6-14 represents an excerpt from the Inclined Limestone Conveyor Drawing provided in **Appendix D-5** and demonstrates the link between the Tippler, Hopper and inclined limestone conveyor that is located approximately 15m below ground level.

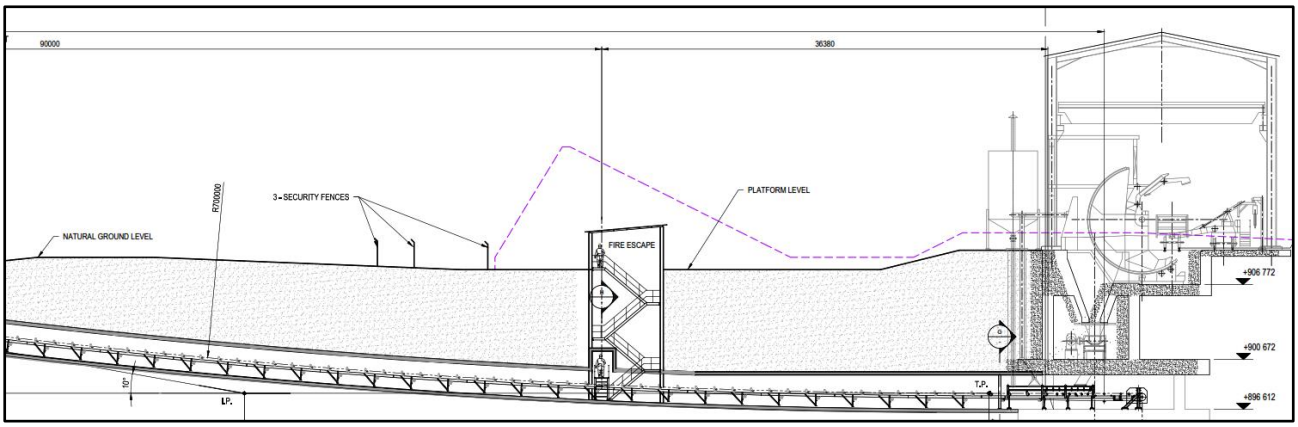


Figure 6-14: Inclined limestone conveyor from Tippler building below ground level

Figure 6-15 represents the elevated limestone truck offloading facility and hopper arrangement. Limestone transported to the MPS by trucks will be offloaded from the elevated platform structure through hoppers onto a conveyor, from where it will be conveyed to the limestone storage area.

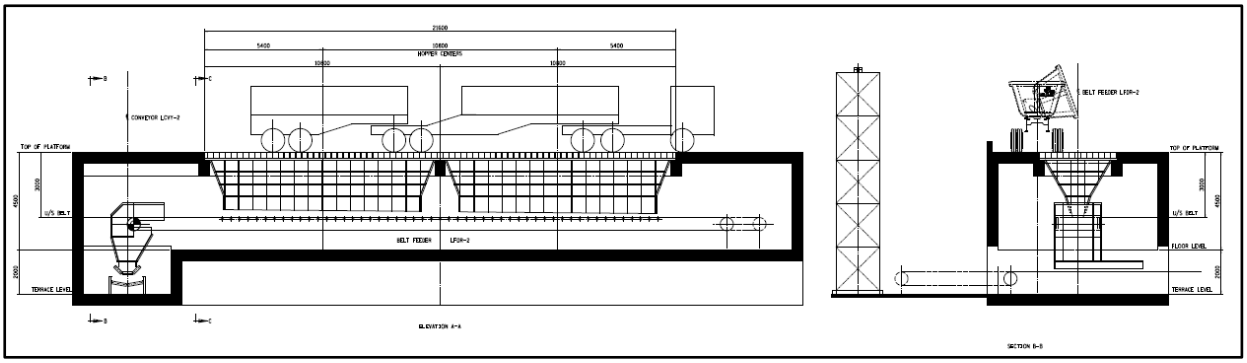


Figure 6-15: Elevated Limestone Truck Off-loading Facility and Hopper Arrangement

The overall Bulk Material Handling (BMH) layout indicating the layout of the limestone offloading facility and gypsum loading facility is provided in **Appendix D-6**.

6.4.10 Gypsum loading facility and conveyance

The gypsum handling system will include the following infrastructure, as presented in **Figure 6-16** below:

- Gypsum reclaim hoppers that receive gypsum from the mobile reclaim equipment and discharge to the gypsum reclaim belt conveyor;
- Gypsum reclaim belt conveyor that discharges to the inclined gypsum belt conveyor;
- Inclined gypsum belt conveyor that discharges to the bin at the loading facility; and
- Gypsum bin, which is an overhead bin feeding the rail wagons with a controlled discharge.

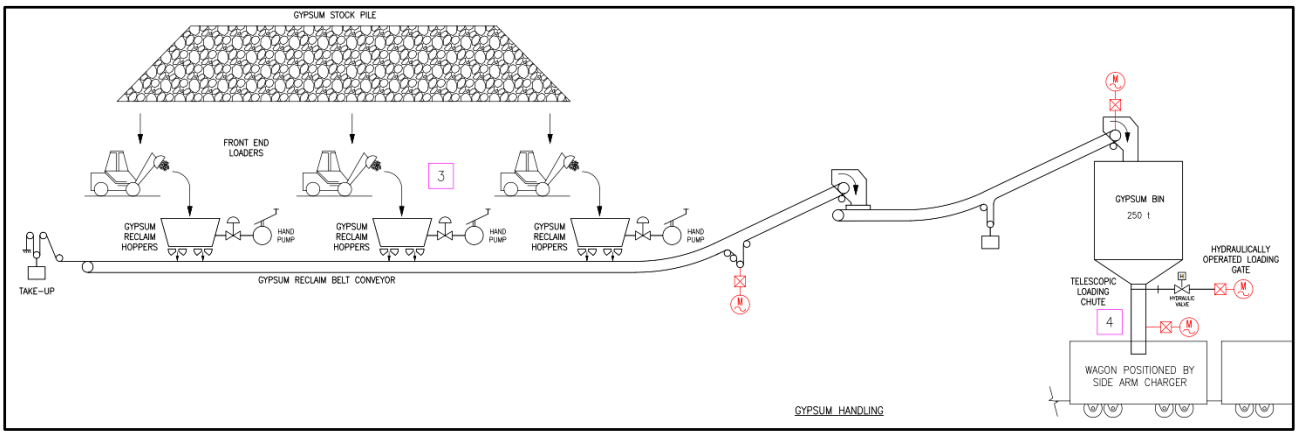


Figure 6-16: Gypsum handling infrastructure and process

Figure 6-16 represents an excerpt from the Materials Handling PFD Drawing relating to limestone and gypsum handling provided in **Appendix D-7**. As per **Figure 6-16** the gypsum stockpile will be manually reclaimed by mobile wheeled or tracked loaders feeding reclaim hoppers which will in turn load gypsum onto two gypsum reclaim belt conveyors.

One of these gypsum reclaim belt conveyors will discharge to an inclined conveyor feeding a single elevated surge bin which will provide the necessary buffer capacity before the gypsum is discharged to the receiving rail wagons.

The second gypsum reclaim belt conveyor will discharge to another belt conveyor which will feed onto either of the two overland ash conveyors to facilitate disposal of gypsum together with ash, which are both Type 3 waste, to the an Ash Disposal Facility (ADF).

The overall gypsum belt conveyor system is provided in **Appendix D-8** indicating the layout of the gypsum loading facility.

6.4.11 Storm water management

Storm water channels and structures are designed to provide a division between storm water and the dirty water from the gypsum loading facility.

The portion of the rail yard north of the rail way line will drain to an earth lined channel at the northern side of the rail yard. This channel drains from west to east and will exit at a newly upgraded storm water culvert. Clean storm water will be collected using concrete channels and underground pipes to drain into a proposed earth lined channel that will drain to an existing newly upgraded culvert. This existing culvert size will be evaluated using the 1:20 year peak flow to determine the required culvert size to deal with the increased run off from the rail way yard.

Dirty storm water from the gypsum loading facility will be collected into an independent concrete channel and underground pipe network that will drain to the proposed Pollution Control Dam (PCD) that will form part of the FGD infrastructure. The estimated run off contribution to the PCD is expected to be 0.05m³/s for a 1:20 year return period.

6.4.12 Infrastructure common to the rail yard

Power supply

The power supply demand to the rail yard will include provision of power for the rail yard infrastructure as discussed in the preceding sections, as well as for lighting of the rail yard and provision of electrical power supply for the bulk material handling equipment, lighting for the rail yard, electrical feed for signalling and all other equipment that requires a power source. The electrical system is therefore expected to provide all equipment within the rail yard boundaries with electrical power.

Power supply infrastructure proposed for the rail yard includes a planned 6.6 kilovolt (kV) / 400 volt (V) limestone handling plant substation where the supply for the rail yard will be delivered. A maximum of 5 Mega Volt Amp (MVA) will be required to run the rail yard. Cabling will be selected to have a volt drop less than 5%. Existing mini-subs will be used for high mast lighting. Yard Lighting required will be at a 20 Lux minimum average.

Eskom will provide the required power supply, while the rail yard mini substations will be constructed in accordance with Eskom's specification.

Water supply

The Medupi plant operates with two separate water networks supplying fire water and potable water. The water network required for the rail yard was designed to tie into connection points within the existing water network of the MPS.

Currently MPS receives water from Phase 1 of the Mokolo Crocodile Water Augmentation Project (MCWAP). Additional water capacity is expected to be obtained from Phase 2A of the MCWAP, which is currently being implemented by the DWS. A more detailed description of the water supply and requirements is provided in **Section 6.12.1**.

Access road

The service road will be designed as a 6m wide gravel ring road to service all facilities in the rail yard. It is proposed that the service road will be designed on the same platform as the rail way to provide level access to all facilities. The start position will be at the existing service road rail way crossing. Concept details of the proposed ring road are provided in the Site Layout Plan Drawing in **Appendix D-1**.

6.5 FGD System component: Limestone handling and preparation (Block 2)

An overview of the limestone handling infrastructure is presented in **Figure 6-17** indicated by the yellow shaded areas. **Figure 6-17** represents an excerpt from the Medupi FGD Plan Plan Revision 7 that is included as **Appendix D-9**. The limestone handling area will include the following infrastructure:

- Limestone stacking conveyor. Enclosed conveyor gantries are employed for the belt conveyors. See Figure 6-18 for an example of a typical enclosed conveyor gantry;
- Limestone storage area (stockpile);
- Boom Stacker and Portal Scraper Reclaimer Machines
- Emergency limestone offloading area;
- Mobile Scraper Chain Feeder;
- Limestone reclaim conveyor;
- Limestone and gypsum handling substation;
- Storm Water Pollution Control Dam. The conceptual storm water management design has resulted in two separate PCDs being proposed in this area. It is also proposed that each of these PCDs is portioned to cater to maintenance activities in the future. A layout of proposed PCDs are presented in **Appendix D-12**; and
- Lined channels for diversion of dirty water to Pollution Control Dams.

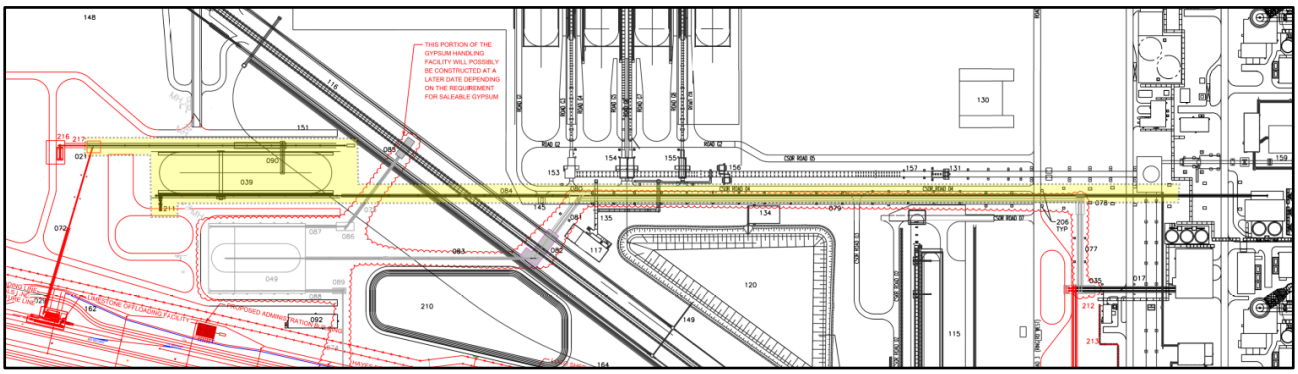


Figure 6-17: Proposed limestone handling infrastructure (Block 2) shaded in yellow

Limestone received from the limestone underground link conveyor, originating at the limestone offloading facility at the rail yard, is transferred to the limestone stacking conveyor via the limestone transfer house 1. Limestone is also loaded onto the tail end of the limestone stacking conveyor via the Truck Off-loading Facility. The limestone stacking

conveyor stockpiles the limestone in the limestone storage area (stockpile) prior to preparation for use in the FGD process. The limestone storage area will provide 30 days' worth of limestone storage for the FGD system, and will be equipped with dust suppression sprayers.

