Project Applicant: **EXXARO REDUCTANTS (Pty) Ltd**

Project: **Char Manufacturing Plant Expansion**

Report Name: **DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT VOLUME 1**

Report Status: **Draft**

Revision No: 01
Report Date: May 2012
Report Number: S0342/EIA02
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For Submission to: Limpopo Department of Economic Development, Environment and Tourism (LEDET), as part of the EIA in terms of the National Environmental Management Act.
Department of Mineral Resources, as part of the EIA and EMP in terms of the Mineral and Petroleum Resources Development Act (No 28 of 2002).
National Department of Environmental Affairs, as part of a waste management license in terms of the National Environmental Management: Waste Act (No. 59 of 2008)

Reference No:
LEDET: 12/1/9/2-W07
DWA: to be announced
DEA: 12/9/11/L783/5
DMR: LP 30/5/1/3/2/1 (46) EM

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PROJECT INFORMATION SHEET

PROJECT:
Char Manufacturing Plant Expansion

REPORT DETAILS:

Report Name:	**Char Manufacturing Plant Expansion – Draft Environmental Impact Assessment**
Report Number:	S0342/EIA02
Report Status:	Draft
Revision No:	02
Date:	May 2012

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EXXARO REDUCTANTS (Pty) Ltd

Char Manufacturing Plant Expansion

Environmental Impact Assessment Report

EXECUTIVE SUMMARY

Introduction and Project Description

Exxaro Reductants (Pty) Ltd (Exxaro Reductants) operate an existing Char Manufacturing Plant located on the Farm Daarby 458 LQ, within the boundaries of the Grootegeluk Coal Mine, approximately 20km west of Lephalale (formerly Ellisras) in the Limpopo Province and is proposing to expand this plant. Grootegeluk Mine is adjacent to the Matimba and Medupi Power Stations, two major clients of Grootegeluk Mine. About 18% of the mine's production consists of semi-soft coking and metallurgical quality coal, which is sold to local and international steel and ferro-alloy plants.

Char, a form of devolatilised coal, is used in the metals industry to reduce oxygen from ore to produce the basic metal. There is a demand for increased production of char within this market, which the proposed expansion aims to address. Exxaro Reductants is in a prime position to address this demand with the existing plant already in production, readily available coal feedstock from Grootegeluk Mine and in close proximity to their customers.

The existing Char Manufacturing Plant was built on an old coal stockpile area within the mining area of Grootegeluk Mine and has been operational since 2009. The existing plant has experienced some operational problems which Exxaro Reductants will endeavour to resolve in the expanded plant. The existing Char Manufacturing Plant is owned and operated by Exxaro Reductants, a separate business entity to the Grootegeluk Coal Mine, which is owned by Exxaro Coal (Pty) Ltd. The existing plant occupies an area of approximately 8.1 ha. Exxaro Reductants now wishes to expand the Char Manufacturing Plant by increasing the number of retorts from 4 to a maximum of 12, thereby increasing their production capacity threefold. The majority of the infrastructure and stockpile areas associated with the retorts will also be expanded. The expansion will be located adjacent to the existing Char Manufacturing Plant and will therefore also be in the Grootegeluk mining area.

The Char Manufacturing Plant involves the conversion of coal to high quality carbon reductants (char) through the removal of volatile gas by heating the coal. The process takes place in a closed circuit and involves the application of gaseous heat in the absence of oxygen, which maximises the recovery of carbon. The technical details of the process are explained in the main report.

In line with best practices and standards for EIAs, certain development alternatives will be discussed and considered during the EIA phase. The alternatives will include the no-go option - that the expansion of the Char Manufacturing Plant will not be undertaken. No locality alternatives have been assessed as part of this report since the proposed expansion will be located adjacent to the existing Char Manufacturing Plant and much of the existing infrastructure will be utilised for the expansion. The Char Manufacturing Plant and the expansion site are conveniently located close to the coal source required to produce char. As the proposed site is located in on a previously disturbed old coal stockpile area and

the disturbance of a green field site is therefore avoided. Any other locality will require replication of existing infrastructure and a larger footprint of disturbance due to additional infrastructure and transport requirements.

Description of the Affected Environment

The core study area can be defined as the existing Char Manufacturing Plant in the current Grootegeluk Coal mining right area, and areas affected by associated activities and infrastructure. During the EIA phase, the various specialist studies have been used to define the project zone of influence which has ultimately defined the broader study area.

The broader area around the mine is mainly used for game farming. Other land uses around the mine include a brick making operation, the Maropong Township and the Medupi and Matimba Power Stations.

The area is located within the land capability classes V and VI which makes the area suitable for grazing land, but not for arable land. Potential agricultural or other uses for the land are limited.

In terms of the environmental baseline which will be affected, the aspect which is of most concern is the current level of air quality in the area. Air quality is affected by the Grootegeluk Mine and the Eskom Matimba (existing) and Medupi (under construction) Power Stations and their associated ash dumps. However, the emissions from the existing Char Manufacturing Plant are likely to have an impact on the air quality in the immediate Char Manufacturing Plant area. The emissions from the existing plant are currently licenced in terms of an existing Atmospheric Pollution Prevention Act (APPA) permit. There has been an indication that the emissions which should be emitted according to the design of the plant, are currently being exceeded. In the past, the existing plant has not run in a stable manner and various operational problems have been experienced, which have resulted in higher than expected atmospheric emissions.

An additional concern regarding the environmental baseline is the current level of groundwater pollution on the site, caused mainly by the historical coal stockpile area and current mining activities surrounding the existing Char Manufacturing Plant. No hydrocarbon pollution has been detected in the monitoring boreholes surrounding the existing Char Manufacturing Plant. Spills of liquor and tar on the existing plant site may leach pollutants into the groundwater. Any stockpiles of coal and char products at the existing Char Manufacturing Plant, which are stored directly on the surface of the ground (i.e. not on a concrete surface) may also be leaching contaminants into the groundwater on the site.

Exxaro Reductants aims to address the air quality and groundwater quality problems through improvements to the design of the expanded Char Manufacturing Plant. These issues will be assed in more detail in the EIA report.

Results of Consultation with Interested and Affected Parties

In August 2010 and March 2011, public participation processes were undertaken for the proposed Char Manufacturing Plant Expansion Project. The issues raised included the source of water required for the project and whether suitable measures to control surface water pollution would be put in place. In addition, IAPs were concerned about air quality impacts and their effect on human health, the generation and disposal of hazardous waste, and the time period required for construction.

Environmental Legal Requirements

The key legislation applicable to the proposed project includes:

- *The National Environmental Management Act (No. 107 of 1998) (NEMA);*
- *The Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA);*
- *The National Water Act (No. 36 of 1998) (NWA);*
- *The National Environmental Management: Waste Act (No. 59 of 2008) (NEMWA); and*
- *The National Environmental Management: Air Quality Act (No. 39 of 2004) (NEMAQA).*

There will be five key deliverables for the project, each of which will be submitted to the relevant government department. These are:

- *An Environmental Impact Assessment (EIA) in accordance with NEMA will be submitted to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) for activities that are listed in terms of the EIA Regulations;*
- *An EIA and Environmental Management Programme (EMP) in accordance with the MPRDA will be submitted to the Department of Mineral Resources (DMR) for approval (THIS REPORT);*
- *An amendment to the Integrated Water Use Licence Application (IWULA) will be submitted to the Department of Water Affairs (DWA);*
- *A Waste Management Licence in accordance with NEMWA will be submitted to the National Department of Environmental Affairs (DEA) or LEDET for approval; and*
- *An Atmospheric Emissions Licence in accordance with the NEMAQA will be submitted to LEDET for approval.*

Environmental Impacts

This report assesses the potential environmental impacts (physical, biological, social and economic) associated with the proposed Char Manufacturing Plant Expansion Project, as well as a strategy of how these impacts can be managed and mitigated. An EMP (separate document) has also been compiled to further aid the management of the impacts.

The impacts which may be significant for this project include: air quality, surface and ground water quality, social and economic impacts.

Methodology for the Environmental Impact Assessment

The methodology for the EIA involved identifying, assessing and mitigating the potential environmental impacts. Specialist studies and consultation with the public and authorities was used to assist with the impact assessment process.

Study Team

Synergistics Environmental Services (Pty) Ltd (Synergistics) has been appointed by Exxaro Reductants as the independent environmental consultant to undertake the EIA. Matthew Hemming, a director of Synergistics, is the Environmental Assessment Practitioner (EAP) for the project. Several specialists have undertaken specialist studies as part of the EIA.

EIA Process

The EIA process has been developed to ensure that it complies with GNR 543 Sections 26 to 33 and the associated guidelines as well as the requirements of the MPRDA. The EIA process and public participation process are discussed in the report, with specific reference to the opportunities for consultation and participation for IAPs, Competent Authorities, and relevant State Departments and Organs of State.

Table A: Simplified EIA Process

Phase of Environmental Process		Opportunities for Consultation and Participation		Schedule	
		Competent Authorities (LEDET, DEA, DMR and DWA)	IAPs, State Departments and Organs of State		
Project Announcement and Application Phase	Specialist Baseline Studies	Initial telecommunication.	Project notification to affected landowners.	Aug 2010 - Mar 2011	2010 - 2011
			Advertisements and project notifications to potential interested and affected parties.	Aug 2010 - Mar 2011	
		Submit NEMA application form which was acceptable to LEDET.		Apr 2011	
		Initial consultation with authorities.		Aug 2010 - Mar 2011	
Scoping Phase		Focused consultation with LEDET, DMR and DWA.	Initial public meetings.	Aug 2010, Mar & May 2011	
			Focused consultation with Lephalale Municipality, Waterberg Municipality.		
		Draft scoping report to LEDET, DMR and DWA.	Review of draft scoping report (40 days, ±6 weeks).	June to Sept 2011	2011 - 2012
		Final scoping report to LEDET, DMR and DWA. Review and acceptance of final scoping report (30 days)	Review of final scoping report (30 days, ±4 weeks).		
EIA Phase EMP Development	Specialist Assessments	Meetings with LEDET, DMR and DWA to discuss specialist studies.	Results of specialist assessments and recommendations made available for review	May to June 2012	2012
		Submit draft EIA report to LEDET, DMR and DWA.	Review of draft EIA report (40 days, ±6 weeks)		
		Submit draft IWWMP to DWA.	Review of draft IWWMP (40 days, ±6 weeks)		
		Meetings with LEDET, DMR and DWA during EIA.	Possible public and authority meeting during EIA phase (14 days' notice)		
Authority review & Authorisation Phase		Final EIA report to LEDET, DMR and DWA. SUBMIT IWWMP with IWULA to DWA.	Review of final EIA report (21 days, ±3 weeks) Review of Final IWWMP (21 days, ±3 weeks)	July to Nov 2012	
		LEDET Acceptance of EIA report (60 days)			
		Environmental Authorisation Granted / Refused (45 days) IWULA approved / rejected by DWA.			
			Notifications to IAPs regarding environmental authorisation (granted or refused).		
Appeal / Pre-Construction Period		Consultation during processing of appeal.	Consultants to provide guidance regarding the appeal process as and when required.	Variable	

Specialist Studies

Specialist input and studies were conducted for the following environmental components. The results of these studies are outlined in the main report:

- *Air Quality Assessment.*
- *Traffic Impact Assessment.*
- *Surface Water Assessment.*

- *Groundwater Assessment.*
- *Waste Stream Assessment.*

Conclusions and Key Findings

This report forms part of the EIA phase of the Char Manufacturing Plant Expansion Project environmental assessment. It outlines the results of the public participation and authority consultation process undertaken in August 2010 and March 2011, explains the results of the specialist studies undertaken, assesses the environmental and socio-economic impacts and outlines mitigation measures.