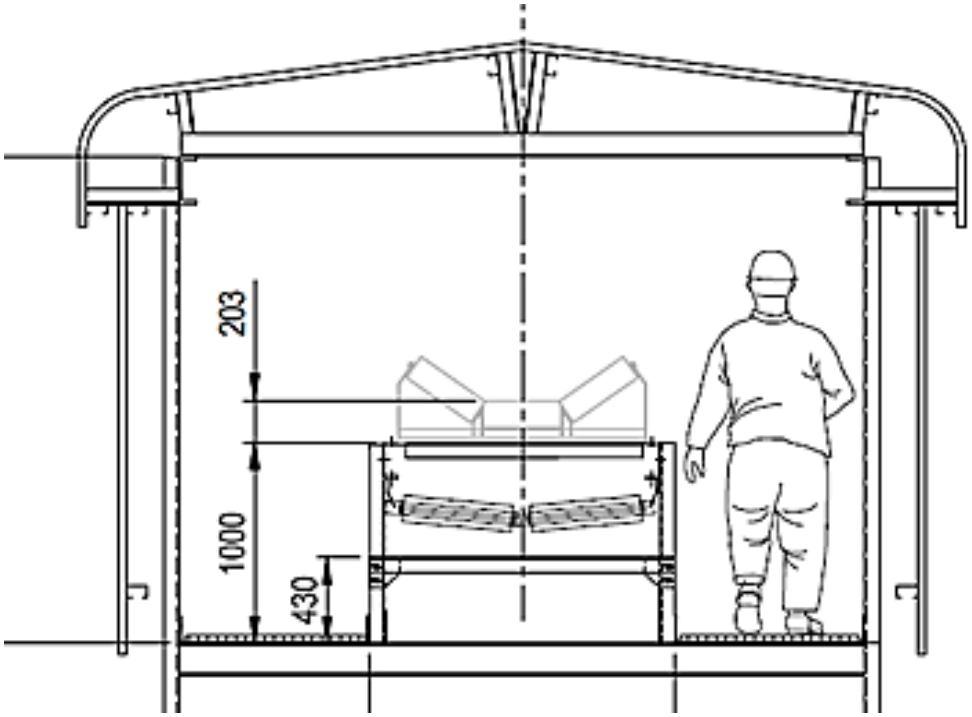


Figure 6-18: Conveyor belt typical cross section

At the limestone storage area, limestone is loaded onto the limestone reclaim conveyor (**Figure 6-18**), which is located at the southern extent of the limestone storage area. The conveyor belt infrastructure will be fully enclosed within a housing structure to prevent interference of the elements with the limestone on the conveyor system, as is evident from **Figure 6-18**, and transported to the limestone silos located at the Limestone Preparation Building. Each of the three limestone silos will have a storage capacity of 24 hours catering to 50% of the design consumption.

From the limestone silos limestone is transferred to the reagent preparation system housed in the Limestone Preparation Building. Here limestone is ground into fine particles in a wet milling process where limestone slurry is produced. Limestone will be fed by weigh belt feeders into the wet ball mills. The mill itself will primarily consist of a rotating drum containing steel balls. The total mill feed flow will be composed of water and new limestone feed, which will pass through the grinding chamber and be reduced in size. The ground slurry will be collected in the mill recycle tank and classified by means of pumps and a hydrocyclone station.

Limestone slurry will flow from the hydrocyclone overflow by gravity to the limestone slurry feed tank, with oversize particles being recycled to the mill inlet for additional grinding. The limestone slurry will be pumped via piping on the elevated FGD utility rack to each absorber for utilisation in the FGD system. The limestone slurry is fed into the wet FGD system

absorber (indicated as Flue Gas Cleaning), which is a large cylindrical tower where the flue gas comes in contact with the limestone slurry to “scrub” the unwanted SO_2 from the flue gas.

6.6 FGD System component: Input materials (Block 3)

6.6.1 Limestone

The limestone slurry is received from the limestone preparation process.

6.6.2 Process water

Raw water for the FGD system, including the MPS as a whole, will be supplied by the existing raw water reservoir, which is in turn supplied by the MCWAP scheme. A back-washable strainer pre-treatment system will filter the water to appropriate quality required by the FGD equipment. Once strained the raw water is considered makeup water for use in the FGD system.

Makeup water is also used in the FGD Closed Cycle Cooling Water System and the FGD WWTP. The backwash from the back-washable strainers will be discharged into the existing dirty water drains system. Other uses for the makeup water include the washing of the gypsum and preparation of the fresh limestone suspension.

Water will be supplied by gravity feed or by two of the low pressure raw water pumps drawing water from the reservoir. After pre-treatment the water is sent to the Process Water Tanks for utilization in the FGD process.

Three Process Water Tanks (two operational and one backup for redundancy) will have a storage capacity of 8 hours of full load operation, supplying all FGD plant water demands. Six process water pumps, each providing 100% redundancy, and one spare pump for each tank, will secure the necessary backup water supply. Water will be supplied from the pumps to all systems requiring clean process water.

Appendix E-2 provides a visual representation of the process followed for water handling associated with the FGD process.

6.6.3 Untreated Flue Gas

Untreated flue gas leaving the existing ID fans will be diverted to the absorber inlet, via additional dampers. Flue gas will enter the absorber and flow from the bottom to the top. Existing ductwork will be used for the bypass. The inlet, outlet and bypass dampers will be double louver dampers. Seal air blowers will operate between the dampers to minimize any leakage of flue gas through the closed damper.

6.6.4 Oxidation Air

Oxidation air will be added to the FGD absorbers to aid the formation of gypsum crystals in the process.

6.7 FGD System component: Wet FGD system (Block 4)

6.7.1 FGD core infrastructure

The site arrangement of the FGD system for the Medupi Power Station is provided in **Appendix D-10**. The FGD system includes infrastructure that is located within the previously cleared and transformed footprint of the power station. Infrastructure includes:

- An absorber unit associated with each of the 6 x generation units;
- Each absorber unit will include a flue gas duct, absorber tower, absorber pump building and absorber substation;
- Absorber drain and gypsum bleed tanks associated with each cluster of 3 absorber units, i.e. absorber units 1 – 3 and absorber units 4 – 6; and
- FGD above-ground elevated utility racks containing piping to direct fluid from and to relevant systems within the absorber area.

Appendix D-11 provides drawings of the absorbers for unit 1 and 4, with general geometric dimensions, to be used for the FGD retrofit. **Appendix D-11** also shows the open spray tower diagram. These appendices serve to provide a visual representation of the infrastructure associated with the FGD operation for SO_2 reduction.

Also, included in **Appendix D-10** is the site arrangement drawing, for a visual representation of the additional infrastructure to be introduced to the existing Medupi Power Station footprint.

6.7.2 FGD associated infrastructure

6.7.2.1 FGD closed cycle cooling water

A new, independent Closed Cycle Cooling Water (CCCW) system will provide heat rejection for the heat exchangers associated with the FGD equipment that requires water cooling. This system will reduce heat emissions especially via the cooling towers for the MPS. The CCCW system will provide cooling to:

- Limestone ball mill lubrication system;
- FGD system air compressors;
- Brine concentrator/crystalliser equipment in the WWTP area.

Cooling water for the CCCW system will be of condensate quality and will be supplied by the existing plant to the CCCW expansion tank which is elevated to allow for gravity fill of the system. The CCCW heat exchangers will transfer heat from the circulating cooling water to

the auxiliary cooling water. The open cycle cooling water pumps will pump the auxiliary cooling water through the CCCW heat exchangers and to the wet cooling tower. The wet cooling tower will reject heat from the auxiliary cooling water to the atmosphere and will return it to the system at a specified temperature.

6.7.2.2 Fire protection

The existing fire protection system will be extended to the FGD areas and the new rail yard area. Existing firewater pumps will provide pressure for FGD fire protection. New fire water booster pumps will be used to maintain fire water pressure at elevated points within the system.

6.7.2.3 FGD blowdown system

The FGD blowdown system collects and conveys process waste fluids by means of drain trenches, sumps and sump pumps. The sumps and trenches will be below grade (underground), reinforced concrete structures. Process waste water and slurries will be discharged into the trenches, which are sloped for gravity feed into the associated sumps. Sumps that receive slurry will have agitators to maintain solids suspension. Each sump will contain two sump pumps to transfer the contents to the WWTP. Sump level measurement will start and stop the sump pumps in an alternating mode that automatically cycles between pumps to ensure even run time. Sump pumps and pipelines that transfer slurry will be flushed with process water upon pump shutdown.

6.7.2.4 Control system

The existing Medupi control and instrumentation system will be extended to include all equipment required to allow the operation and monitoring of the FGD system and associated activities. A DCS will provide control, display, alarming, reporting and archive capabilities for the retrofit of the new FGD system. A bi-directional loop is provided for reliability so that a break in a fibre will not affect the network. The FGD WWTP system will be provided with a dedicated control room in the FGD WWTP building.

6.7.3 FGD process

The Wet Flue Gas Desulphurisation (WFGD) process system can be categorised into 3 main plant areas as indicated in **Figure 6-19**. The limestone slurry is then fed to the wet FGD system absorber (indicated as Flue Gas Cleaning), which is a large cylindrical tower where the flue gas comes in contact with the limestone slurry to “scrub” the unwanted SO2 from the flue gas.

The limestone slurry along with a mixture of reaction by-products and water is circulated from the absorber reaction tank to spray headers in the upper part of the absorber by-means of recirculation pumps. The spray headers distribute the slurry formed and unreacted limestone by atomizing the mixture to fine droplets with a network of sprays nozzles. As the

atomized falling droplets meet the counter current flue gas, the slurry droplets will absorb SO_2, from the flue gas. The water from the slurry will evaporate and saturate the flue gas.

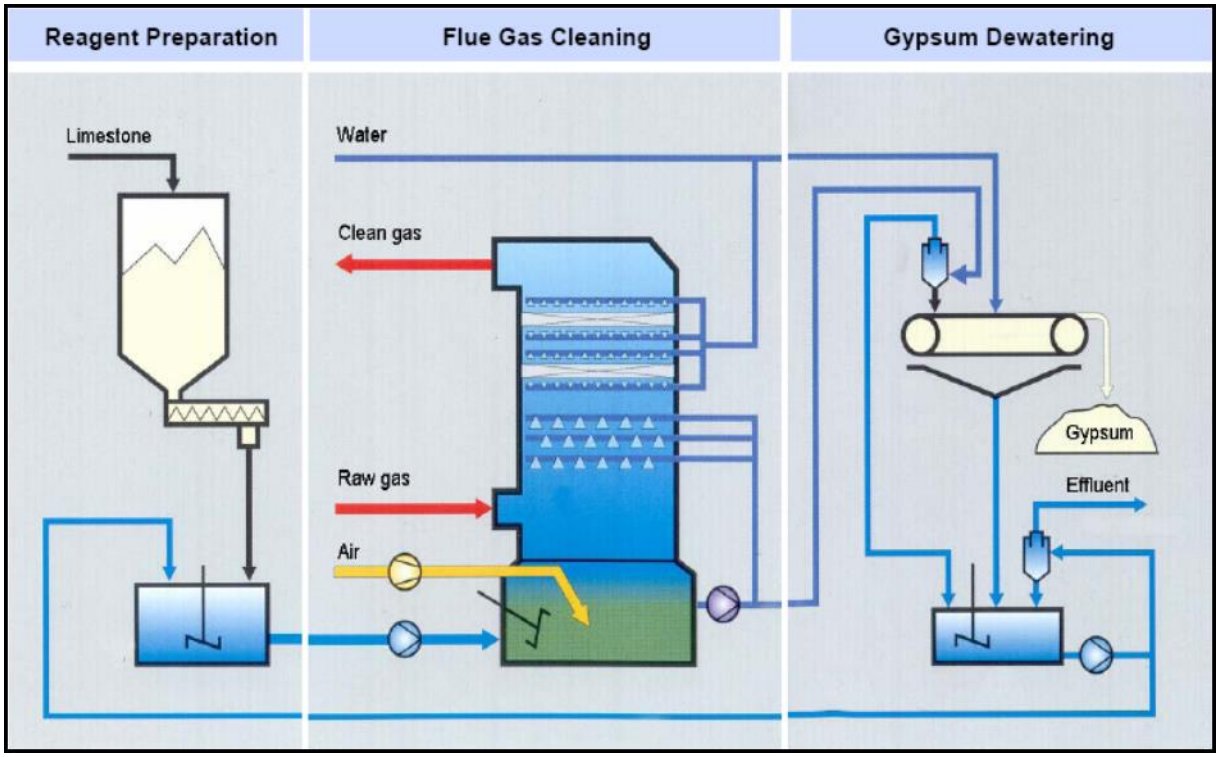


Figure 6-19: Simplified process flow diagram for the FGD system

Makeup water will be consumed entirely by the FGD process plant and no water will be returned to the existing plant. However, effluent water (backwash) from the FGD makeup water pre-treatment plant will be returned to the dirty water drains system. Furthermore, makeup water will also be used to replace evaporation losses in the absorbers. This is done via mist eliminator washing.

The solids will be retained in the absorber and will form gypsum crystals ($CaSO_4$) due to the addition of oxidation air. The formed gypsum slurry is then “bled” from the absorber and then sent to the dewatering plant. The gypsum is then washed and dewatered and conveyed to potential off-takers or for disposal.

The flue gas coming from the boiler will pass through a fabric filter and an ID fan upstream of the FGD plant. In order to protect the absorbers in the case of an emergency, the existing ductwork from the ID fans to the chimney will be retained as a flue gas bypass ductwork around the FGD plant. The bypass is necessary to protect the absorbers in case of failure or emergency conditions. This will avoid complete plant shutdown in the case of absorber malfunction by routing the flue gas through the bypass ductwork system until the absorber can be restarted. The flue gas leaving the existing ID fans will be diverted to the absorber inlet, via additional dampers. Flue gas will enter the absorber and flow from the bottom to the top. Existing ductwork will be used for the bypass. The inlet, outlet and bypass dampers will be double louver dampers. Seal air blowers will operate between the dampers to minimize any leakage of flue gas through the closed damper.

6.7.4 Interface with existing infrastructure

The Medupi Power Station units have been designed, and constructed, with provisions incorporated into the space and equipment design to accommodate the installation of the wet limestone FGD system. Each of the six generating units of the Power Station operates independently, common facilities are provided for electricity, water, coal supply and coal combustion waste disposal. Each unit is constructed with fabric filters and Induced Draft (ID) fans. The fabric filters remove most of the particulates from the coal combustion process and the ID fans provide necessary draft to overcome system resistance. The ID fans were designed to accommodate additional system resistance expected due to the installation of the FGD equipment.

The ID fans currently discharge flue directly to the chimney at each unit. The FGD system will include additional dampers and ductwork to divert the flue gas to the FGD absorbers and then return it to the chimney. The chimney flues are lined with corrosion-resistant liners to handle saturated flue gas expected from the operation of the FGD systems. The existing ID fans have been constructed with sufficient pressure capacity in their original design in order to provide additional pressure increase required to overcome the system resistance of the FGD retrofit.