As most of the assessment was undertaken using modelling exercises, it is vital that suggested monitoring is undertaken to ensure better understanding of the environmental impacts.

The EAP considers that the environmental process followed meets the requirements of the legislation to ensure that the regulatory authorities receive sufficient information to enable them to make an informed decision.

There have been no fatal flaws identified during the EIA phase and the EAP therefore considers that the project should be granted authorisation under the MPRDA. The mitigation measures which are presented in the EMP which accompanies this report are considered to be sufficient to mitigate the impacts to environmentally acceptable levels. There are no impacts which have a high significance after mitigation.

EXXARO REDUCTANTS (Pty) Ltd

Char Manufacturing Plant Expansion

Environmental Impact Assessment Report

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LIST OF ABBREVIATIONS

APPA	Atmospheric Pollution Prevention Act (No. 45 of 1965)
AGIS	Agricultural Geo-reference Information System
As	Arsenic
BID	Background Information Document
BEE	Black Economic Empowerment
CH_4	Methane
CO_2	Carbon dioxide
COC	Chemicals of Concern
DC	Direct current
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources (formerly the Department of Minerals and Energy (DME))
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EAP	Environmental Assessment Practitioner
EMP	Environmental Management Programme / Plan
ESP	Electrostatic precipitators
FeCr	Ferrochrome
GN (R)	Government Notice (Regulation)
ha	Hectare/s
H_2O	Water
H_2S	Hydrogen sulphide
HDPE	High density polyethylene (plastic)
IAPs	Interested and Affected Parties
IWUL(A)	Integrated Water Use Licence (Application)
IWWMP	Integrated Water and Waste Management Plan
kPa	Kilo Pascal (unit of pressure)
ktpa	Kilo tonnes per annum
kVA	Kilovolt ampere
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LPG	Liquid petroleum gas
MAR	Mean annual runoff
MCWAP	Mokolo and Crocodile Water Augmentation Project
Mℓ	Mega (million) litres = 1000 m^3
MPRDA	Minerals and Petroleum Resources Development Act
MSD	Material Safety Data
MVA	Megavolt ampere
NEMA	National Environmental Management Act
NEM:AQA	National Environmental Management: Air Quality Act

NEM:WA	National Environmental Management: Waste Act
NH_3	Ammonia
NO_x	Nitrogen oxides
NWA	National Water Act
O_2	Oxygen
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyl
PCD	Pollution control dam
PM_{10}	Fine particulate matter with diameter less than 10 microns
Pb	Lead
PPE	Personal Protective Equipment
ROM	Run of Mine
SAHRA	South African Heritage Resources Agency
SAWS	South African Weather Service
SLA	Service level agreement
SO_2	Sulphur dioxide
SO_4	Sulphate
SSV	Soil Screening Value
TP	Test Pit
tph	Tons per hour
TPH	Total petroleum hydrocarbons
µg/Nm^3	Micrograms per cubic metre of gas at normal condition for temperature and pressure being 0ºC and 101.3 kPa respectively.
µm	Micrometre or micron
V	Vanadium
WWTW	Grootegeluk Mine Waste Water Treatment Works

GLOSSARY OF TERMS

Base Flow
That part of stream flow that derives from groundwater and shallow subsurface storage. During the dry season, stream flow is typically composed entirely of base flow.

Baseline Environment
Pre-development environmental conditions. The prevailing environmental conditions (or *status quo*) prior to the start of an activity or project, includes current / existing environmental damage / degradation.

Baseline Impacts (Existing Impacts)
The current level of environmental degradation associated with existing developments, including those currently under construction or approved. Determination of the current level of degradation associated with existing developments is essential to understand and enable the assessment of cumulative impacts.

Boiler
A boiler is a closed vessel in which water or other fluid is heated. The heated or vaporised fluid (e.g. steam) exits the boiler for use in various processes including power generation.

By-product
A substance that is produced as part of a process that is primarily intended to produce another substance or product and that has the characteristics of an equivalent virgin product or material. (NEM:WA definition).

Calcareous
An adjective meaning mostly or partly composed of calcium carbonate, in other words, containing lime or being chalky.

Char
Char is the solid material that remains after volatile gas (e.g. coal gas) and coal tar have been driven out or released from a carbonaceous material during the initial stage of combustion, which is known as carbonisation, charring or devolatilisation.

Circulating Fluidised Bed Boiler
This is a boiler which is heated through fluidised bed combustion which is a type of combustion where fuels are suspended in upward-blowing jets of air during the combustion process. The tumbling action facilitates more effective chemical reactions and heat transfer. The technology has proved well suited to burning fuels that are difficult to ignite, low quality fuels and mixtures of fuels.

Coke
Coke is the solid carbonaceous material derived from the distillation of coal to drive off its volatile constituents.

Cumulative Impacts
Combined impacts of two or more activities, or the combined impacts of an activity with that of current activities. For this report, cumulative impacts are described as:

Baseline Impacts + Incremental Impacts of the project = Cumulative Impacts

Cyclonic separation
This is a method of removing particulates from an air, gas or liquid stream, without the use of filters, through vortex separation. Rotational effects and gravity are used to separate mixtures of solids and fluids. The method can also be used to separate fine droplets of liquid from a gaseous stream.

Environment
The surroundings within which humans exist and that are made up of -

(i) the land, water and atmosphere of the earth;
(ii) micro-organisms, plant and animal life;
(iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and
(iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being. (NEMA definition).

Environmental Impact Assessment (EIA)
An EIA is an assessment of the positive and negative environmental consequences of the proposed project. The primary objective of the EIA is to aid decision-making by providing factual information on the assessment of these impacts, determining their significance, as well as making valued judgements in choosing one alternative over another. For this EIA a combination of checklists, overlays and mapping, scoping and professional experience was used to identify the possible negative and positive impacts on the environmental components.

Fatal Flaw
With reference to environmental issues, a factor or situation, which prevents the development of a project, except at prohibitive cost. These are critical issues with the ability to stop a project's implementation.

Hydrocarbons
A group of organic compounds which contain only hydrogen and carbon. Hydrocarbons are the predominant constituent of fossil fuels, e.g. crude oil, and are referred to as petroleum when extracted in a liquid form.

Incremental Impact
This is the impact of an activity looked at in isolation (impact of an individual activity), thus not considering the combined, cumulative or synergistic impacts of the activity, or the cumulative impacts of the activity with other activities or the current level of degradation. For this report, incremental impacts refer to impacts of only the rail and associated infrastructure to be relocated.

Interested and Affected Parties (IAPs)
These are individuals or groups concerned with or affected by the environmental impacts and performance of a project. Interested groups include those exercising statutory environmental control over the project, local residents/communities (people living and/or working close to the project), the project's employees, customers, consumers, investors and insurers, environmental interest groups, the general public, etc.

Liquor
When the coal in the Char Manufacturing Plant is heated, and the tar has been removed from the coal off-gas, the remaining off-gas is cooled (condensed) to precipitate water which contains a small amount of hydrocarbon oils and sulphur. This precipitated water is known as liquor. The liquor is considered to be waste under NEMWA.

Manifold
A pipe or chamber having multiple apertures for making connections.

Microgram
One millionth (1/1 000 000) of a gram, or equivalently one thousandth (1/1 000) of a milligram.

Mineral
Any substance, whether in solid, liquid or gaseous form, occurring naturally in or on the earth or in or under water and which was formed by or subjected to a geological process, and includes sand, stone, rock, gravel, clay, soil and any material occurring in residue stockpiles or in residue deposits, but excludes: water, other than water taken from land or sea for the extraction of any material from such water; petroleum; or peat (MPRDA definition).

Mining
Mining is the making of any excavation for the purpose of winning a mineral, and it includes any other associated activities and processes (MPRDA definition).

Mining Area
The area for which a mining authorisation/permission to mine has been granted. It includes:

- Any adjacent surface of land;
- any non-adjacent surface of land, if it is connected to such an area by means of any road, railway line, powerline, pipeline, cableway or conveyer belt; and
- any surface of land on which such road, railway line, power line, pipeline, cableway or conveyer belt is located, under the control of the holder of such permit or authorisation and which the holder is entitled to use in connection with the operations performed or to be performed under such permit or authorisation (MPRDA definition).

Petroleum Hydrocarbons
A term used for any mixture of hydrocarbons that are found in crude oil. There are several hundred of these compounds which. include hexane, benzene, toluene, xylenes, naphthalene, and fluorine, other constituents of gasoline, of jet fuels, of mineral oils, and of other petroleum products.

Phenols
Phenols are a class of chemical compounds consisting of a hydroxyl group (-OH) bonded directly to an aromatic hydrocarbon group (e.g. carbolic acid C_6H_5OH). Phenols are similar to alcohols but they are more acidic. They can be used in the chemical and plastics industry.

Polycyclic Aromatic Hydrocarbons (PAHs)
Pollutants that occur in oil, coal, and tar deposits and are produced as by-products of fuel burning. PAHs are found primarily in soil, sediment and oily substances, as opposed to in water or air. Natural crude oil and coal deposits contain significant amounts of PAHs, arising from chemical conversion of natural product molecules, to aromatic hydrocarbons. Some PAH compounds have been classified as probable human carcinogens.

PM_{10}
Fine inhalable particles (smaller than 10 µm) found in the air. When inhaled, PM10s could cause damage to the lower airways and lungs.

Receptor
A receptor is the target or object on which the impact, stressor or hazard is expected to have an effect.

Red Data Species
Species listed in the International Union for Conservation of Nature (IUCN) List of Threatened Species, which categorises the level of threat facing species. It is considered the world's most comprehensive and widely understood system for classifying species at high risk of extinction.

Reductant (Carbon based)
A reductant is a substance that is able to oxidise (donate an electron) to another substance. A carbon reductant (e.g. char) is used with heat to change the oxidation state of a metal ore. The carbon or carbon monoxide derived from it removes oxygen from the ore with the metal remaining.

Retort
A retort is an airtight vessel in which substances are heated for a chemical reaction.

Significant Impact
An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provide reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the proponent to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.

Spontaneous Combustion
A type of combustion which occurs without an external ignition source. Coal reacts with atmospheric oxygen, which results in an exothermic reaction and when the temperature reaches the ignition temperature of coal, the coal starts to burn.

Tar
The tar (coal tar) is a black liquid of high viscosity, which has an odour of aromatic hydrocarbons. Coal tar is a by-product, formed when coal is carbonised to produce char. When the coal in the Char Manufacturing Plant is heated, tar is produced as a liquid substance which has been removed (precipitated) from the coal off-gas. As the tar is currently sold, it is considered a by-product and thus does not fall within the definition of waste as stated in the NEMWA.

Waste
Any substance, whether or not that substance can be reduced, re-used, recycled and recovered—
(a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;
(b) which the generator has no further use of for the purposes of production;
(c) that must be treated or disposed of; or
(d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—

(i) a by-product is not considered waste; and
(ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste. (NEMWA definition)

EXXARO REDUCTANTS (Pty) Ltd

Char Manufacturing Plant Expansion

Environmental Impact Assessment

Preliminaries

Purpose of the Report

The purpose of this Environmental Impact Assessment (EIA) report for the Char Manufacturing Plant Expansion Project is to present the results of the EIA process undertaken for the project.

The report provides a description of the proposed Char Manufacturing Plant Expansion and associated activities. It presents the EIA and various specialist studies, as well as the Environmental Management Programme (EMP). All the specialist studies are appended to the main report.

Report Volumes

The report is in 2 volumes:
Volume 1: EIA report and Appendices
Volume 2: EMP report and Appendices

List of Reports Completed for the Project to Date

The following reports have been completed to date:
Char Manufacturing Plant Expansion: Draft Environmental Scoping Report (June 2011).
Char Manufacturing Plant Expansion: Final Environmental Scoping Report (August 2011).
Various specialist assessment reports, as appended to this report (refer List of Appendices).
Char Manufacturing Plant Expansion: Draft EIA Report (May 2012, THIS REPORT).

1. Introduction to the Project

1.1 Project Background and Location

Char, a carbonaceous agent, is used in the metals industry as a reductant of iron ore (rock containing iron and its oxides (FeO_3) and other metals and their oxides) in the presence of heat at melting point, by allowing the oxides contained in the ore to react with the carbon. Exxaro Reductants (Pty) Ltd (Exxaro Reductants) propose to construct an expansion to the existing Char Manufacturing Plant, within the boundaries of the Grootegeluk Coal Mine (Figure 1.1 and Figure 1.2) on the farm Daarby 458 LQ, approximately 20 km west of Lephalale (formerly Ellisras) in the Limpopo Province.

The proposed site of the Char Manufacturing Plant Expansion Project is on a 54.6 ha portion of an old coal stockpile area (also known as the old coal middling stockpile area) and a disused railway loop. This site is also adjacent to the existing Char Manufacturing Plant which has been operational since 2009 (refer to Figure 1.3). The Char Manufacturing Plant is owned by Exxaro Reductants, on land leased from the Grootegeluk Mine. The proposed Char Manufacturing Plant Expansion will also be

owned and operated by Exxaro Reductants and will also be constructed on land leased by Exxaro Reductants from the Grootegeluk Mine.

The construction of the existing Char Manufacturing Plant was completed in 2008 and has a production capacity of 140 ktpa of char. The existing plant occupies an area of approximately 8.1 ha. The land leased by the Char Manufacturing Plant from Grootegeluk Mine includes associated infrastructure such as the pollution control dam, the workshops and the offices. Exxaro Reductants now wishes to expand the Char Manufacturing Plant by increasing the number of retorts from 4 to a maximum of 12, thereby increasing their production capacity threefold. The majority of the infrastructure associated with the retorts will therefore also be expanded within the existing footprint of the Char Manufacturing Plant. The stockpile areas required for the coal and char product will expanded considerably.

The other developments and land uses nearby include two major Grootegeluk Coal Mine clients - the Eskom Matimba and Medupi Power Stations. Neighbouring properties include private farms which are mainly used as game farms, and the Manketti Reserve on the Grootegeluk Mine's property which is managed by Ferroland (a subsidiary of Exxaro). Access to the mine and the existing Char Manufacturing Plant is from an east-west aligned provincial tarred road, the D2001, between Lephalale and Stockpoort.

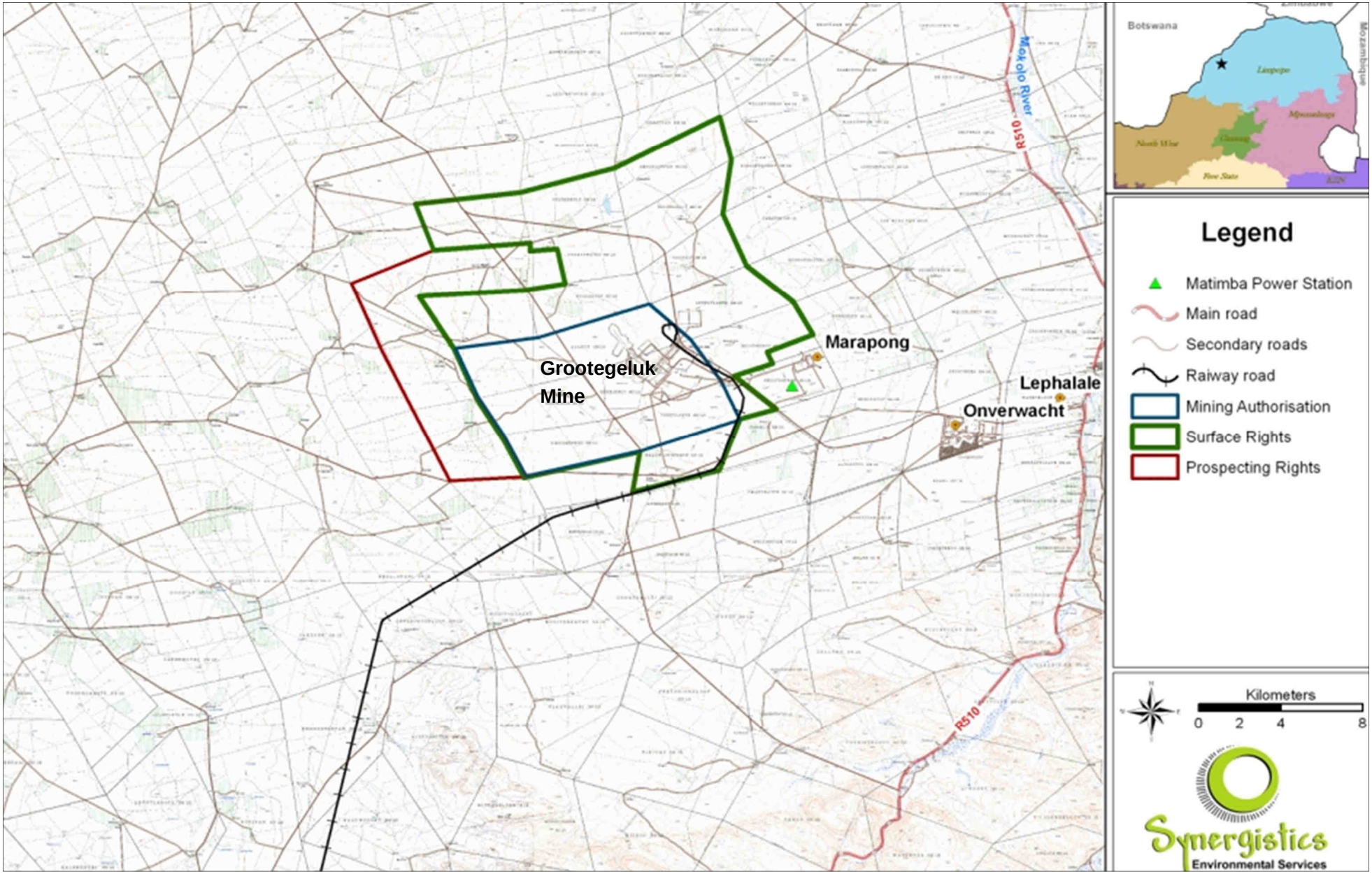


Figure 1.1: Regional Location of the Grootegeluk Coal Mine within which the Char Manufacturing Plant Expansion will be constructed.

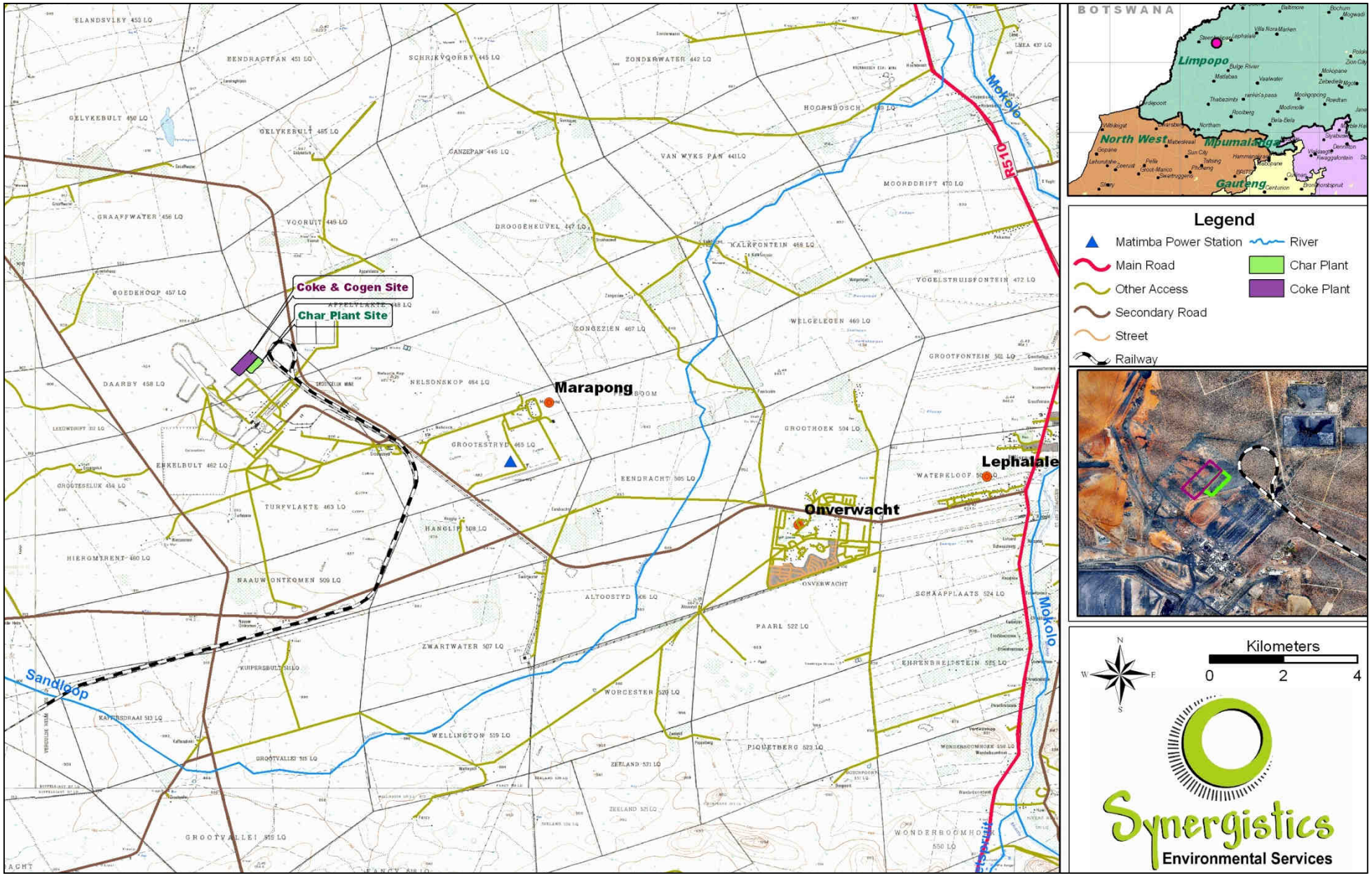


Figure 1.2: Approximate location of the Char Manufacturing Plant Expansion, adjacent to the existing Char Manufacturing Plant at Grootegeluk Mine