Each of the two existing chimneys contains the flues from three boilers. The existing chimneys will be reused with minor modification. The inside diameter of the existing flues is adequate to cater for the flue gas volumes. The liner associated with the chimneys has sufficient transitional velocity for condensation re-entrainment to withstand the calculated worst-case design so that re-entrainment of moisture droplets will not occur.

The steel flue liner material for Medupi Power Station is borosilicate identical to that used for Kusile Power Station and has to be modified in certain areas to cater for the high chloride levels associated with the wet stacks. Furthermore, modifications to the chimney drain piping and the chimney drain system are necessary to return collected condensation to the gypsum bleed tanks.

6.8 FGD System component: Treated Flue Gas (Block 5) and evaporation (Block 6)

Treated flue gas is redirected from the absorbers via the flue gas ducts back to the chimneys for release with much reduced SO_2 content. During the process evaporation losses are incurred.

6.9 FGD System component: Gypsum handling, re-use and disposal (Block 7)

6.9.1 Gypsum dewatering and conveyance

Gypsum will be produced from the FGD process as a by-product of the wet scrubbing process. Slurry exiting the FGD process will comprise gypsum, a mixture of salts

(Magnesium Sulphate ($MgSO_4$) and Calcium Chloride ($CaCl_2$)), limestone, Calcium Fluoride (CaF_2), and dust particles.

Effluent generated in the process is directed to the Waste Water Treatment Plant (WWTP), while the overflow of the gypsum dewatering hydro cyclones goes to the Waste Water Hydro Cyclone (WWHC) feed tanks. The tanks are located in the gypsum dewatering building. From the WWHC feed tanks, the water goes through the WWHC where the underflow is directed to the reclaim tanks and the overflow to the Zero Liquid Discharge (ZLD) holding tanks. The ZLD holding tanks feed the WWTP.

The gypsum discharged from the dewatering infrastructure will be dropped onto a collecting conveyor by means of bifurcated chutes. An online monitoring system installed within the gypsum production process will be utilised to assess gypsum quality. The collecting conveyor will take the gypsum to the transfer house where the gypsum will be transferred to one of two link conveyors feeding a series of gypsum conveyors.

The site arrangement of the FGD system for the Medupi Power Station is provided in **Appendix D-10** and shows the infrastructure associated with the gypsum dewatering and conveyance. Infrastructure associated with the gypsum dewatering and conveyance includes:

- Gypsum bleed tanks and forwarding pumps;
- Piping and elevated FGD utility rack;
- Gypsum dewatering building containing gypsum hydrocyclones and waste water hydrocyclones;
- Belt filter and reclaim tank;
- Gypsum conveyer belt system;
- Gypsum truck loading facility; and
- Gypsum storage building and offtake via rail.

6.9.2 Gypsum re-use or disposal

Dewatered gypsum generated during the dewatering process can be sold commercially given the right quality and demand. In order to produce commercial-grade gypsum, it is necessary to keep the chloride content under a certain limit. For this reason, during the dewatering process, the filter cake will be washed with FGD makeup water to decrease the chloride content to an acceptable level for saleable gypsum. A refinement process is carried out to separate and dewater the gypsum.

Gypsum leaves the Gypsum Dewatering Building via gypsum collecting conveyor in an eastward direction. At the gypsum transfer house 1, gypsum is either transferred onto gypsum link conveyors that will transport gypsum to the gypsum storage building, or onto a gypsum link conveyor that will link the gypsum stream to the overland ash conveyor that transports ash to the existing ADF. A direct gypsum offtake area will be constructed at the gypsum transfer house 1 for small scale off-take of gypsum by offtakers. This will consist of

a road leading off an internal road and loading bay area where gypsum will be loaded on to vehicles. At this point, the ground will be prepared for management of any gypsum that is not contained and the trucks will be washed before leaving this area. The washing is a means to minimise the spreading of the gypsum.

Given demand and off-take potential from commercial off-takers, infrastructure to convey gypsum from the gypsum transfer house 1 to the gypsum storage building and rail way yard for transport of large volumes of gypsum via rail will be constructed at a future date. At the gypsum storage facility commercial grade gypsum will be fed onto an elevated mobile tripper car. Material from the car will be stacked into three indoor day storage stockpiles. The separate storage piles will allow for one pile to be stacked while another is being reclaimed and a third is quality tested.

The gypsum storage facility will accommodate 100% of the total gypsum production for three days, but it is anticipated that only 20% of the gypsum will be required for commercial sales. Eskom is currently investigating markets for gypsum resale. This will have a significant impact on the amount of gypsum that will require disposal. The gypsum storage building will be used in conjunction with the rail siding only. The storage building is a future use facility that will be built with the rail siding. There will be no facilities for gypsum recovery from the storage building to be loaded onto trucks. Use of gypsum will be subjected to quality assessments, which will be done at the storage facility. If the quality is not usable, the gypsum will be taken for disposal.

In the event that no large-scale commercial offtake of gypsum is secured, gypsum from transfer house 1 will be conveyed to the existing overland ash conveyor. In this conveyor system, the gypsum will be mixed with ash and will be disposed together on the footprint of the existing authorised ADF. The conveyor route and transfer houses for gypsum onto the overland ash conveyor are shown in **Appendix D-9**. It should be noted that gypsum disposal at the ADF will be carried out from the 6th year of the power station operation, at which point the ash facility will have a Class C liner, which is appropriate for the gypsum and ash waste types (Type 3).

In terms of the previous ash classification processes, i.e. the Minimum Requirements Documents Series, ash was considered to be hazardous and thus the 0 to 2 year area was designed and authorised according to the Department of Water and Sanitation (DWS) Minimum Requirements, resulting in a H:h liner system being installed, at the ADF. However, regulations were promulgated by the DEA in terms of NEM:WA on the 23 August 2013. In terms of the NEMWA regulations, ash and gypsum now classify as Type 3 wastes, and require to be disposed of on a Class C barrier system. This barrier will be implemented at the existing ADF from the 4 to 19.2 year area.

A separate application to amend the existing ADF Waste Management Licence is being undertaken for disposal of gypsum and ash together on the existing footprint of the authorised ADF and is therefore not part of this authorisation application process.

Appendix E-3 provides a flow diagram of the activities involved in gypsum handling.

6.10 FGD System component: Waste Water Treatment (Block 8)

The Medupi FGD Waste Water Treatment Plant is located directly west opposite generation units 1 to 3 at the Medupi Power Station. FGD chloride bleed stream, from the washing of the gypsum, and FGD auxiliary cooling tower blowdown stream are diverted to the ZLD holding tanks. The Total Organic Carbon (TOC) scavenger regeneration waste water from the filter press system / existing water treatment plant (WTP) will also be directed to FGD WWTP located next to the gypsum dewatering plant.

From the ZLD holding tank the wastewater is transported via pipes on the elevated FGD utility rack to the WWTP. The pre-treatment process will include physical/chemical treatment to precipitate solids and heavy metals from the water by making use of slaked lime in a softening clarification process. Quicklime is delivered by bulk tankers and transferred into a quicklime silo, from where it is slaked with water in a detention-type slaker. At the WWTP slaked lime is added to the wastewater to convert the dissolved calcium and magnesium into salts so that the clarified water can be effectively treated in the brine concentrators and crystallisers.

The precipitates from this pre-treatment process are settled out in clarifiers as sludge, 50% of which is sent to a filter press dewatering system. The other 50% of the sludge is returned to the clarifier. The filter press filtrate will be returned to the pre-treatment holding tank. This pre-treatment process produces approximately 160t of sludge per day from 90% limestone.

After chemical treatment, the precipitates are settled out in clarifiers as slurry, 50% of which is sent to a filter press dewatering system. The other 50% of the slurry is returned to the clarifier. The filter press filtrate will be returned to the pre-treatment holding tank. The overflow from the softening clarifier is sent to the brine concentrator and crystalliser processes for further salt removal. Salts are settled out and crystallised during this process. Approximately 80t per day of salts are expected to be generated from 90% lime, and will require environmentally responsible management. The distillate water produced from the brine concentrator and crystallisation process is returned to reclaim tanks for reuse in the process. Chemical storage is likely to exceed 955m^3 to provide sufficient capacity for storage of chemicals in the FGD process.

The distillate emanating from the process will be diverted back to the FGD system for re-use in the FGD process, while dirty water run-off will be utilised in the FGD process to improve water usage.

Appendix E-4 provides a visual interpretation of the activities carried out during the wastewater handling.

6.11 FGD System component: Management of WWTP by-products (Block 9)

Sludge and salts will be temporarily stored in appropriately designed storage facilities next to the WWTP. The storage facilities will have a 7-day storage capacity. Two storage areas will

be provided for, with Salts and Sludge Storage Area 1 and 2 sized to approximately 4 800m^2 and 16 000m^2 in size, respectively. The storage areas will conform to the Norms and Standards for the Storage of Waste (GN926 of 29 November 2013) and will be registered as a waste storage facility in terms of these Norms and Standards. This process will be undertaken separately to this authorisation.

Salts and Sludge will, subsequent to storage, be transported (trucked) and disposed of at a registered waste disposal facility for the first 5 years of operation. The waste disposal service provider has not been confirmed yet, although disposal at Holfontein has been considered as a suitable waste disposal service provider, among other suitable service providers. For transportation of this waste to a disposal site, Eskom will utilise the services of a service provider who has all required authorisations and systems in place to manage the waste stream from storage to disposal facility.

6.12 Resource Requirements

6.12.1 Raw water supply and MPS Water balance

Medupi Power Station requires a total volume of 15.4 million cubic metres per annum (Mm^3/a) of raw water to operate the power station including the FGD units which will be retrofitted later as per the water balance in **Appendix E-1**. Currently the power station has a total water allocation of 10.9 Mm^3/a, which is sourced from Mokolo Dam via Phase1 of the MCWAP. This allocation of 10.9 Mm^3/a will be enough to operate the MPS as well as 3 (three) x FGD units. The water shortfall of 4.5 million m^3/a will be sourced via Phase 2A of the MCWAP once implemented by DWS, and will cater for, amongst other requirements, for the remaining 3 (three) x FGD units. Water supply agreements are to be concluded and signed with the DWS by the middle of 2018 for the supply of water to both Medupi and Matimba power stations which will be aligned to WUL (section 21(a). Medupi Power Station must be able to treat up to 100% of its water requirements from Phase 2A of the MCWAP should the need arise to ensure water security to the area.

6.12.2 Potable water

The existing potable water system at the MPS will be extended to ensure supply to the potable water requirements of the FGD area. Two 100% potable water booster pumps will ensure adequate pressure to meet system demands. Backflow preventers will prevent contamination into the potable water system and backpressure regulators will isolate the nonessential water users in the event of low system pressure.

6.12.3 Compressed Air

The compressed air system will supply dry air for all the service and instrument air uses of the FGD and rail yard. Two FGD air compressors and two filter/air dryers will provide compressed, oil-free air at the required capacity and pressure to meet the FGD requirements.

6.12.4 Auxiliary power supply

A new 132kV power supply is under investigation for installation at the 132kV switchyard to provide backup power to the FGD system. This backup power is required to maintain 100% redundancy in the FGD power system.

New auxiliary transformers will transform 11kV three-phase power supplied from the existing 11kV system, to 6.9kV three-phase power as required by the FGD system and the rail yard. The transformers will supply 6.9kV to the FGD plant board switchgear buses through main breakers. The switchgear buses for similar service will be connected through a tiebreaker. The main breakers and the tiebreaker will make it possible for a switchgear bus to be fed from two separate sources.

A new emergency diesel generator (EDG) with a dedicated day tank will be required to provide emergency shutdown power at 6.6kV upon loss of normal 6.6kV AC power supply. The existing 2500kVA Medupi EDG's do not have this additional capacity to support the FGD loads. The EDG will be connected to a 6.6kV AC essential switchgear and provide a backup power feed to the essential 6.6kV process water pumps. The essential power will then be distributed to step-down transformers which will supply 400V AC essential boards in each of the FGD clusters. From there the power will be distributed to loads such as the valves that must operate on the loss of power to the FGD system, etc.

New 230V AC uninterruptible power supply (UPS) systems will be provided for all FGD buildings containing LV 400V boards. These UPS systems will provide essential power for board control as well as functioning as "dip-proof" power supplies to maintain contactor position.

New 220V DC Nickel Cadmium (NiCad) batteries with dedicated chargers will be provided to supply essential power for control of MV boards and will be located within each substation.

6.13 Timelines for the Medupi FGD retrofit

At the time that Eskom had received environmental authorisation for the Medupi Power Station in 2007, the power station design complied with the requirements stipulated by the Air Quality Act (Act 39 of 2004).

The power station was therefore constructed in line with the approved designs. However, on 1 April 2010, after the authorisation of the Medupi Power Station, the list of activities and associated minimum emissions standards in terms of Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004) came into effect. These listed activities amended the requirements in terms of emissions standards that needed to be adhered to by industries, including coal-fired power stations. At this stage, it was evident that technology would be required to reduce emissions, particularly SO_x, from the Medupi Power Station in the medium term.

The Medupi Power Station was designed to accommodate a Wet FGD technology retrofit. The Wet FGD retrofit technology aims at reducing the SO2 emissions by up to 95%. Thereby ensuring that Medupi Power Station will comply with the NEM: Air Quality Act air emissions standards for “new plants” by 2030. In the interim, the Medupi Power Station will comply with the minimum emissions standards for “existing plants”.

7 ALTERNATIVES ASSESSMENT

7.1 Introduction

A number of alternatives types are generally associated with EIAs. In terms of the EIA Regulations published in Government Notice R543 of 2 August 2010 in terms of Section 24 (5) of the National Environmental Management Act (Act No. 107 of 1998), the definition of "alternatives" in relation to a proposed activity, refers to different means of meeting the general purpose and requirements of the activity, and may include alternatives to:

- The property on which or location where it is proposed to undertake the activity;
- The type of activity to be undertaken;
- The design or layout of the activity;
- The technology to be used in the activity;
- The operational aspects of the activity; and
- The option of not implementing the activity.