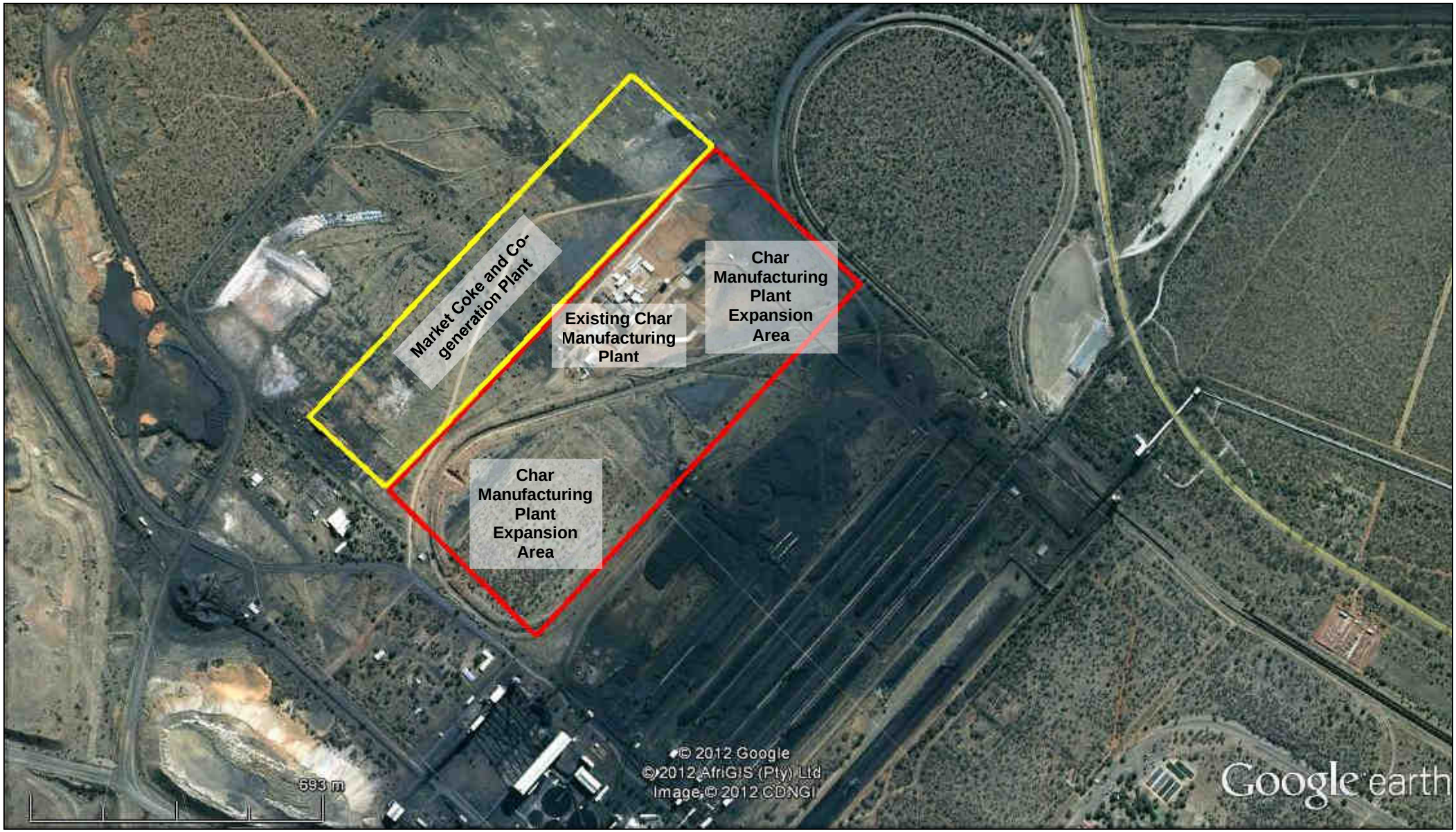


Figure 1.3: Char Manufacturing Plant Expansion area (within the red outline) within the Grootegeluk Mine (aerial view)

1.2 Project Motivation

Char, a carbonaceous agent, is used in the metals industry as a reductant of iron ore (rock containing iron and its oxides (FeO_3) and other metals and their oxides) in the presence of heat at melting point, by allowing the oxides contained in the ore to react with the carbon. Exxaro Reductants has entered into the reductants market with the existing Char Manufacturing Plant targeting the Ferrochrome market. Ferrochrome is the main constituent in the production of stainless steel. There is a demand for increased production of char within this market, which the Char Manufacturing Plant Expansion aims to address (Figure 1.4). Exxaro Reductants is in a prime position to manufacture and supply char with readily available coal feedstock (from the Grootegeluk Mine) and is in close proximity to their customers.

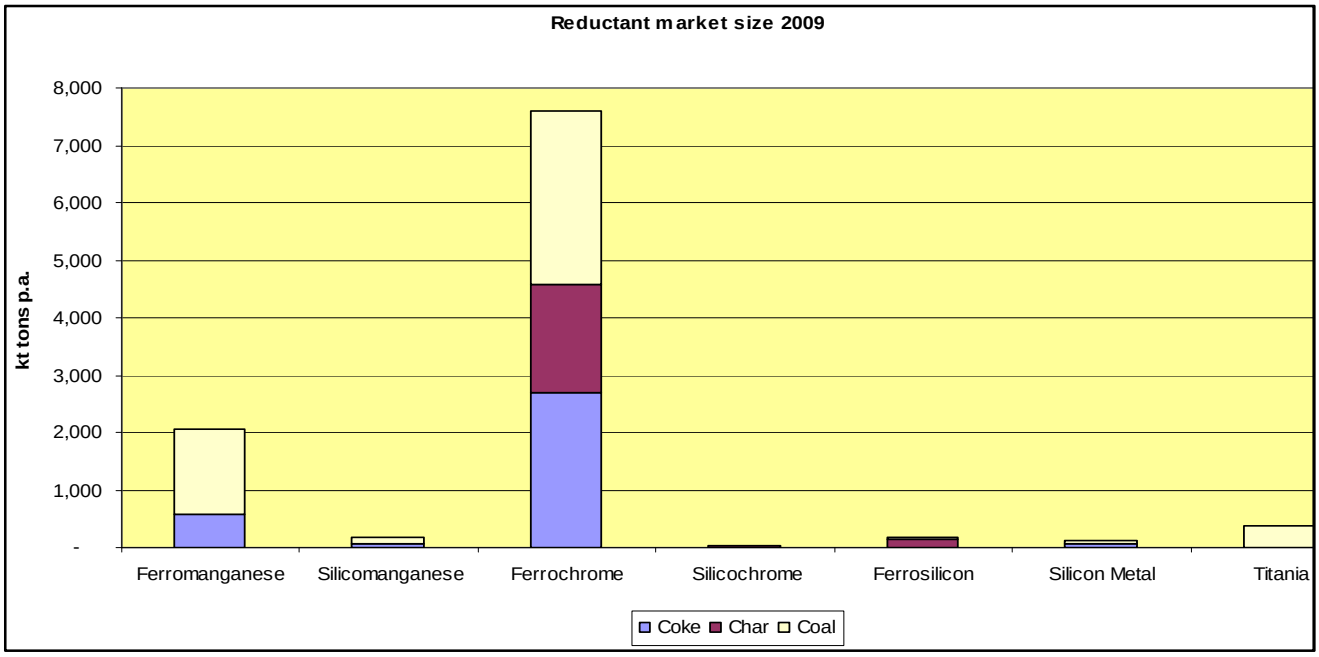


Figure 1.4: Reductant market size in 2009

In addition, Exxaro would like to invest more in char production opportunities due to the high profit margins on this product (as shown in Figure 1.5).

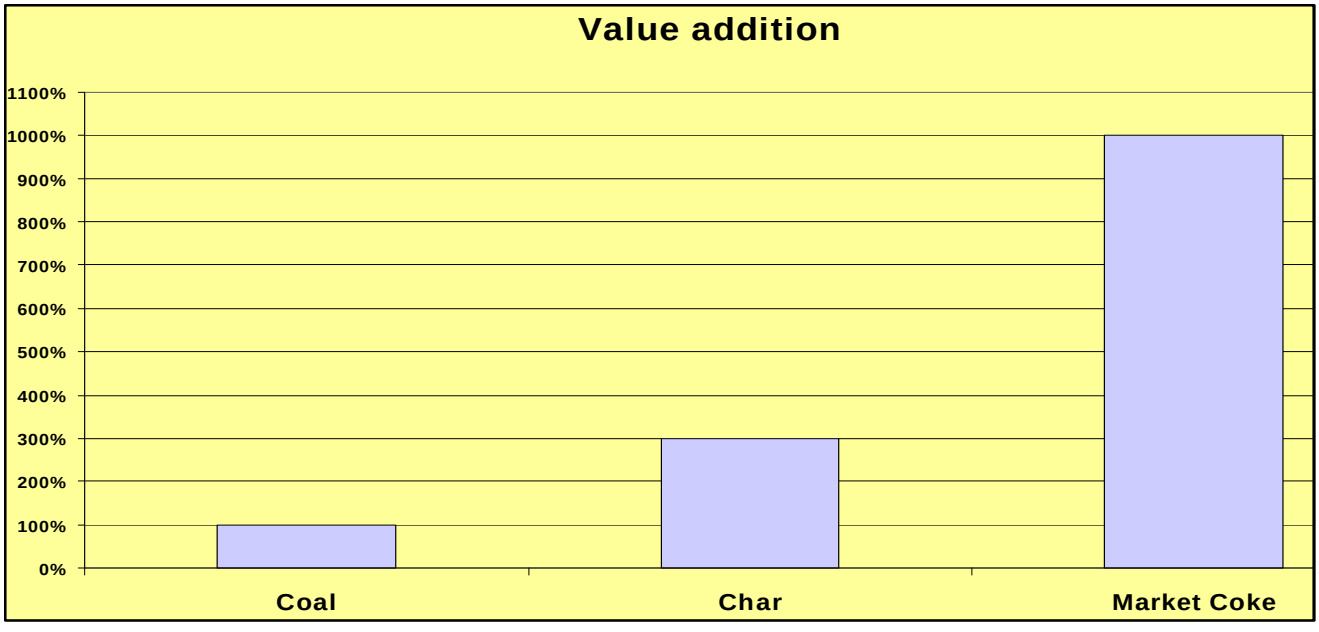


Figure 1.5: Increase in value addition created by downstream beneficiation of coal.

The provision of coal to the Char Manufacturing Plant Expansion project will not affect the provision of coal from the Grootegeluk Mine to the Eskom Matimba and Medupi power stations. This is due to the fact that a different type of coal, mined from a different bench at the mine will be used to supply the Char Manufacturing Plant Expansion Project.

1.3 Project Need and Desirability

The expansion of the Char Manufacturing Plant is required in order to:

- Enable Exxaro Reductants to stay in operation and earn a profit.
- Enable Exxaro Reductants to produce a sufficient quantity of char reductant, to satisfy the various reductant requirements of its clients, mainly the stainless steel industry in South Africa.
- Ensure that South African char consumers source more char reductant from within South Africa and not obtain it from overseas suppliers ('import replacement').
- Safeguard the employment and economic development opportunities created by the existing Char Manufacturing Plant.

1.4 Environmental Legal Requirements and Terms of Reference

An EIA for the existing Char Manufacturing Plant was undertaken by Clean Stream Environmental Services in 2005/2006. Authorisation for the EIA was obtained in 2006 and the existing Char Manufacturing Plant operates in accordance with the existing authorisation (LEDET ref. no. 16/1/12-29). An Integrated Water Use Licence Application (IWULA) was compiled for the greater Grootegeluk Mine in 2007, which included the existing Char Manufacturing Plant. The Water Use Licence was obtained in June 2010. Key legislation applicable to the Char Manufacturing Plant Expansion project includes:

- The National Environmental Management Act,1998 (No. 107 of 1998) (NEMA);
- The Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA);
- The National Water Act, 1998 (No. 36 of 1998) (NWA);
- The National Environmental Management: Waste Act, 2008 (No. 59 of 2008) (NEMWA); and
- The National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004) (NEMAQA).

There will be five key deliverables for the Char Manufacturing Plant Expansion project, each of which will be submitted to the relevant government department. These are:

- An application for environmental authorisation in accordance with NEMA will be submitted to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) for activities that are listed in terms of the 2010 EIA Regulations. An EIA in terms of NEMA will be submitted to the LEDET for approval as part of the environmental authorisation application;
- An EIA and Environmental Management Programme in accordance with the MPRDA will be submitted to the Department of Mineral Resources (DMR) for approval;
- An amendment to the Integrated Water Use Licence Application (IWULA) will be submitted to the Department of Water Affairs (DWA);
- A Waste Management Licence (WML) Application in accordance with NEMWA will be submitted to the National Department of Environmental Affairs (DEA) for approval and an EIA in terms of NEMWA will be submitted to the DEA as part of the WML application for approval; and
- An Atmospheric Emissions Licence Application in accordance with the NEMAQA will be submitted to LEDET for approval.

Synergistics Environmental Services has been appointed as the independent consultants to undertake the required environmental work on behalf of Exxaro Reductants (Pty) Ltd, as required by the applicable environmental legislation. The full list of legislation which has been considered for the proposed Char Manufacturing Plant Expansion project has been described in Table 1.1 below.

Table 1.1: List of Applicable Legislation and Guidelines Consulted

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
EIA Process and Listed Activities	National Environmental Management Act 107 of 1998	Section 2 of NEMA	Sets out the principles of environmental management	Section 2 principles are to be considered during the EIA process.
		Chapter 5 of NEMA	Integrated environmental management, provides information on environmental management tools that promote the implementation of principles set out in Section 2 of NEMA	Environmental management tools are to be considered during the EIA process for the Project.
		Regulation 543	Chapter 2: Identification of the competent authority Chapter 3: Application for environmental authorisation Chapter 6: Public participation process Chapter 7: Appeal process	Scoping and EIA must be undertaken in accordance to Regulation 543.
		Regulation 544, Listing Notice 1	Lists activities requiring a basic environmental assessment	Environmental authorisation must be obtained prior to commencement with listed activities
		Regulation 545, Listing Notice 2	Lists Activities requiring an EIA	Environmental authorisation must be obtained prior to commencement with listed activities
		Regulation 546, Listing Notice 3	Lists activities that require a basic environmental assessment at specific identified geographical areas only.	Environmental authorisation must be obtained prior to commencement with listed activity
		Guideline Series 5	Integrated Environmental Management Guideline Series 5: Companion to the NEMA EIA Regulation of 2010	The EIA process to be followed
		Guideline 4 and Guideline Series 7	Public Participation in support of the EIA regulations, 2005 Draft Public Participation Guideline (2010 EIA Regulations)	The public participation process to be followed.
		Guideline 5	Assessment of Alternatives and Impacts	The EIA process to be followed
Mining	Minerals and Petroleum Resources Development Act 28 of 2002	Section 102 of the MPRDA	The EMP cannot be amended without written consent from the minister.	Amended EMPR must be submitted to the DMR for approval.
		MPRDA Regulations 527	Chapter 2 Part 3: Environmental Regulations for Mineral Development, Petroleum Exploration and Production. Chapter 2 Part 4: Pollution Control and Waste Management Regulation	EIA must be undertaken prior to operations and an EMP must be developed for the mine.
Biodiversity	National Environ-mental Management: Biodiversity Act 10 of 2004	Regulation 151 Publication of critically endangered, vulnerable and protected species	No person may carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit.	A permit will be required prior to removal of endangered, vulnerable and protected species.
	National Forests Act 84 of 1998	Notice 835 List of Protected tree species under the Act	No person may carry out a restricted activity on any protected tree except if there is a licence granted by the minister.	A licence must be obtained prior to removing any protected trees on site.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Waste Management	National Environ-mental Management: Waste Act	Regulation 718	Lists waste management activities that require a waste management licence prior to construction and operation.	A waste management licence is required for this project as it includes some waste management listed activities.
		Framework For the Management of Contaminated Land, May 2010	Provides standards for the identification and registration of contaminated sites, for assessing sites and for compiling remediation plans. The Framework includes a system of Soil Screening Values for priority soil contaminants.	The Char Manufacturing Plant Expansion site will be assessed to determine the possible contamination of the soil on site and how this can be mitigated.
		Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, 1998	These requirements must be taken into account when considering the handling / disposal of hazardous waste.	These requirements will be taken into account when considering the handling of hazardous waste.
Water Use	National Water Act	Section 21	Lists water uses that require a licence prior to commencement	Application for a water use licence must be submitted to DWA for triggered activities.
Heritage Resources	National Heritage Resources Act	Section 38	Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as: (a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length; (c) any development or other activity which will change the character of a site- (i) exceeding 5000 m² in extent	South African Heritage Resources Agency (SAHRA) has to be notified of the proposed development.
		Section 38(2)	The responsible heritage resources authority must within 14 days of receipt of a notification in terms of subsection (1) – (a) if there is reason to believe that heritage resources will be affected by such development, notify the person who intends to undertake the development to submit an impact assessment report.	Heritage Impact Assessment is not required for the project.
Air Quality	National Environmental Management: Air Quality Act	Notice 248	Lists activities that require an atmospheric emissions licence prior to construction.	An atmospheric emissions licence application must be submitted to LEDET for an AEL for listed processes.
Noise		Section 34	Minister may prescribe national standards to: -control noise in general, by specific machinery, activities or in specified places or areas; -for determining definition for noise and maximum levels of noise.	Applicant is to adhere to the national standards for noise.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Provincial Laws	Limpopo Environmental Management Act 7 Of 2003	Chapter 4, section 31 Chapter 8, section 64	Permits are required to hunt game and remove certain indigenous plants in certain areas.	The possible requirement for a permit should be determined before any wild animals or plants are removed or destroyed.
Land Use Management	Conservation of Agricultural Resources Act 43 of 1983	Regulation 280 of 2001	Requires the landowner to manage agricultural resources i.e. the removal of invasive species, protection of soils against water and wind erosion and the management of water resources.	An alien invasive species plan must be developed for the site and a land use and soil management plan must be developed. Alternatively the Grootegeluk Mine plans could be used.
Health and Safety	Mine Health And Safety Act 29 of 1996		To provide for protection of the health and safety of employees and other persons at mines.	The Char Manufacturing Plant Expansion is located within the Grootegeluk Mine area and thus the Mine Health and Safety Act must be complied with.

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

The National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA) and the EIA Regulations (GN R 543, 544, 545 and 546, 18 June 2010) published thereunder, set out a schedule of listed activities that may not be undertaken without environmental authorisation from a competent authority. The EIA Regulations (GN R 543) define the requirements for the submission, processing, consideration and decision of applications for environmental authorisation of listed activities. Any activity that is captured in these lists requires environmental authorisation from the competent authority. In accordance with the legislation, the listed activities in Table 1.2 below require approval from the LEDET.