Further, in terms of NEMA and the EIA Regulations, feasible and reasonable alternatives have to be considered within the Environmental Impact Assessment, including the 'No Go' option. All identified, feasible and reasonable alternatives are required to be identified in terms of social, biophysical, economic and technical factors. Feasible and reasonable alternatives identified are discussed in more detail below.

7.2 Location of activity

7.2.1 Location alternatives: FGD Infrastructure

The location for the FGD retrofit infrastructure does not have feasible alternatives. This is because the FGD infrastructure must be fitted to the existing Power Station infrastructure. Placement of the FGD infrastructure is constrained by space and existing infrastructure alignments, therefore it is accepted that the proposed FGD infrastructure layout and alignment is already the best fit and optimised placement. Therefore, no alternatives were identified or assessed for location of the FGD technology retrofit.

7.2.2 Location alternatives: Rail yard infrastructure

The location of the proposed rail yard was also pre-determined during the design and construction of the Medupi Power Station itself. The proposed yard is situated just north of the existing Transnet Freight Rail (TFR) mainline that runs between the towns of Thabazimbi and Lephalale. The location and placement of the rail yard was governed by the following factors and as a result no feasible location alternatives could be identified:

- The decision to use the existing rail way network to deliver limestone to the power station.

- The position and layout of the proposed FGD plant.
- Available space within the existing Medupi Power Station fence boundaries.
- The availability of existing services such as potable water, fire water and storm water drainage structures.

See **Appendix D-9** for the plot plan indicating how the FGD infrastructure and proposed rail yard are required to be fitted to the existing Power Station facilities.

7.3 Type of activity

The Medupi Power Station Air Emissions License (AEL) dated 1 April 2015 requires that SO_2 emissions be reduced from 3500 mg/Nm^3 at 10% O_2 to less than 500 mg/Nm^3 at 10% O_2. The objective of this activity is to reduce the SO_2 emissions to satisfy the legislative requirements and World Bank loan conditions. This dictates the type of activity, which must be a sulphur dioxide reducing technology to be retrofitted to the existing power station infrastructure. No alternatives to the type of activity have been investigated because the objective of this project determines the activity type.

7.4 Design or layout of activity

7.4.1 Design and layout alternatives: FGD infrastructure

The layout of the FGD infrastructure within the MPS footprint is predetermined by the layout of the power station. Specific infrastructure need to be fitted to the stacks of the MPS, which influences the effective layout for the FGD infrastructure. The remaining infrastructure must be placed where there is adequate space, and this is also determined by the power station layout. **Appendix D-10** shows the proposed layout of the FGD retrofit within the Medupi Power Station footprint.

7.4.2 Design and layout alternatives: Rail yard

The placement of the rail yard infrastructure and associated infrastructure is constrained by the space available at the proposed location. The design and layout of the proposed rail yard has therefore already been optimised to maximise the use of available space while dealing with the alignment constraints of connecting to existing and already operational infrastructure. As such no design or layout alternatives could be considered for the proposed rail yard infrastructure and associated infrastructure.

7.5 Technology to be used

The Scoping Report concluded that the selection of the wet FGD technology was undertaken prior to this EIA and technology alternatives and is therefore the preferred SO_2 reduction technology.

Although water from the MCWAP scheme has been allocated to the Medupi FGD project, Eskom proposed to investigate further water savings, most notably the edition of Inlet Gas Cooler Technology. The use of Inlet Gas Cooler Technology is dependent on whether it will be feasible for implementation based on an acceptable cost-benefit analysis.

Eskom commissioned a cost benefit analysis of the Wet FGD, Dry FGD – Circulating Fluidized Bed (CFB) technology, and Wet FGD with flue gas cooling technology. This report was finalised on 9 January 2018 and is included as **Appendix C-1** to this DEIR. Conclusions from the analysis are summarised in the following sections.

7.5.1 Wet FGD

The Wet FGD has a long history of application to fossil fuelled power plants in units of all sizes, and remains the predominant process utilized today. It has high removal efficiency on high sulphur coals and only requires a single absorber vessel per boiler. The gypsum created through this process can be used in concrete and wall board manufacturing or be landfilled. There is generally a waste water stream created that will require further processing. The amount of water used in Wet FGD is higher than a Dry FGD-CFB technology.

A further benefit of the implementation of WFGD technology is that it has the potential to contribute to the broader socio-economic development of Lephalale and its surrounding areas due to WFGD flexibility of using lower quality limestones that can be sourced from areas closer to the power station which is not the case with the DFGD systems.

Water for the WFGD will be provided from Phase 2A of the Mokolo and Crocodile Water Augmentation Project which is being developed to bring additional water to the Lephalale area from the Crocodile River Catchment" .The development of Phase 2A therefore creates an opportunity for economic development in the area which cannot take place without it.

The WFGD technology is the only of the FGD technologies that has the potential for reduction in its water consumption. Eskom is a strategic water user in the country and based on its commitment to water conservation it has already taken various measures to reduce the plant's water consumption. The implementation of dry cooling technology and the adoption of the zero liquid effluent discharge policy (ZLED) are notably Eskom's most significant water-saving initiatives. Once completed Medupi will be the largest dry-cooled power plant in the world. The implementation of dry cooling reduces the water consumption from approximately 2 l/kWh to 0.14 l/kWh. It is expected that the water use with WFGD (power plant with WFGD≈ 0.35 l/kWh) will still be lower when compared to the conventional wet-cooled power plants (power plant without WFGD≈ 2 l/kWh), excluding water for FGD, within Eskom's fleet.

7.5.2 Dry FGD-CFB

The Dry FGD-CFB has been used extensively around the world and mixes lime, water, and fly ash-laden flue gas in a reactor to remove the sulphur dioxides from the boiler flue gas

stream. There is no waste water stream created by this process, however the fly ash generated in the process will require disposal to landfill. This process works best with low to medium sulphur coals and has a current reactor size maximum of 450 MW, so two reactors would be required for each boiler for Medupi Power Station.

The cost-benefit analysis concluded that DFGD technology resulted in a 9% higher capital cost for implementation due to modifications required for existing ductwork design and the addition of a new fabric filter system to the existing Fabric Filter Plant (FFP) in order to retrofit this technology. Although the DFGD processes use slightly less water for the Medupi site, the estimated operating expense for the DFGD is 53% higher than the WFGD system, mostly due to the significantly higher cost of the lime reagent. The use of DFGD is therefore not economically feasible.

7.5.3 Wet FGD with Flue Gas Cooling Technology

The implementation of WFGD with flue gas cooling has the potential to reduce the water consumption associated with WFGD, however the practical challenges cannot be ignored as this is expected to have a significant impact on the maintainability and availability of the power plant and the cost of electricity to the consumer.

Eskom visited 3 power stations in Europe and 2 in China fitted with flue gas cooler installations. All three power stations in Europe experienced significant challenges with operation and maintenance of the gas cooler infrastructure, to the extent that all three power stations from Europe visited by Eskom during a benchmarking exercise advised against the installation of the system due to the problematic operation that it provides. WFGD with flue gas cooling is therefore not considered as a feasible option for Medupi.

It was furthermore concluded that the installation of a regenerative type heat exchanger at Medupi is not possible due to the established layout and space constraints at the plant. When installation of a flue gas cooler before the articulate abatement plant was considered it was concluded such an installation was not possible due to the ash characteristics. The ash characteristics at Medupi are highly abrasive, which will erode the finned tube material easily if the velocity is not kept sufficiently low enough. The velocity reduction in a high ash environment although good for wear protection, will incur both dust fall-out and plugging problems. It is therefore not advisable to install a flue gas cooler before the FFP at Medupi.

When installation of a flue gas cooler after the articulate abatement plant was considered it was concluded that availability of space on the already established footprint and plant layout will cause a significant constraint to the installation of a flue gas cooler. Although the real estate may be found to install the cooler itself, space is conceptually not available to install all the maintenance provisions that is required to service the plant appropriately. Without the increased maintenance provisions, complexity in maintenance and plant downtime will be experienced.

Further disadvantages of installation of a gas cooler at Medupi relate to the cost of the material selection for the flue gas cooler which is high. Elements such as the cooler’s weight

contributes to the overall cost and considerations such as deep piling for founding conditions which may require blasting at Medupi on an already generating unit. Installation of the flue gas cooler will also reduce the power output of the unit due to increased pressure drop and pumping for water recirculation. This will increase the relative CO_2 per megawatt sent out from the generating unit, which is contradicting to the objective of the FGD plant.

For these reasons the WFGD with flue gas cooling is therefore not considered to be a feasible option at Medupi and was not considered further.

This DEIR therefore only considered the installation of WFGD without gas cooler technology as the only feasible alternative suitable for the conditions at Medupi Power Station

7.6 Operational Aspects of activity

Construction of the WFGD system and associated infrastructure will commence as soon as authorisation is granted in order to meet the legislation requirements of the National Environmental Management: Air Quality Act, No 39 of 2004. No operational aspect relating to the construction of the FGD infrastructure has been considered.

7.7 No Go Option

The no-go option is to continue the operation of the Power Station without the FGD retrofit. However, this will result in the MPS operating in contravention of the conditions of its Air Emissions License. To remain compliant to legislation, the MPS would need to shut down operation. This would have a catastrophic impact on the South African economy and the stability of electricity supply to southern Africa. It can therefore be considered that the No-Go Option is fatally flawed for these reasons.

8 RECEIVING ENVIRONMENT

In investigation of the receiving environment of the Medupi Power Station footprint, information was sourced from the original Medupi Power Station Environmental Impact Assessment Report (Bohlweki Environmental, 2006), existing specialist reports covering the study area and field assessments and specialist reports undertaken by specialists for this EIA.

The receiving environment is discussed in the sections below. It must however be noted that the FGD retrofit activities, besides the proposed area where the rail yard and associated structures will be constructed, will occur predominantly within an impacted footprint. A bird's eye view of the construction at the MPS is provided in **Figure 8-1**. Construction has, however, progressed at the MPS since this photograph was taken.

Figure 8-1: Photograph of the construction of the MPS

8.1 Climate

8.1.1 Regional Climate

The climatic regime of the Lephalale area is characterised by hot summers and mild winters. The long-term annual average rainfall is 485 mm, of which 420 mm falls between October and March. The area experiences high temperatures, especially in the summer months, where daily maxima of >40°C are common. The annual evaporation in the area is approximately 2 281mm. Frost is rare (Bohlweki Environmental; 2006).

The climate within the Lephalale Municipality and Limpopo Province in general results in a negative climatic water balance, and very little water for utilisation by industry, mining, agricultural and domestic land use.

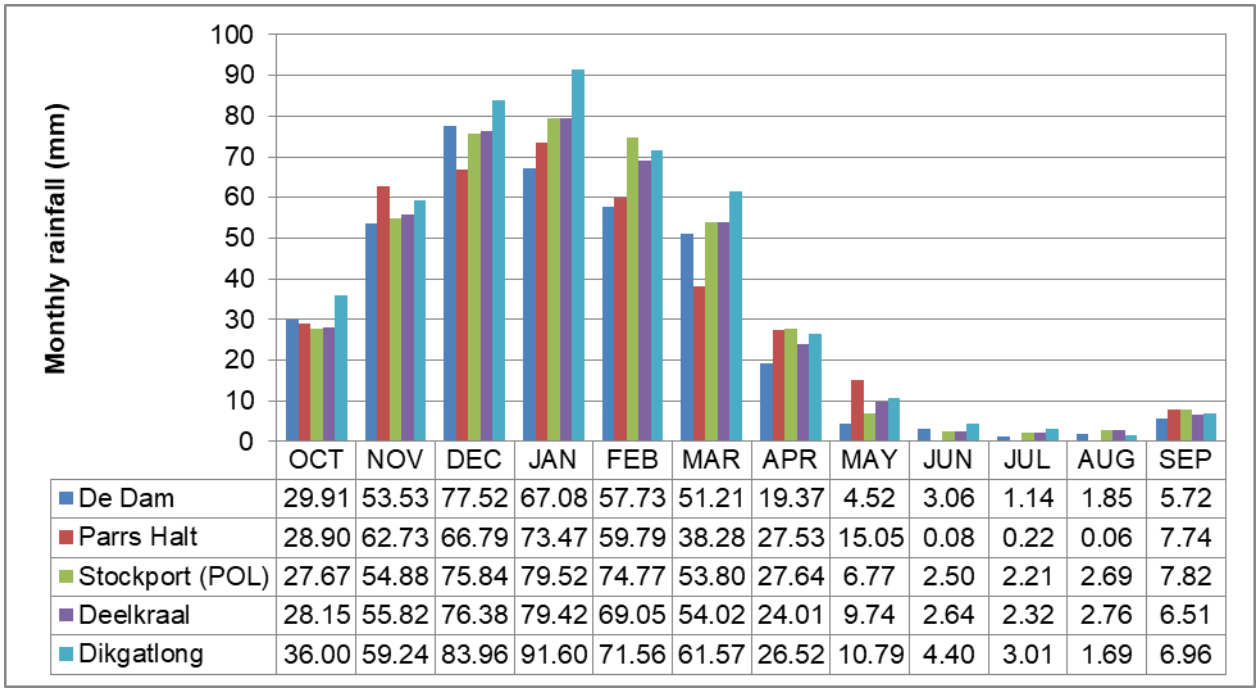
8.1.2 Rainfall at the study area

Climatic data for the area around MPS was sourced from rainfall stations are presented in **Table 8-1**. This table presents rainfall data over a period of approximately 100 years. The Mean Annual Precipitation (MAP) between the 5 stations range from 372.65 mm to 457.30 mm.