Table 1.2: NEMA Listed Activities Applicable to the Char Manufacturing Plant Expansion (GNR 544, GNR 545 and GNR 546)

Government Notice	Activity No.	Listed Activity	Applicability to the Char Manufacturing Plant Expansion
Activities requiring a Basic Assessment in terms of GNR 544 (Listing 1)			
R544, 18 June 2010	**Activity No. 9**	The construction of facilities or infrastructure exceeding 1 000 meters in length for the bulk transportation of water, sewage or storm water – (i) with an internal diameter of 0.36 meters or more; or (ii) with a peak throughput of 120 liters per second or more, excluding where: (a) such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or (b) where such construction will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of the watercourse.	The Char Manufacturing Plant Expansion project will involve constructing pipelines and channels for the bulk transportation of storm water which will be approximately 1500m long and have an internal diameter of 0.5m.
R544, 18 June 2010	**Activity No. 22**	The construction of a road, outside urban areas, (i) with a reserve wider than 13,5 meters or, (ii) where no reserve exists where the road is wider than 8 meters, or (iii) for which an environmental authorization was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.	The Char Manufacturing Plant Expansion project will require the construction of a new road which will be approximately 9m wide and 400m long.
R544, 18 June 2010	**Activity No. 28**	The expansion of existing facilities for any process or activity where such an expansion will result in the need for a new or amendment of, an existing permit or license in terms of national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	The Char Manufacturing Plant Expansion project will require an amendment to the existing and approved Grootegeluk Mine Water Use License. The license includes information controlling polluted water and this project will increase the amount of polluted water to be controlled. The Char Manufacturing Plant Expansion project will also require a new Atmospheric Emissions License. The license includes information governing the release of emissions as this project will increase atmospheric emissions.
R544, 18 June 2010	**Activity No. 37**	The expansion of facilities or infrastructure for the bulk transportation of water, sewage or storm water where: (a) the facility or infrastructure is expanded by more than 1000 meters in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more- excluding where such expansion: (i) relates to transportation of water, sewage or	The Char Manufacturing Plant Expansion project will involve increasing the capacity of pipelines and channels for the bulk transportation of storm water which will be expanded by approximately 1500m.

Government Notice	Activity No.	Listed Activity	Applicability to the Char Manufacturing Plant Expansion
Activities requiring a Basic Assessment in terms of GNR 544 (Listing 1)			
		storm water within a road reserve; or (ii) where such expansion will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of the watercourse.	
R544, 18 June 2010	**Activity No. 42**	The expansion of facilities for the storage or storage and handling, of a dangerous good, where the capacity of such storage facility will be expanded by 80 cubic metres or more.	The Char Manufacturing Plant Expansion project will involve the expansion of storage and handling facilities for dangerous goods (waste and/or by-products from the coal processing, including liquor and tar). The existing capacity of the storage tanks will be expanded by approximately 700 cubic metres.
R544, 18 June 2010	**Activity No. 47**	The widening of a road by more than 6 meters, or the lengthening of a road by more than 1 kilometer- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 meters – excluding widening or lengthening occurring inside urban areas.	The Char Manufacturing Plant Expansion project will require the construction of a new road which will be approximately 9m wide and 400m long.
R544, 18 June 2010	**Activity No. 56**	Phased activities for all activities listed in this Schedule, which commenced on or after the effective date of this Schedule, where any one phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold; - Excluding the following activities listed in this Schedule: 2; 11(i)-(vii); 16(i)-(iv); 17; 19; 20; 22(i) & 22(iii); 25; 26; 27(iii) & (iv); 28; 39; 45(i)-(iv) & (vii)-(xv); 50; 51; 53; and 54.	
Activities requiring a full Environmental Impact Assessment in terms of GNR 545 (Listing 2)			
R. 545, 18 June 2010	**Activity No. 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 meters.	The Char Manufacturing Plant Expansion project will involve the storage and handling of dangerous goods (waste and or by-products of the coal processing, including liquor and tar). The combined capacity of the storage tanks will be approximately 1010 cubic metres.
R. 545, 18 June 2010	**Activity No. 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: except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply.	The Char Manufacturing Plant Expansion project will involve the transformation of undeveloped mine land, outside an urban area, into an expanded industrial mine plant approximately 54 hectares in size.
Activities requiring a Basic Assessment in terms of GNR 546 (Listing 3)			
None			

LEDET is the competent authority in terms of the NEMA and EIA Regulations. An application form for environmental authorisation was submitted to the LEDET in March 2011 and accepted by LEDET on the 20th of April 2011. The reference number for the project is 12/1/9/2–W07.

The draft scoping report was submitted to LEDET in June 2011 and accepted on the 10th of August 2011. The final scoping report was submitted on the 16th of August and accepted on the 12th of October 2011.

Please note that a separate EIA process is also underway for two additional plants which are proposed to be constructed adjacent to the Char Manufacturing Plant Expansion. These additional plants are the Coke Manufacturing Plant and Electricity Co-generation (Co-gen) Plant (LEDET ref. 12/1/9/2-W12).

1.4.2 National Environmental Management Waste Act 2008 (No. 59 of 2008)

Waste management is regulated under the National Environmental Management: Waste Act (No. 59 of 2008) (NEMWA), in order to protect the environment and human health. The Act makes provision for the identification of various waste management activities, which may have a detrimental effect on the environment. A waste management activity identified in terms of the Act may not commence be conducted or undertaken except in accordance with a Waste Management Licence.

On 3 July 2009, the list of waste management activities requiring a WML from a competent authority were published (GN R 718). Listed waste management activities are divided into Category A and Category B in the schedule. Activities identified in Category A require a Basic Assessment process, as stipulated in the EIA Regulations, while activities identified in Category B require an EIA process, as stipulated in the EIA Regulations (GN R 543, 18 June 2010) of the NEMA, in order to inform an application for a WML.

The National Department of Environmental Affairs (DEA) is the competent authority to administrate and review applications for a WML which involve hazardous waste in terms of the NEMWA. The WML application forms were submitted to the DEA on the 8th of November 2011 and accepted on the 23rd of November 2011. The DEA reference number for the project is: 12/9/11/L783/5.

Activities applied for as per the NEMWA are listed in Table 1.3 below:

Table 1.3: NEMWA Listed Activities Applicable to the Char Manufacturing Plant Expansion (GN 718)

Government Notice	Activity No.	Listed activity	Applicability to the Char Manufacturing Plant Expansion
GN 718 of 3 July 2010	Category A (2)	The storage including the temporary storage of hazardous waste at a facility that has the capacity to store in excess of 35m^3 of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons.	Liquor may be stored in storage tanks on site, approximately 402m^3 in size.
GN 718 of 3 July 2010	Category A (18)	The construction of facilities for activities listed in Category A of this Schedule (not in isolation to associated activity).	Construction of liquor storage tanks and liquor destructors.
GN 718 of 3 July 2010	Category A (19)	The expansion of facilities of or changes to existing facilities for any purpose or activity, which required an amendment of an existing permit or licence or a new permit or licence in terms of legislation governing the release of pollution, effluent or waste.	Construction of liquor storage tanks and liquor destructors as part of the Char Manufacturing Plant expansion project.
GN 718 of 3 July 2010	Category B (5)	The treatment of hazardous waste using any form of treatment regardless of the size or capacity of such a facility to treat such waste.	Liquor will be treated through incineration.
GN 718 of 3 July 2010	Category B (7)	The treatment of effluent, wastewater or sewage with an annual throughput capacity of 15 000 cubic metres or more.	The annual throughput of the Pollution Control Dam for the Char Manufacturing Plant Expansion will be 15 468 m^3 per annum.

Government Notice	Activity No.	Listed activity	Applicability to the Char Manufacturing Plant Expansion
GN 718 of 3 July 2010	Category B (8)	The incineration of waste regardless of the capacity of such a facility.	Liquor will be incinerated.
GN 718 of 3 July 2010	Category B (11)	The construction of facilities for activities listed in Category B of this Schedule.	Construction of liquor storage tanks and liquor destructors.

The final scoping report was submitted to the DEA on 9 March 2012. This draft EIA report also forms part of the WML application for the DEA in accordance with the EIA Regulations GN R543 of 18 June 2010 and NEMWA.

1.4.3 Mineral and Petroleum Resources Development Act 2002 (No. 28 of 2002)

An EIA and EMP amendment in accordance with the Mineral and Petroleum Resources Development Act (MPRDA) legislation are required, as the Char Manufacturing Plant and the proposed expansion are located within the boundaries of Grootegeluk Mine and are therefore classified as forming part of the "mining area". The MPRDA defines the mining area as:

"(i) in relation to a mining right or a mining permit, means the area for which that right or permit is granted;

(ii) in relation to any environmental … matter and any … impact thereto, includes-

(a) any adjacent or non-adjacent surface of land on which the extraction of any mineral and petroleum has not been authorised in terms of this Act but upon which related or incidental operations are being undertaken and, including-

(i) any area connected to such an area by means of any road, railway line, power line, pipeline, cable way or conveyor belt; and

(ii) any surface of land on which such road, railway line, power line, pipeline or cable way is located …"

Section 39 of the MPRDA requires that an EIA be undertaken and an EMP submitted. These are in place for the Grootegeluk Mine and the existing Char Manufacturing Plant. However, the current approved EMP does not cover the proposed Char Manufacturing Plant Expansion project. Thus the EMP must be amended to include the impacts and mitigation of the expansion.

The EIA/EMP amendment report will be undertaken in accordance with Sections 48 – 52 of the MPRDA Regulations, which stipulate the requirements and contents of the Scoping and EIA reports. The EIA/EMP will be submitted to the Limpopo Department of Mineral Regulation (DMR) for their approval.
As a full scoping and EIA is needed as per NEMA, NEMWA and the MPRDA, an EIA/EMP report will be prepared for the project integrating NEMA, NEMWA and MPRDA requirements.

Table 1.4: Structuring of the EIA/EMP Report in terms of Section 50 of the MPRDA regulations GNR 527

Legal and Regulatory Requirement	Cross Reference to Report Section
(a) An assessment of the environment likely to be affected by the proposed mining operation, including cumulative environmental impacts;	Section 4 and section 6.
(b) an assessment of the environment likely to be affected by the identified alternative land use or developments, including cumulative environmental impacts;	Section 4 and section 6.
(c) an assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation including the cumulative environmental impacts;	Section 6 and 7.
(d) a comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts;	Section 6.
(e) determine the appropriate mitigatory measures for each significant impact of the proposed mining operation;	Section 6 and the EMP.

Legal and Regulatory Requirement	Cross Reference to Report Section
(f) details of the engagement process of interested and affected persons followed during the course of the assessment and an indication of how the issues raised by interested and affected persons have been addressed	Section 2.7
(g) identify knowledge gaps and report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information;	Section 2.2 and 2.3
(h) description of the arrangements for monitoring and management of environmental impacts; and	Section 6 and the EMP
(i) Inclusion of technical and supporting information as appendices, if any.	Appendices

1.4.4 National Water Act 1998 (No. 36 of 1998)

Section 21 of the National Water Act (NWA) lists water uses for which a Water Use Licence (WUL) must be obtained. In terms of the NWA, the following water uses are applicable for the Char Manufacturing Plant Expansion:

- Section 21 b 'storing of water'. A raw water storage dam will be constructed to store water to ensure that the plant will not be affected by water supply interruptions.
- Section 21 g 'disposing of waste in a manner that may detrimentally impact on a water resource'. An existing pollution control dam (PCD) will be utilised as part of this project. The capacity of the existing PCD will remain unchanged, but it will now be fully utilised upon completion of the Char Manufacturing Plant Expansion project.

An existing WUL is in place for the existing Char Manufacturing Plant. A WUL amendment application will be submitted to the Limpopo Department of Water Affairs (DWA) for their approval. The scoping report was submitted to the DWA for their information. The WUL (amendment) application will be submitted during 2012.

1.4.5 National Environmental Management Air Quality Act 2004 (No. 39 of 2004)

The National Environmental Management Air Quality Act, 2004 (No. 39 of 2004) makes provision for the identification of various activities, which result in atmospheric emissions which may have a significant detrimental effect on the environment. Activities identified in terms of the Act (GN R 248, March 2010) may not commence except in accordance with an Atmospheric Emissions Licence (AEL) and the minimum emissions standards. In terms of Section 37 of the National Environmental Management Air Quality Act (No. 39 of 2004) (NEMAQA) an Atmospheric Emissions Licence is required for the Char Manufacturing Plant Expansion.

Although the existing Char Plant has a permit in terms of the Atmospheric Pollution Prevention Act, 1965 (No. 45 of 1965) (APPA), the new law requirements of the NEMAQA dictate that an AEL is required for the Char Manufacturing Plant Expansion. This Licence will be an amendment/update of the approved Permit in terms of the APPA. The AEL will be submitted to the LEDET for authorisation and approval during 2012.

Table 1.5: NEMAQA Listed Activities Applicable to the Char Manufacturing Plant Expansion (GN 718)

Government Notice	Activity No.	Listed activity
GN 248 of 31 March 2010	Subcategory 3.4	Char, charcoal and carbon black production

1.4.6 National Environmental Management Biodiversity Act 2004 (No. 10 of 2004)

The National Environmental Management Biodiversity Act 2004 (No. 10 of 2004) (NEMBA) provides for the protection of threatened ecosystems and species.

A biodiversity study has been conducted for the Grootegeluk Mine area. The results of this study have been included in this report. It is possible that protected species may occur on the site. NEMBA regulations state that no person may carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit. Thus, if threatened or protected species are found on site, a permit will be required prior to their removal.

No threatened ecosystems will be affected by the proposed development. Thus this issue will not need to be considered further.

1.4.7 National Heritage Resources Act 1999 (No. 25 of 1999)

The National Heritage Resources Act 1999 (No. 25 of 1999) (NHRA) provides for the protection of all archaeological and paleontological sites and meteorites. Section 38 of the Act defines the categories of development for which the responsible heritage resources authority must be notified. Under Section 38 (1)(c) *"any development or other activity which will change the character of a site - (i) exceeding 5000 m^2 … must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."*

The footprint of the Char Manufacturing Plant Expansion will be approximately 54.6 ha. However, the proposed site has been previously disturbed by coal stockpiling undertaken for the past 40 years. The possibility of artefacts of cultural or heritage significance being located at the site is therefore considered to be negligible.

A phase one Heritage Impact Assessment has been conducted for the entire mining rights area for the Exxaro Grootegeluk Mine (previously owned by Kumba Resources Ltd), which includes the proposed site of the Char Manufacturing Plant Expansion (refer to Appendix 7). The investigation was conducted by J. van Schalkwyk of the National Cultural History Museum, who also wrote the report. The results of this report indicate that the closest archaeological site to the proposed development is 3.16km away. For this reason, it is assumed that no additional heritage mitigation is required for these developments.

In accordance with section 38 of the NHRA, a letter and a copy of the report has been sent to the South African Heritage Resources Agency (SAHRA) (refer to Appendix 7). SAHRA has not requested that any further heritage studies be done on the site.

2. Study Approach and Methodology

2.1 Study Objectives

The objectives of the EIA are to:

- Identify legislative requirements for the proposed development to ensure compliance through the different phases of the project;
- Establish a detailed project description in order to understand the likely impacts;
- Undertake detailed specialist studies to understand the baseline environmental conditions and to inform the EIA on the projects impacts;
- Afford an additional opportunity for Interested and affected parties (IAPs) to comment on the proposed development;
- Identify environmental and social impacts of the proposed development; and
- Assess the significance of identified impacts in order to advise on the level of management and

mitigation required.

The objectives of the EMP are to:

- Identify and list measures to avoid, minimise, manage or mitigate the identified impacts;
- Identify the roles and responsibility for the implementation of management and mitigation measures; and
- Establish the timeframes in which the management measures are to be implemented.

2.2 Study Assumptions

It is assumed that the project description used for the assessment and as provided by Exxaro Reductants is a true reflection of the intended project and that Synergistics has been provided with all necessary information required to undertake an assessment of the potential impacts of the project.

It should be noted that some of the specialist studies were undertaken prior to the finalisation of the project description. The project description provided in specialist reports may thus differ slightly from that given in the EIA Report. The EIA Report however presents the most up to date description for which the impacts have been assessed and management measures proposed.

The identification of environmental impacts, the rating of impact significance and the recommendation of mitigation measures assumes that the design parameters and standard operating conditions at the Char Manufacturing Plant Expansion will be implemented with an acceptable level of management and maintenance efficiency. Occasional non-compliances or limited failures are an accepted part of operations and were thus included in the impact assessment.

2.3 Knowledge Gaps and Uncertainties

The impacts identified in this report are based on the current understanding of the baseline environment. The monitoring conducted has been considered sufficient by the specialists to undertake the necessary studies.

Models are simulations and as far as possible try to reflect the future reality. However additional monitoring and an updating of the models will be required throughout the different stages of the proposed development to ensure a thorough understanding of the impacts.

2.4 Study Area

The study area can be roughly defined as the existing Char Manufacturing Plant (8.1 ha) whose footprint will be expanded to a 54.6 ha site to the south, north and west. This area of land is on the Grootegeluk Mining rights area, on an old coal stockpile which has been cleared (Figure 1.3.)

2.5 Scoping Phase

The existing scoping report, undertaken in 2006, and a site visit formed the basis for obtaining baseline information for the project site. The site visits to the existing char plant were undertaken by Vivienne Vorster and Shelley Holt on several occasions during 2011 and 2012, in order to view the existing operations, conduct public participation and to collect additional information to incorporate into the EIA.

A scoping study was undertaken as the first phase of the EIA process. During the scoping phase:

- Project and baseline environmental information was gathered and collated;
- Landowners, adjacent landowners, local authorities, environmental authorities, as well as other stakeholders which may be affected by the project, or that may have an interest in the environmental impacts of the project were identified.
- Interested and affected parties (I&APs) were informed about the proposed project.
- Public meetings were arranged and I&AP issues and concerns were identified.
- Environmental authorities were consulted to confirm legal and administrative requirements.
- Environmental issues and impacts were identified and described.
- Development alternatives were identified and evaluated, and non-feasible development alternatives were eliminated.
- The nature and extent for further investigations and specialist input required in the EIA phase was identified.
- The draft and final scoping reports were submitted for review by authorities, relevant organs of state and I&APs.
- Key I&AP issues and concerns were collated into an issues and response report for consideration in the EIA phase.

The draft scoping report was submitted in June 2011 and the final scoping report was submitted in August 2011. The final scoping was accepted by LEDET on the 12th of October 2011. Scoping is a critical step in the environmental assessment process. Through scoping, significant issues, which require further investigation, are identified. Issues that are identified as having a potentially significant impact are carried forward into the EIA phase and subsequently addressed in the EMP.

2.6 EIA Phase

2.6.1 EIA Process

The EIA component of the study includes:

- Specialist investigations which were undertaken in accordance with the terms of reference established in the scoping assessment (plan of study for EIA included in the scoping report).
- An evaluation of development alternatives and identification of a proposed option.
- An assessment of existing impacts (no-go development option), environmental impacts that may be associated with the proposed project option and cumulative impacts using the impact assessment methodology as described in Section 2.4.6.
- Identification of mitigation measures to address the environmental impacts
- Consultation with I&APs
- Incorporation of public comment received during the scoping into the draft EIA report
- Issuing of the draft EIA report for review

2.6.2 Specialist Studies

The following specialist studies were undertaken as part of the EIA process in order to understand the environmental impacts of the project:

Table 2.1: Specialist Studies undertaken as part of the EIA process (or studies undertaken on the site previously)

Specialist Study	Purpose of Study
Air Quality Specialist Studies	To determine the air quality impacts as a result of the project. An emission inventory was compiled and a model was run to determine the extent to which air quality impacts will be experienced.
Groundwater Specialist Studies	To determine project impacts to groundwater. The study considered impacts of groundwater contamination due to the project.

Specialist Study	Purpose of Study
Ecological/Biodiversity Studies	To identify sensitive habitats for faunal species as well as to identify any species of ecological significance on site. (This study was done previously for the entire Grootegeluk Mine area).
Heritage Impact Assessment	To investigate the presence of archaeological resources on site. (This study was done previously for the entire Grootegeluk Mine area).
Traffic Impact Study	To assess the projects impact on the public roads (R380)
Waste Classification and Soils Study	To determine the nature of the wastes produced and the extent of possible soil contamination on site.

Specialist reports have been structured in terms of GNR 543 Section 32.

2.6.2.1 Air Quality

The air quality specialist report contains the following information:

- Air quality baseline assessment (this includes nearby projects to be commissioned before Char Expansion, Coke and Co-gen Plants);
- Review of existing information;
- Description of air quality legislation, guidelines and standards;
- Update meteorological data;
- Set up wind model and regional dispersion model;
- Assess predicted impacts (includes health impacts);
- Propose monitoring required;
- Compilation of an air quality impact assessment report which will include concentrations of pollutants, significance of the results and mitigation options.

2.6.2.2 Traffic Impact Assessment

The scope of the traffic assessment included:

- A preliminary site inspection.
- Data collection, including: traffic surveys, details of intersections, road condition, travel patterns of residents and mine staff.
- Assessment of the existing roads.
- Trip generation characteristics of the project.
- Forecast of future traffic conditions.
- Proposed mitigation measures.

2.6.2.3 Surface Water

The scope of this study was as follows:

- Surface water assessment for the Char Manufacturing Plant Expansion project including:
    - Review of existing information;
    - Water and salt balance for the Char Manufacturing Plant;
    - Surface water input for environmental authorisations;
    - Surface water-related closure costs.
    - Baseline assessment;
    - Water quality sampling;
    - Water quantity and floodline determination;
    - Compilation of a stormwater management plan;
    - Input regarding the pollution control dams, sewage treatment and potable water supply.
- Provision of water management and surface water impact assessment information for the Water Use Licence Application.
- Input to the Integrated Water and Waste Management Plan (IWWMP).

2.6.2.4 Groundwater

The groundwater study covered the following aspects:

- Describe baseline groundwater characteristics.
- Compile hydro-census data.
- Groundwater sampling and analysis.
- Modelling to predict the movement of dissolved contaminants.
- Assess risks of groundwater pollution associated with the construction and operation of the plant.
- Make recommendations for the management and protection of groundwater resources.