Table 8-1: Rainfall Stations in the Lephalale Area around the Medupi Power Station

Station	Name	Altitude (masl)	From	To	No. of Years	MAP (mm)
0717834 W	De Dam	825	1903	2000	97 (73.1% patched)	372.65
0717624 P	Parrs Halt	824	1903	2000	97 (61.9% patched)	380.63
0717595 W	Stockport (POL)	824	1903	2000	97 (35.4% patched)	416.09
0718147 W	Deelkraal	865	1908	2000	93 (86.9% patched)	410.82
0717418 P	Dikgatlong	834	1903	2000	97 (63% patched)	457.30

The monthly rainfall distribution for the five rainfall stations in the Lephalale area presented in **Figure 8-2**. It can be seen from the information presented that the monthly rainfall is fairly uniform.



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
De Dam	29.91	53.53	77.52	67.08	57.73	51.21	19.37	4.52	3.06	1.14	1.85	5.72
Parrs Halt	28.90	62.73	66.79	73.47	59.79	38.28	27.53	15.05	0.08	0.22	0.06	7.74
Stockport (POL)	27.67	54.88	75.84	79.52	74.77	53.80	27.64	6.77	2.50	2.21	2.69	7.82
Deelkraal	28.15	55.82	76.38	79.42	69.05	54.02	24.01	9.74	2.64	2.32	2.76	6.51
Dikgatlong	36.00	59.24	83.96	91.60	71.56	61.57	26.52	10.79	4.40	3.01	1.69	6.96

Figure 8-2: Monthly rainfall distribution for five rainfall stations in the Lephalale area

When the 5 stations were considered, Stockport (POL) roughly corresponded to the average among the 5 stations and is considered the most reliable of the 5 stations. When the rainfall data for the entire period was considered at this station, 75 events measured more than 50

mm/day and rainfall events with more than 100 mm/day were recorded 9 times during the data period. The highest recorded rainfall events at the Stockport (POL) station are shown in **Table 8-2** with the most recent occurrence on 8 February 2000.

Table 8-2: Highest rainfall events measured at Stockport (POL) rainfall station

Maximum recorded daily rainfall (mm)	Date of maximum rainfall
112.9	29 December 1917
120.9	22 April 1951
107.4	6 January 1958
109.2	7 April 1963
103.5	19 December 1970
125.5	11 February 1976
112	26 March 1977
103.5	6 January 1981
145	8 February 2000

The 24-hour storm rainfall gridded data for the 1:2, 1:5, 1:10, 1:20, 1:50, 1:100 and 1:200-year recurrence intervals is provided in **Table 8-3** and was obtained from South African Weather Services (SAWS) Rainfall station 0717595_W (Stockport POL). The rainfall distribution on site is classified as a type 3 design rainfall distribution.

Table 8-3: 24 Hour Rainfall Depths for Different Recurrence Intervals (mm/day)

Recurrence interval (years)	1 in 2	1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200
24-hour rainfall depth (mm)	61.7	87.1	105.3	123.9	149.7	170.3	192.0

8.1.3 Evaporation

Monthly evaporation data was available for two Department of Water and Sanitation (DWS) stations namely A4E003 Zandpan and A4E007 Mokolo Nature Reserve at the Mokolo Dam. The Mean Annual Evaporation (MAE) for station A4E003 and A4E007 is calculated at 2 572 mm and 2 014 mm, respectively.

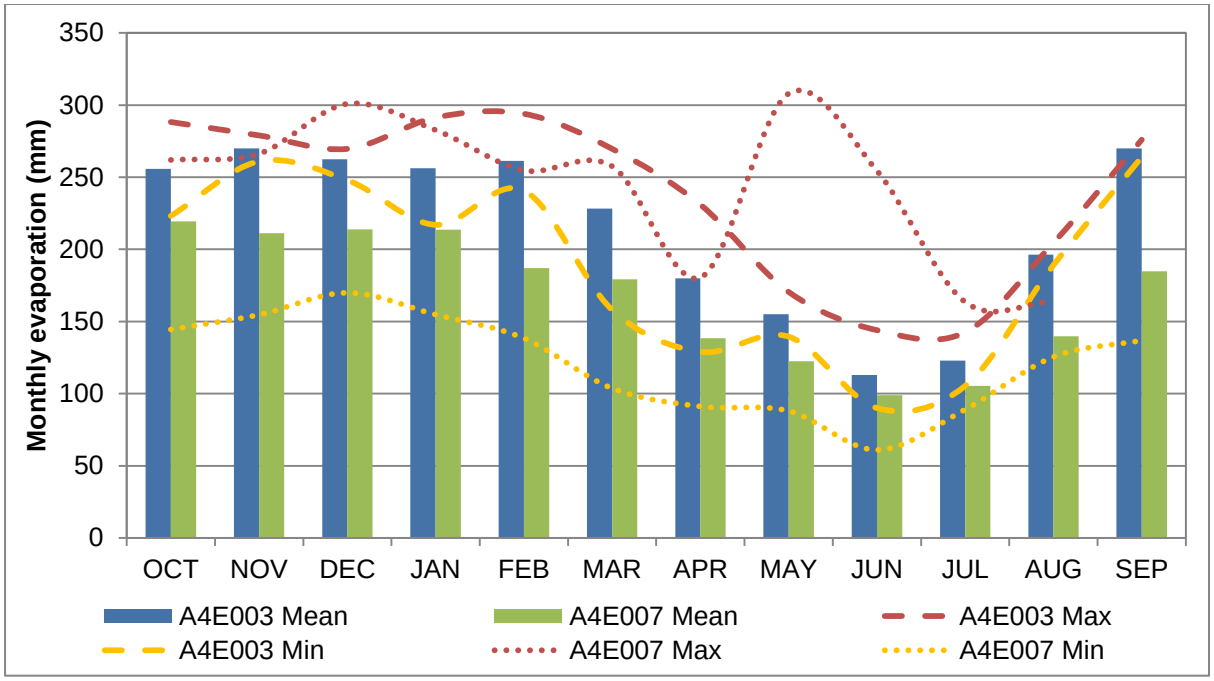


Figure 8-3: Monthly mean, minimum, maximum evaporation for stations A4E003 and A4E007

Monthly mean, minimum and maximum evaporation depths are shown in **Figure 8-3**. The highest evaporation occurs in the summer months from September to March. This is further verified by the in Average monthly evaporation values for stations A4E003 and A4E007 provided in **Table 8-4**.

Table 8-4: Average monthly evaporation values for stations A4E003 and A4E007

Month	Station A4E003	Station A4E007
Oct	255.75	219.38
Nov	270.00	211.21
Dec	262.47	213.81
Jan	256.27	213.56
Feb	261.40	186.99
Mar	228.37	179.34
Apr	180.00	138.32
May	155.00	122.51
Jun	113.00	98.83
Jul	122.97	105.45
Aug	196.33	139.85
Sep	270.00	184.88
Total	2 572	2 014

8.1.4 Wind

Wind data from meteorological data was obtained from the Medupi Power Station site for the period 2011-2013 in order to calculate wind roses representative of period, day- and night-times (von Gruenewaldt, et al., 2018). These wind roses are provided in **Figure 8-4** below.

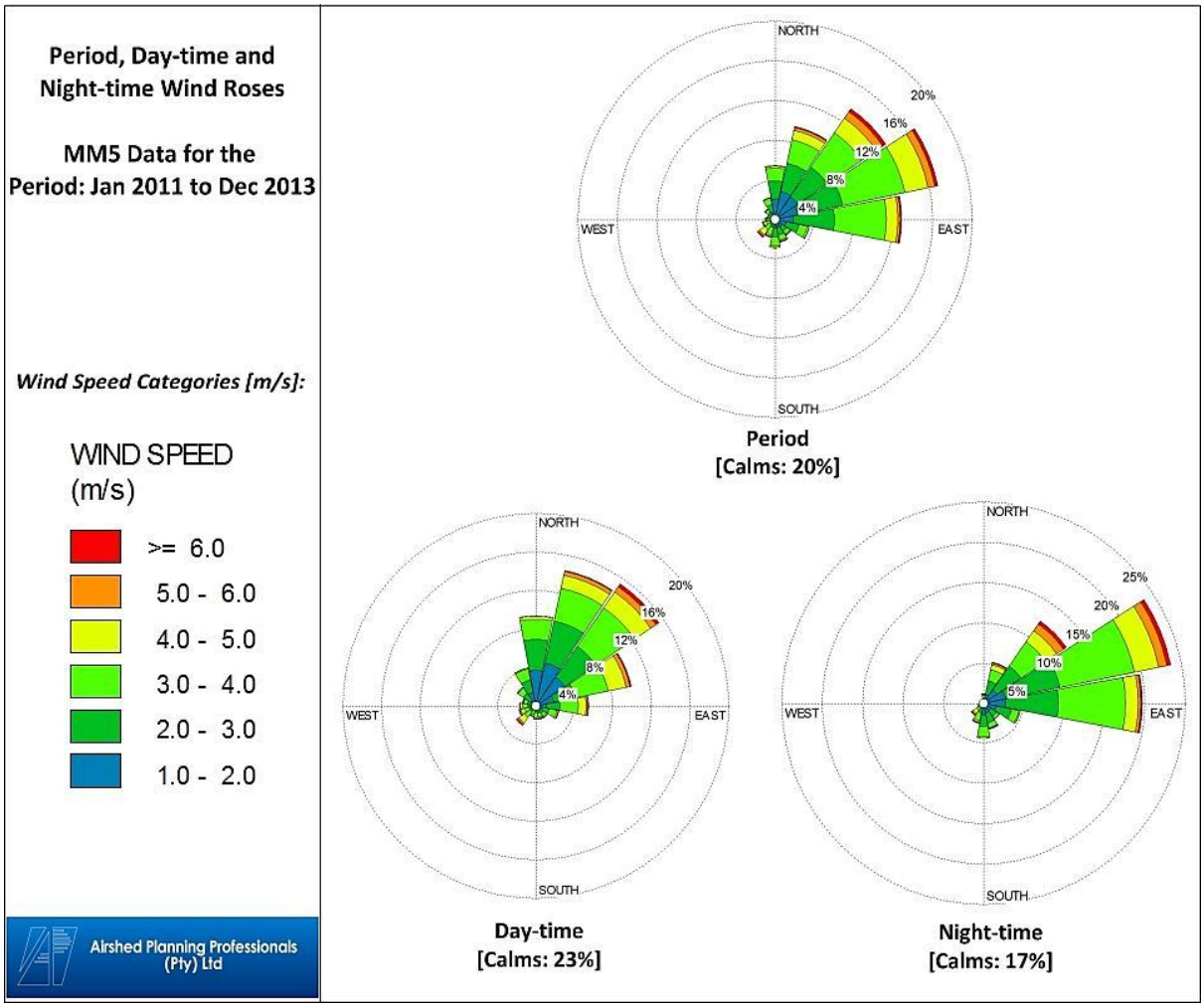


Figure 8-4: Period, day- and night-time wind roses for the period 2011-2013 (taken from von Gruenewaldt, et al., 2018)

Wind roses represent wind frequencies for the 16 cardinal wind directions. Wind frequencies are indicated by the length of the shaft when compared to the circles drawn to represent frequency of occurrence. Wind speed classes are assigned to illustrate the frequencies of high and low wind for each wind vector. The frequency of calm periods, defined as periods for which wind speeds are below 1 m/s, are indicated below the wind rose.

Results obtained for wind speed and direction represented in the wind roses indicate that the flow field is dominated by north-easterly winds, while winds are infrequently experienced from the westerly and southerly sectors. The wind speeds are generally low (1-3 m/s) to moderate (3-5 m/s) throughout the period.

8.2 Geology

Information relating to the geology within the proposed study area were obtained from the Soils and Land Capability Specialist Study (**Appendix G-2**) undertaken by Earth Science Solutions (Jones, 2018), as well as the Geotechnical Assessment (**Appendix G-1**) undertaken by Golder associated Africa (Owens-Collins, 2018), and Groundwater Impact

Assessment Study (**Appendix G-3**) also undertaken by Golder Associated Africa (Brink & van der Linde, 2018), including literature sited within these reports. These specialist study reports are included in **Appendix G** to this DEIR.

8.2.1 Regional Geology

The geological description below is taken directly from the specialist geology assessment as discussed in Sections 8 of the Scoping Report (Bohlweki, 2005) and the EIA Report (Bohlweki; 2006).

The Waterberg Coalfield comprises a graben structure with the Eenzaamheid fault forming the southern boundary and the northern boundary being delineated by the Zoetfontein fault. Archaean granite rocks outcrop to the north of the Zoetfontein fault and sediments of the Waterberg Group outcrop to the south of the Eenzaamheid fault.

The study area is further subdivided by the Daarby fault, a major northeast, then northwest, trending fault. The Daarby fault has a down throw of 360m to the north, at an angle of 50° to 60°. The down throw of 360 m to the north serves to bring the Grootegeluk Formation rocks to the south in contact with the younger Clarens Formation sandstone and Letaba Formation basalts in the north. Thus, the fault divides the coalfield into a shallow (opencast) coal area to the south of the Daarby Fault, and a deep north coal area.

The Eenzaamheid fault has a throw of 250 m to the north and the fault is near vertical. The fault brings the upthrown Waterberg Group sediments on the south side of the fault in contact with shallow coal on the northern side of the fault.

Due to the fact that the groundwater in the area has potential for enhancement, it is important that any activities that have the potential to impact on groundwater should be located away from the fault lines as described above.

Figure 8-5 provides an overview of the underlying geology of the receiving environment and has been obtained from the Hydrogeology Impact Assessment Report (Brink & van der Linde, 2018).

8.2.2 Geology within the study area

The local geology of the area can be subdivided into a northern and southern type. The Matimba Power station and all its facilities, except for the ash disposal facility, as well as Grootegeluk Mine, lies on Karoo sediments. The existing licensed disposal facility, Medupi Power Station and the Matimba ash dump lie on Waterberg sandstone, just south of the Eenzaamheid fault (**Figure 8-6**).

The area is classified as having a climatic N-value of almost 5, which indicates that both chemical weathering and mechanical weathering are likely. From the description of the geology of the area it can be expected that residual soils are generally shallow and transported soils vary greatly in thickness.

Ground conditions within the Medupi Power Station footprint were considered based on groundwater borehole results and include:

- The study site is underlain by a sequence of pebbles, weathered quartzitic conglomerate with fresh variously fractured quartzitic conglomerate at depth.
- The conglomerate is interbedded with bluish grey siltstone (bands). The drilling has shown the siltstone forms discontinuous layers of up to 50cm thick but mostly about 20cm thick.
- Generally surface weathering to shallow depth (<5m) occurs. In some boreholes a second fractured and associated weathered zone is observed and is normally found between 7 - 14m.
- Some boreholes showed no surface weathering.
- Boreholes in the extreme north or west, show the presence of deep weathering, up to 21m.
- Water strikes were made in 14 of the 35 boreholes at depths between 6 and 10.5m below surface.

The groundwater specialist considered Information relating to the railway yard and limestone and gypsum handling facilities based on information contained in an existing geotechnical study undertaken for the rail yard development and offloading facilities (Rockland Geoscience, 2015). This study reported at test pits closest to the proposed rail yard area medium dense silty sand to between 1.1m and 1.8m, underlain by dense gravel to between 1.5m and 2.4m, underlain by very soft rock quartzite, with TLB refusal at 1.8m on medium hard rock quartzite, and refusal on hardpan ferricrete at 2.4m.

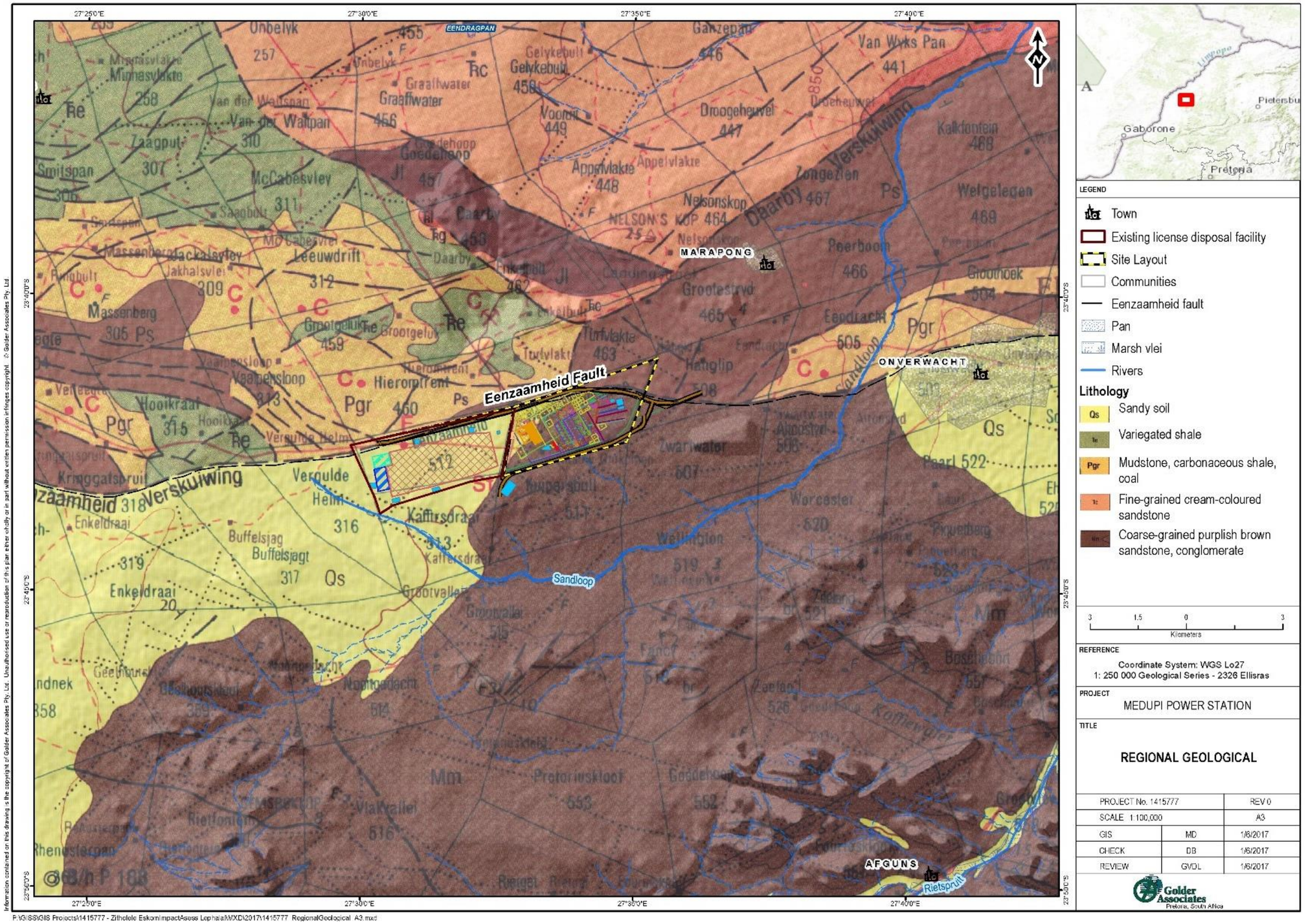


Figure 8-5: Regional geology associated with the development area and surrounds

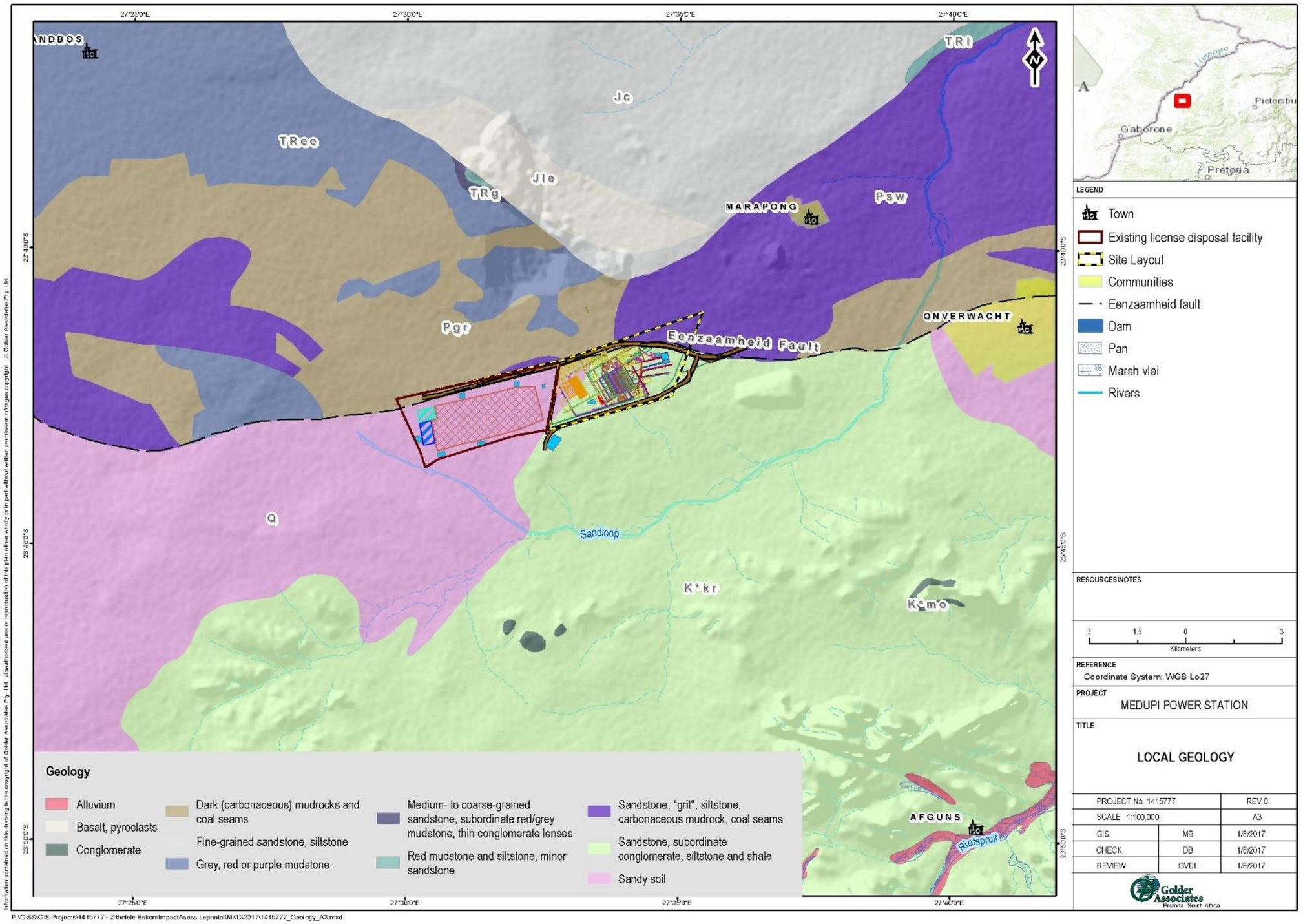


Figure 8-6: Local Geology at the MPS

8.3 Soils, Land Use and Land Capability

Information relating to the soils and land capability within the proposed study area were obtained from the Soils and Land Capability Specialist Study undertaken by Earth Science Solutions (Jones, 2018), including literature sited within the study report. This specialist study report is included in **Appendix G-2** to this DEIR. This specialist study initially focused on the soils and land capability within the proposed alternative sites, including the existing ADF footprint, referred to in the study as Site 13. Site 13 covered the western half of the MPS footprint where the proposed rail yard would be constructed. The specialist subsequently included a professional opinion relating to the sensitivity of the area within the MPS where the rest of the FGD infrastructure would be constructed.

8.3.1 Soils

The major soil types mapped within the study area reflect the host geology / lithologies of the parent materials, while the topography and climatic conditions that prevail have further influenced the pedogenisis and soils forms present in the area.

Noticeable to the area is the presence of the Permo-Carboniferous Waterberg Coalfield, which forms part of the Karoo Sequence. These coalfields extend approximately 90 km in an east-west alignment and approximately 40 km in a north-south alignment near the northwestern border of the RSA, and also continue into Botswana. This coal deposit is fault bounded along the southern and northern margins and can be classified as a graben or structural trough. The Eenzaamheid Fault forms the southern boundary of the deposit, where the Karoo strata abut with the strata of the Precambrian Waterberg Group.

It is these lithologies combined with the subtle topographic changes and changes in the position of the Limpopo River System over geological time that have produced the complex of differing soil Forms and groupings mapped.

The major or dominant soil forms in the area include those of the orthic phase Hutton, Clovelly, Glenrosa and Mispah forms with sub dominant soils of the Tukulu, Valsrivier and Shortlands Form, while the major hydromorphic forms mapped include the Glencoe, Dresden, Avalon, Pinedene, Bloemdal and Westleigh forms.

The semi-arid climate and negative water balance combined with the horizontal attitude of the sedimentary host lithologies that characterise the Karoo sediments in the area have aided in the development of evaporites within the vadose zone. These include calcrete, and in places ferricrete or laterite (Ouklip) formation as a feature of some of the soil profile.

The presence of a hard pan calcrete and in places ferricrete and plinthic horizons is considered of importance to the soil moisture regime and in many cases is the reason for wet features within the soil profile (barrier layer). This moisture is important to the biodiversity, the presence of pans and water features within the landscape, and the success or failure of the wetland systems in the extreme. These soils classify as highly sensitive where they occur within the top 500mm of the soil profile.

In addition to the geomorphological aspects mentioned above, soil texture and structure also played a role in the soil classification and the resultant sensitivity of the materials mapped. The fine to medium grained nature of the top soils, the relatively low clay contents (<12%) and the generally low organic carbon renders the majority of the top soils highly sensitive to erosion. This is only tempered by the relative flatness of the topography for all but a few areas, with a resultant moderate to low erosion index for most of the site if not well protected. Once the cover is disturbed or removed, the potential for erosion is increased.

The study area generally contain moderate to deep soils (**Figure 8-7**) and comprise for the most part fine to medium grained sandy topsoils on lithocutanic subsoil (Glenrosa) or sandy loams on a hard rock base (Mispah). Area of wet based (hydromorphic) soils within the study area.

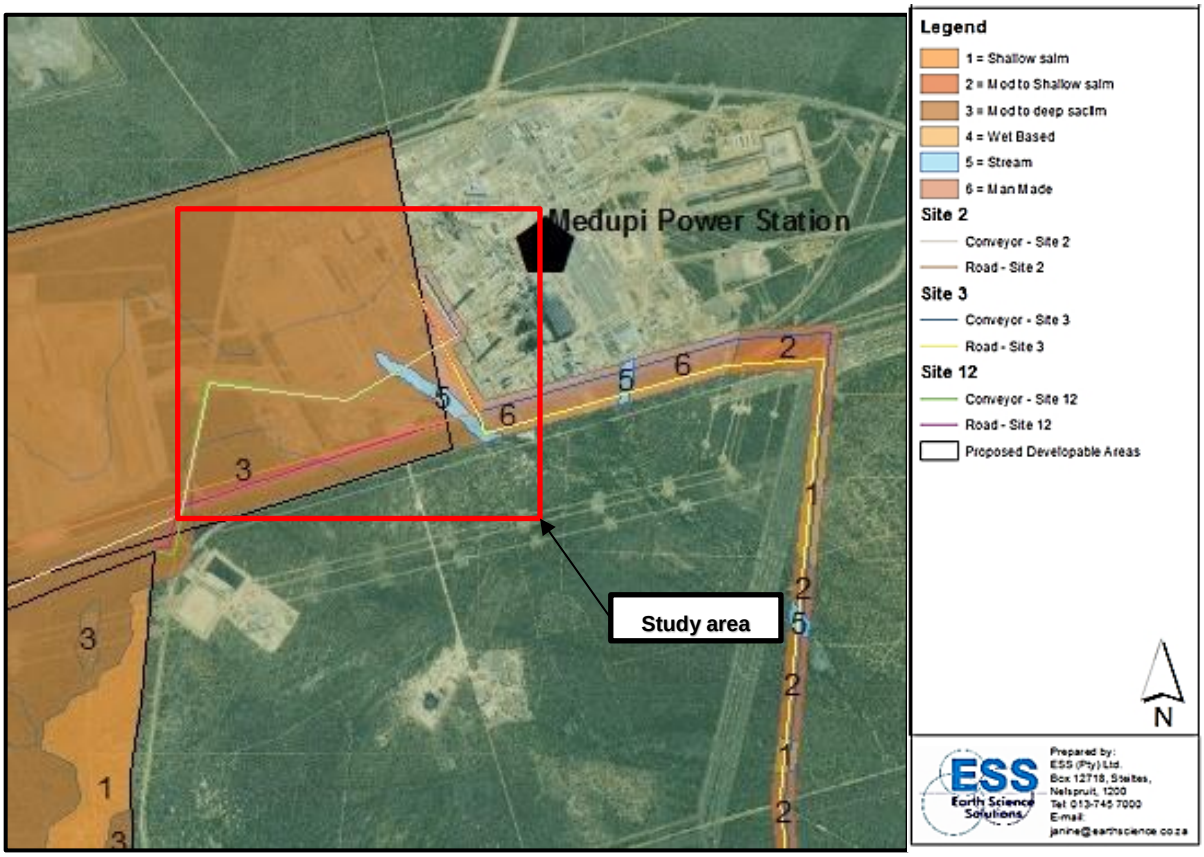


Figure 8-7: Dominant soils in the study area (excerpt from soils specialist study)

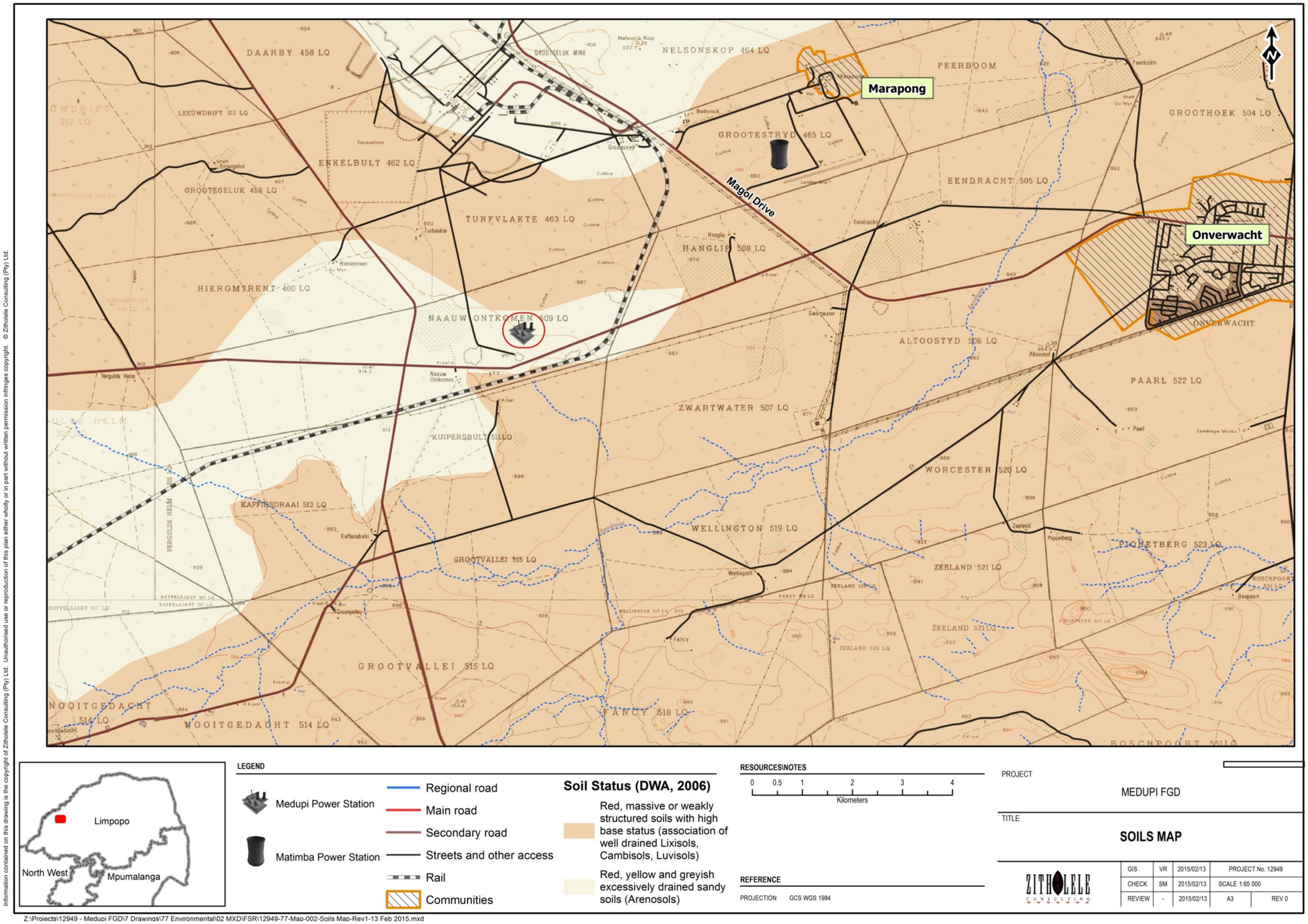


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Figure 8-8: Regional soils profile in the area

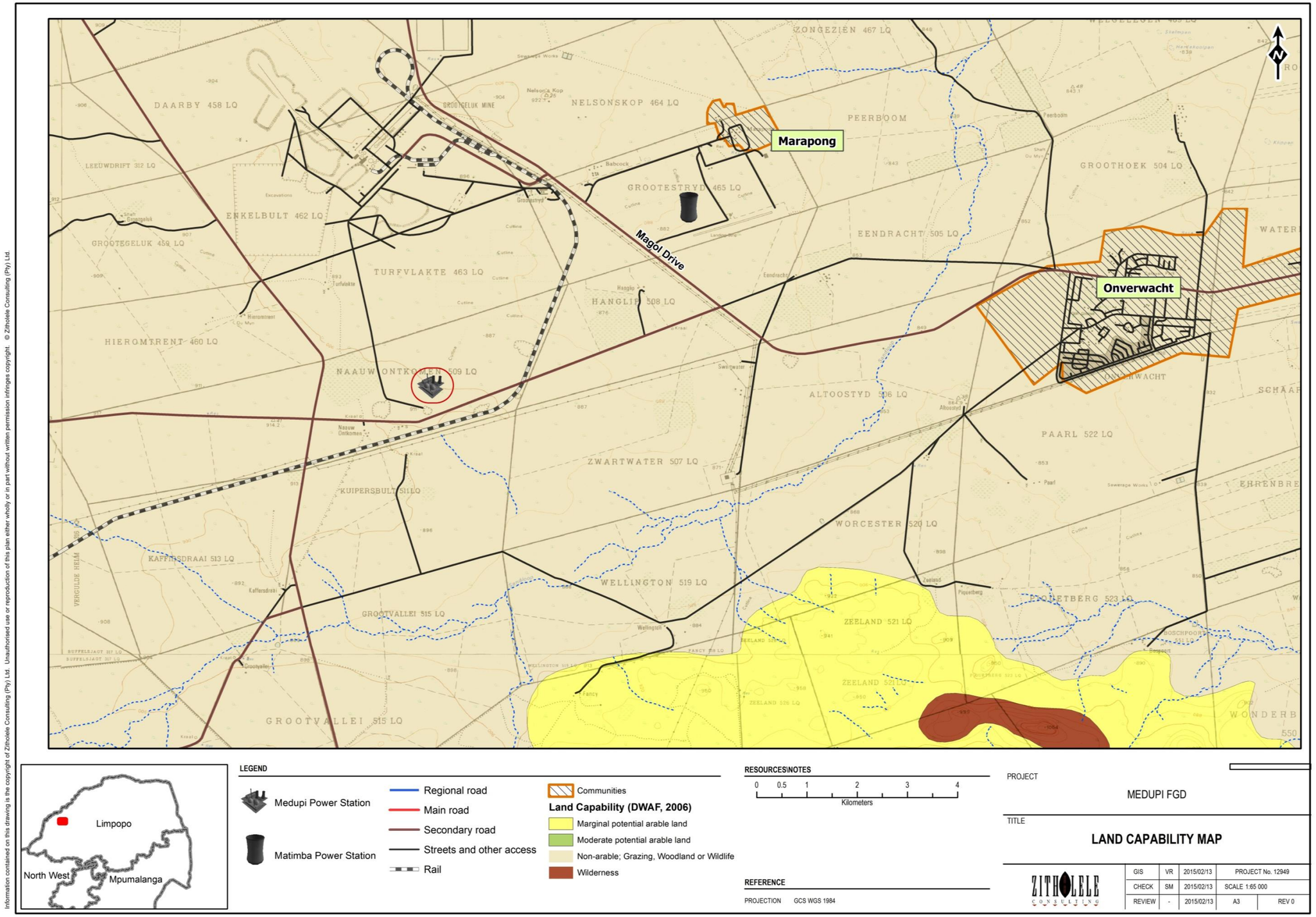

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Figure 8-9: Land capability in the area

The study area contains clay rich soils, shallow soils and light textured soils.

8.3.1.1 Clay rich soils

In general soils with higher clay content are associated with the colluvial derived/transported materials, and are most often found associated with the lower lying streams and river deposits, albeit that the geology and underlying lithologies also influence the soil pedogenisis, with the more basic lithologies producing soils with more structure and heavier clay percentages.

The higher clay contents, and in places the swelling clay (2:1 Montmorillonite clays) have resulted in stronger than average soil structure that varies from pedocutanic to prismacutanic with distinctive slick-n-sides in the wet state and prominent open cracking at surface in the dry state. Stronger than average structure is noted in some of the colluvial and alluvial derived soils associated with the lower lying areas and flood plain deposits.

The sensitivity of these soils to being disturbed (worked on or moved) is evident in the ease of erosion that is noted where over grazing or disturbance of the topsoil has occurred, while the wetness factor and their importance in soil water storage and base flow transfer renders these materials as highly sensitive.

8.3.1.2 Shallow soils

A significant proportion of the soils within the study area are of a shallow to very shallow rooting depth. These soils are almost always founded directly on a hard rock interface, with little to no saprolite at the base of the “B” horizon and are considered of a poor to very poor land capability rating.

These soils are associated with the more resistant host rock lithologies and often form the ridge lines and upper slope positions. The resultant poor vegetative cover, the generally lower clay content and lower organic carbon contents result in a high sensitivity rating for these materials.

8.3.1.3 Light Textured Soils

The light textured soils include the majority of the orthic form soils, as well as some of the deeper hydromorphic soil Forms. The majority of these Forms are characterised by a humic “A” horizon overlying a red or red-brown apedel (poorly structured) B, with indications of mottling within the lower “B” horizons in the case of the hydromorphic soils.

Depths to the “C” horizon or the plinthic layer vary from less than 400mm on the shallow forms to over 800mm on the deep colluvial soils. The soils generally show a very thin saprolitic horizon, with the sub soils founded directly on hard bedrock.

The sensitivity of these soils is highly variable and depended on the depth and relative texture (clay content) of the materials. However, on average, and for the dry soils that are greater than 500mm deep, these soils are of the least sensitive, are generally more easily

worked on and with, and can be stored with relative ease and re-used at closure for rehabilitation.

8.3.2 Land capability

The land capability within the study area consists mainly of arable and grazing land. However, it is also important to note that the pre-development conditions or status quo for the area of concern is one of disturbed industrial. For the most part the site comprises land that has been cleared or disturbed to some degree by the power station development.

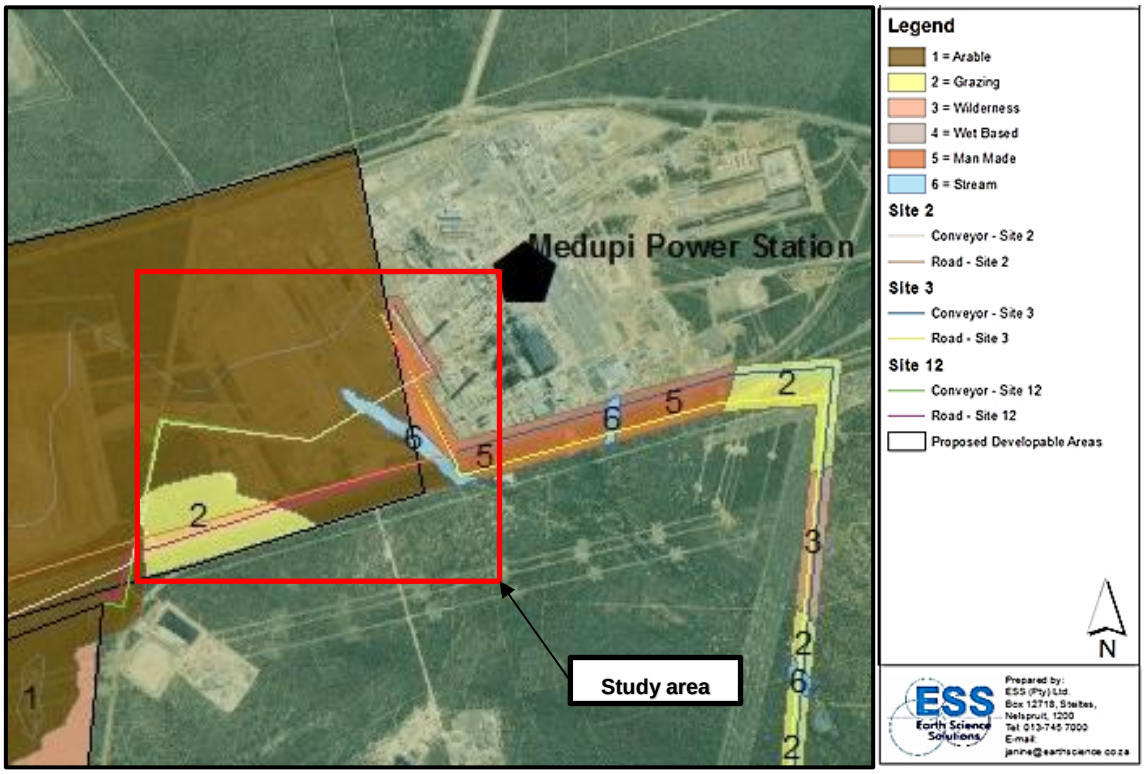

Figure 8-10: Land capability within the study area (excerpt from soils specialist study)

8.4 Groundwater

Information relating to groundwater resources within the proposed study area was obtained from the Hydrogeological Impact Assessment Study undertaken by Golder Associates Africa (Pty) Ltd (Brink & van der Linde, 2018), including literature sited within the study report. This specialist study report is included in **Appendix G-3** to this DEIR.

8.4.1 Regional Groundwater

Two distinct and superimposed groundwater systems are present in the geological formations of the coal fields in South Africa. They are the upper weathered aquifer and the system in the fractured rock below.

The Weathered Aquifer System generally occurs in the top 5-15 m and normally consists of soil and weathered rock. The upper aquifer is associated with the weathered horizon. In boreholes, water may often be found at this horizon. The aquifer is recharged by rainfall.

In a Fractured Aquifer System, grains in the fresh rock below the weathered zone are well cemented, and do not allow significant water flow. All groundwater movement therefore occurs along secondary structures such as fractures, cracks and joints in the rock. These structures are best developed in sandstone and quartzite, hence the better water-yielding properties of the latter rock type. Dolerite sills and dykes are generally impermeable to water movement, except in the weathered state.

8.4.2 Groundwater Quality

An analysis of groundwater monitoring results from 2016 were undertaken and it was found that the water quality of the existing boreholes is largely poor quality, with water quality classes ranging from Class 0 (Ideal water quality) to Class IV (Unacceptable water quality).

8.4.3 Regional Aquifer Recharge

From the published hydrogeological maps (DWAF 1996) the average recharge for the study area is shown as between 10 to 15mm per annum.

8.4.4 Groundwater Vulnerability

Groundwater vulnerability gives an indication of how susceptible an aquifer is to contamination. Groundwater vulnerability at the MPS is shown on the national groundwater is indicated as medium.

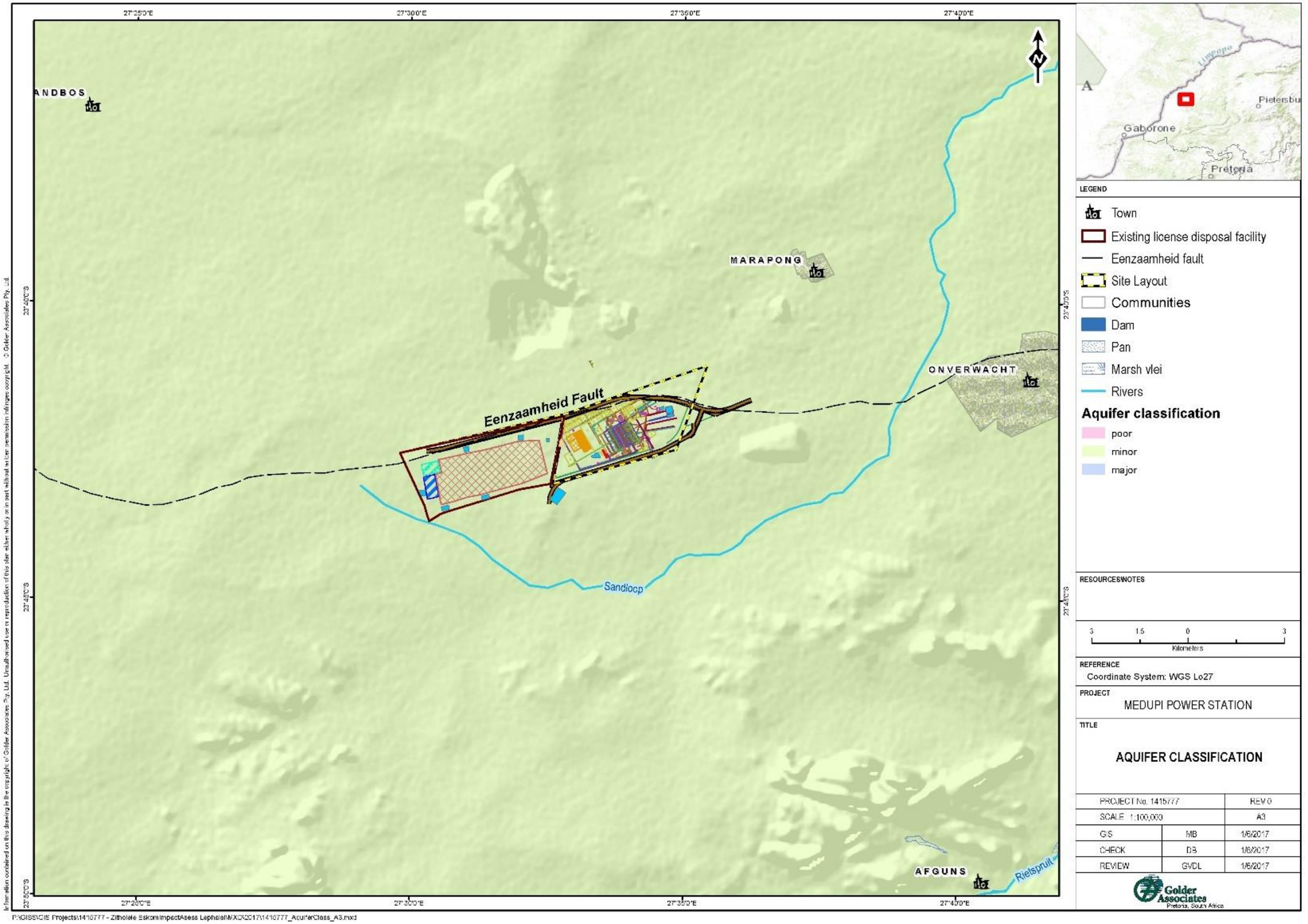

Figure 8-11: Regional aquifer classification

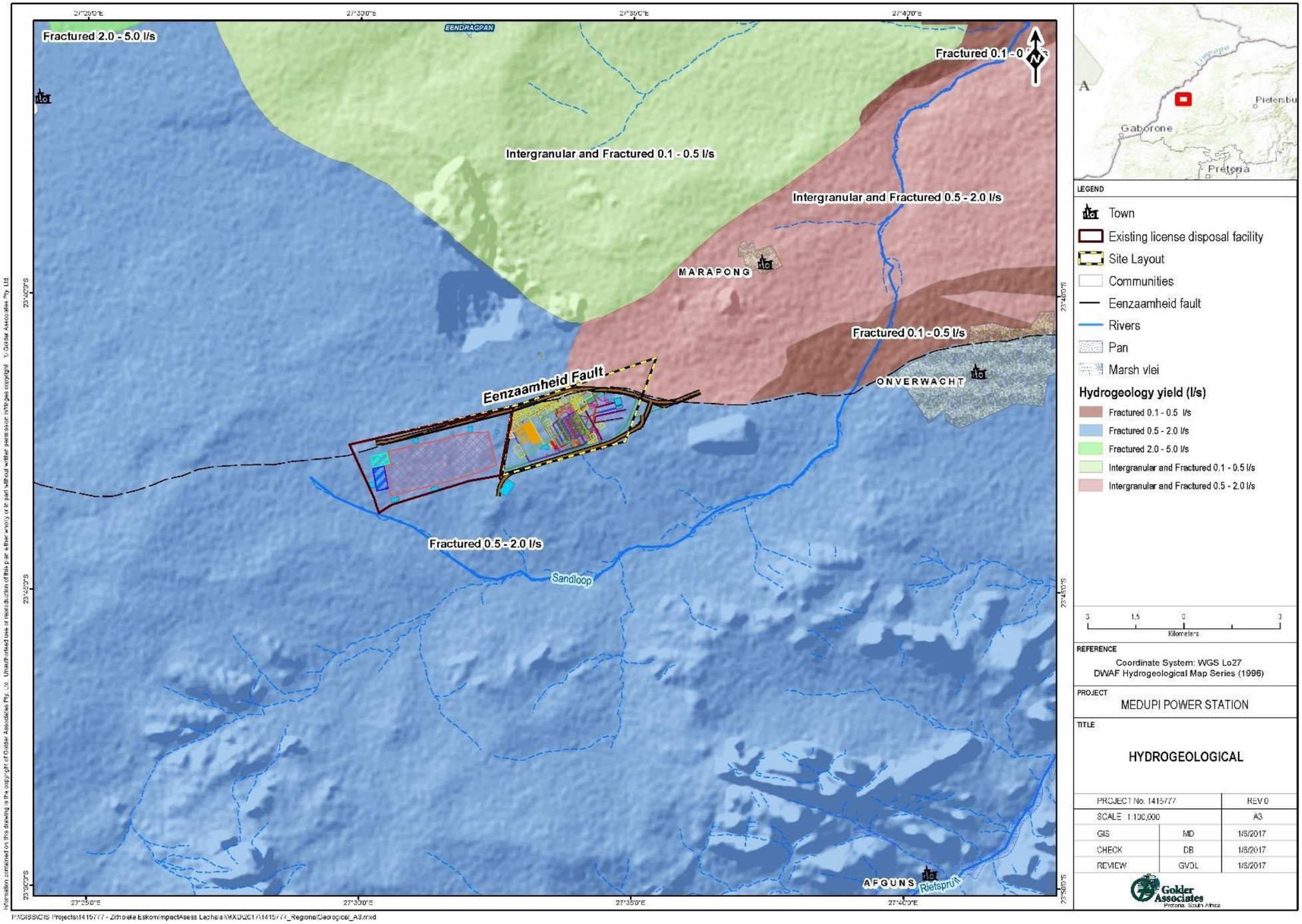

Figure 8-12: Hydrogeology Map

8.4.5 Aquifer Classification and Borehole Yield

The published hydrogeological maps series by DWAF (1996) was used to define the regional aquifer classification (**Figure 8-11**), which is classified as a minor aquifer system with fractured aquifer zones (**Figure 8-12**). The published hydrogeological maps (DWAF 1996) indicate that the average borehole yield in the area is between 0.5l/s and 2.0l/s.

8.4.6 Groundwater Levels and Flow Directions

From the available data and previous groundwater studies undertaken in the area, groundwater levels ranged from between 4.41 to 69.98 meters below ground level (mbgl), with the average water level as 30.4mbgl. The groundwater flow from the study area is primarily away from the site, towards the east/south-east and northeast towards the non-perennial Sandloop River.

8.5 Surface Water

Information relating to the surface water resources within the proposed study area was obtained from the Surface Water Impact Assessment Study undertaken by Golder Associates Africa (Pty) Ltd (Sithole & Jordaan, 2018), and Biodiversity and Wetland Assessment undertaken by Natural Scientific Services (NSS) (Abell, et al., 2018), including literature sited within these study report. These specialist study reports are included in **Appendix G-4** to this DEIR.

8.5.1 Regional Drainage Network

The study area is located within the A42J Quaternary catchment (**Figure 8-13**) to the south of the Lephalale coalfield where numerous mining developments are foreseen predominantly to the north of the Eenzaamheid Fault line. There are no perennial streams originating within the area itself. The closest perennial river is the Mokolo into which the non-perennial Sandloop River drains. The Mokolo flows through A42J to the Limpopo River.

Medupi is situated in the Mokolo catchment, with the non-perennial Sandloop River flowing around the site in an easterly to north easterly direction to confluence with the Mokolo River approximately 16 kilometres downstream of the town of Lephalale. The study site falls in a predominantly flat area of the Limpopo Water Management Area (WMA).

8.5.2 Water uses in the catchment

The water use within the catchment is predominantly agriculture (87%) and industry (13%) related. The Limpopo Province, and in particular, the Lephalale area, is a water stressed area with evaporation significantly higher than precipitation. Agricultural and industrial land uses in the municipal area are water intensive. There is therefore a high demand for water from an already water-stressed catchment.

Within the provisions of the National Water Act (Act 39 of 1998 as amended) as stipulated in the National Water Resources Strategy, there is a need to meet the water requirements of

the Reserve (Basic Human needs and Ecological) in terms of water quantity and quality. Taking the requirements into account, there is insufficient water to maintain the current balance. Added to this, it is anticipated that water demand will increase with new developments proposed in the Mokolo Catchment, such as new or expanded mining activities and new power stations (Bohlweki Environmental, 2006).

The MCWAP scheme has been initiated in order to provide adequate water to supply the current and planned water users with allocations of water from the Mokolo Dam. Medupi Power Station already has an allocation for water from the MCWAP phase 1 scheme. There is currently a WULA in process for additional water allocation to Medupi from the MCWAP phase 2 scheme in order to supply for the planned FGD technology operation. This WUL is been applied for at a strategic level by Eskom. The total water requirement will be of 15.4 million m^3 per annum, the pipeline infrastructure is being sized for this and the licence will be for the same amount.

8.5.3 Water Resource Classification and Resource Quality Objectives

The classification of significant water resources in the Crocodile (West), Marico, Matlabas and Mokolo catchments in accordance with the Water Resource Classification System (WRCS) was undertaken in 2011 / 2012 and finalised in 2013.

In terms of the classification system, each quaternary catchment is classified as a Class I, II or III, defined as:

- Class I - Minimally used: Water resource is one which is minimally used and the overall condition of that water resource is minimally altered from its pre-development condition;
- Class II - Moderately used: Water resource is one which is moderately used and the overall condition of that water resource is moderately altered from its pre-development condition; and
- Class III - Heavily used: Water resource is one which is heavily used and the overall condition of that water resource is significantly altered from its pre-development condition.

The recommended Class for quaternary catchment A42J is a Class II (Department of Water Affairs, 2013). In this respect mitigation implemented must be such that it will protect the water resources so that an ecological category of B/C is maintained.

The determination of Resource Quality Objectives (RQO) for the area was undertaken in 2016/ 2017 and will be gazetted during the first quarter of 2018 (DWS, 2017, Report number: DM/WMA01/00/CON/RQO/0516). The proposed RQOs and numerical limits are set out in **Table 8-5**.