2.6.2.5 Waste Stream Assessment

The scope of work included:

- Waste characterisation according to the Draft Regulations and Standards for Waste Classification and Management in terms of NEMWA.
- Waste classification according to SANS 10234 and the National Waste Information Regulations.
- A waste risk profile will be determined. This will involve waste sampling and analysis.
- A soil assessment will be undertaken. This will involve the following tasks:
    - Soil sampling
    - Laboratory analyses of samples
    - Site conceptual model including: geology, soil profile, location of surface water and depth to groundwater.
    - Data will be evaluated and interpreted to determine environmental risks.

2.6.3 Baseline Environmental Description

Baseline information has been sourced primarily from the existing EIA undertaken in 2006 for the existing Char Manufacturing Plant, as well as from the specialist studies which were conducted for the Char Manufacturing Plant Expansion. Baseline information largely remains the same as for the original EIA/EMP, as the expansion will be located directly adjacent to the existing plant.

The baseline environment represents the current prevailing environmental conditions prior to the construction of the proposed Char Manufacturing Plant Expansion. It is indicative of the level of environmental degradation due to existing human activities such as mining, and existing infrastructure such as railway lines and roads.

2.6.4 Consideration of Alternatives

Development alternatives considered during the scoping and EIA phase are discussed in Section.3.2.7.

2.6.5 Identification and Description of Impacts

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, *inter alia*: the purpose and need for the project; views and concerns of interested and affected parties; social and political norms, and general public interest.

The methodology used for assessing impacts associated with the proposed project follows the philosophy of EIAs, as described in the booklet Impact Significance, Integrated Environmental Management Information Series 5 (DEAT, 2002b). The philosophy is summarised by the following extracts:

"The impact magnitude [or intensity] and significance should as far as possible be determined by reference to legal requirements, accepted scientific standards or social acceptability. If no legislation or scientific standards are available, the EIA practitioner can evaluate impact magnitude based on clearly described criteria. Except for the exceeding of standards set by law or scientific knowledge, the description of significance is largely judgemental, subjective and variable. However, generic criteria can be used systematically to identify, predict, evaluate and determine the significance of impacts." (DEAT, 2002b).

"Determining significance [of impacts] is ultimately a judgement call. Judgemental factors can be applied rigorously and consistently by displaying information related to an issue in a standard worksheet format." (Haug et al., 1984 taken from DEAT, 2002b).

For each environmental component (i.e. visual, air quality, health), impacts will be identified and described in terms of: detectability / visibility of the impact, exposure of receptors to the impact, compliance with legislation and standards, other applicable targets, limits or thresholds of concern, the level of change / intrusion imposed, and receptor sensitivity.

The perceived sensitivity of receptors (people and/or receiving environment) will be professionally judged based on available scientific data (fact) and feedback from public participation processes (views, opinions, attitudes, and concerns). The following impacts will be described:

2.6.5.1 Existing Impacts (Impacts of Existing Developments within Project Impact Area)

The Char Manufacturing Plant is located in an area surrounded by existing developments such as the Grootegeluk coal mining activities as well as agricultural, residential, major roads and the Matimba and Medupi Power Stations. The current level of environmental degradation (existing impacts) associated with existing developments, including those currently under construction, will be described in the environmental impact report. Defining the current level of degradation associated with existing developments is essential to understand and enable the assessment of cumulative impacts. The assessment of existing impacts is qualitative and limited to the area of impact for the individual environmental components.

2.6.5.2 Incremental Impacts (Impact of the Expansion of the Char Manufacturing Plant)

Incremental impacts refers to the impacts of an activity looked at in isolation (impacts of an individual activity), thus not considering the combined, cumulative or synergistic impacts of the activity, or the cumulative impacts of the activity with other activities or the existing impacts. The environmental impact report will describe the incremental impacts of the Char Manufacturing Plant Expansion.

2.6.5.3 No-go Development Impacts

The no-go development is considered as an alternative in the evaluation of development alternatives. In the EIA the no-go development impacts would be similar to the existing impacts.

The no-go development will have negative impacts on the production and sale of Char to clients in South Africa. It is therefore assumed that alternative sources of Char will have to be found.

2.6.5.4 Cumulative Impacts

For this project, cumulative impacts will be determined as:

Existing Impacts	+	*Incremental Impacts*	=	*Cumulative Impacts*
Existing impacts within the project area of impact for individual project components (current level of degradation) associated with existing developments		Impacts of the proposed Char Manufacturing Plant Expansion		Existing impacts (current level of degradation) associated with existing developments and developments under construction combined with the impacts of the proposed Char Manufacturing Plant Expansion

In the assessment above, existing impacts often also represent the impacts of the no-go development option. Potential future projects in the area, for which the environmental impacts are currently undefined, cannot be included in the cumulative impact assessment and will have to be assessed in separate EIA processes for these projects.

2.6.6 Mitigation Measures

The significance of environmental impacts are rated before and after the implementation of mitigation measures. The impact rating system considers the confidence level that can be placed on the successful implementation of the mitigation.

2.6.7 Rating the Significance of Environmental Impacts and Mitigation Measures

The system used for evaluating impact significance is explained below in Table 2.2.

Table 2.2: Criteria for Assessing the Impact Significance

SEVERITY CRITERIA

INTENSITY = MAGNITUDE OF IMPACT	**RATING**
Insignificant: impact is of a very low magnitude	1
Low: impact is of low magnitude	2
Medium: impact is of medium magnitude	3
High: impact is of high magnitude	4
Very high: impact is of highest order possible	5

FREQUENCY = HOW OFTEN THE IMPACT OCCURS	**RATING**
Seldom: impact occurs once or twice	1
Occasional: impact occurs every now and then	2
Regular: impact is intermittent but does not occur often	3
Often: impact is intermittent but occurs often	4
Continuous: the impact occurs all the time	5

DURATION = HOW LONG THE IMPACT LASTS	**RATING**
Very short-term: impact lasts for a very short time (less than a month)	1
Short-term: impact lasts for a short time (months but less than a year)	2
Medium-term: impact lasts for the for more than a year but less than the life of operation.	3
Long-term: impact occurs over the operational life of the Gravenhage Manganese Project	4
Residual: impact is permanent (remains after mine closure)	5

EXTENT = SPATIAL SCOPE OF IMPACT/ FOOTPRINT AREA / NUMBER OF RECEPTORS	RATING
Limited: impact affects the mining area	1
Small: impact extends to the neighbouring farmers	2
Medium: impact extends to surrounding farmers beyond the immediate neighbours	3
Large: impact affects the area covered by the John Taolo Gaetsewe District Municipality	4
Very Large: The impact affects an area larger than the district	5

PROBABILITY

PROBABILITY = LIKELIHOOD THAT THE IMPACT WILL OCCUR	RATING
Highly unlikely: the impact is highly unlikely to occur	0.2
Unlikely: the impact is unlikely to occur	0.4
Possible: the impact could possibly occur	0.6
Probable: the impact will probably occur	0.8
Definite: the impact will occur	1

IMPACT SIGNIFICANCE

NEGATIVE IMPACTS

≤1	Very low	Impact is negligible. No mitigation required.
>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.

POSITIVE IMPACTS

≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

2.7 Public Participation and Authority Consultation Process

2.7.1 Identification of Interested and Affected Parties - Compilation of IAP Database

The IAPs database has been compiled using the existing IAPs database at Grootegeluk Mine as well as databases used for other projects in the area. The IAPs database includes neighbouring private farms and the Manketti Reserve on the Grootegeluk property which is managed by Ferroland (a subsidiary of Exxaro). The IAPs lists were updated telephonically to obtain the correct stakeholder contact details. Grootegeluk Mine undertakes regular meetings with the surrounding IAPs and farmers. The existing IAPs list is therefore fairly recent and most details were found to be correct.

These stakeholders were initially informed about the project via the Background Information Document (BID), which was sent to everyone on the database via registered mail or email. The IAPs database is attached in Appendix 1. This database is also updated as the project progresses.

2.7.2 Notifications to Interested and Affected Parties

The first round of public participation was carried out in August 2010 (this round of public participation was conducted in English) and the second round in March – May 2011 (this round of public participation was conducted in English and Afrikaans).

Potential IAPs were notified about the project and the public participation process by means of:

- Direct letters and BIDs via registered mail to neighbouring and nearby landowners, posted on the 30th of July 2010 and the 7th of March 2011, in accordance with sub-regulation 54 2(b) of GNR 543.
- Press advertisements and site notices, placed on 6 August 2010 and again from the 5th to the 11th of March 2011.
- Individual notifications via email to IAPs and other people who may be affected by the proposed development on the 7th of March 2011.

Refer to Appendix 1 for copies of the notifications. The notifications mentioned above included BIDs which were compiled and circulated to the list of IAPs. The time and date for the information sharing meeting was also included in the BIDs. Response sheets were attached to the BIDs, requesting written responses and comments regarding the project. Copies of the BIDs are attached in Appendix 1.

2.7.3 Notifications to Relevant Authorities

Two rounds of authority consultation were also conducted for the project, due to the reasons mentioned above. The first round of authority consultation was carried out in August 2010 and the second round in March 2011. In accordance with the regulations, notification was sent to the authorities by registered mail, email and in person at the information sharing meetings. The following authorities were sent information regarding the project and invited to attend information sharing meetings:

- Limpopo Department of Mineral Regulations;
- Limpopo Department of Economic Development, Environment and Tourism;
- Department of Water Affairs;
- Department of Agriculture, Fisheries and Forestry;
- Department of Land Affairs;
- Lephalale Local Municipality; and
- Waterberg District Municipality.

In addition, the following government agencies were notified about the project:

- The South African Heritage Resources Agency.
- The National Department of Environmental Affairs.

Refer to Appendix 1 for copies of the notifications.

2.7.4 Press Advertisements and Site Notices

During the August 2010 and the March 2011 rounds of public consultation, advertisements were placed in three newspapers, the Mogol Post (in English), the Bosveld Bulletin (in English), and the Beeld (in Afrikaans), to advertise the project and to invite interested and affected parties (IAPs) to the information sharing meetings. The adverts in the Mogol Pos/Post appeared on the 6th of August 2010 and the 11th of March 2011, the advert in the Bosveld Bulletin appeared on the 6th of August 2010, and the advert in the Beeld appeared on the 8th of March 2011. Copies of the adverts are attached in Appendix 1.

Site notices (some in English and some in Afrikaans) were also placed at the following locations during the August 2010 and March - May 2011 rounds of public consultation, to advertise the project and

information sharing meetings:

- The main gate notice board at Grootegeluk Mine (August 2010 and March 2011)
- The entrance to the Char Manufacturing Plant (August 2010)
- The entrance to the Grootegeluk Medupi Expansion Project (March 2011)
- The entrance to the Lephalale Local Municipality (March 2011)
- Lephalale Shoprite notice board (August 2010 and March 2011)
- Lephalale Spar notice board (March 2011)
- Lephalale Pick n Pay notice board (March 2011)
- Lephalale Wholesale Dealer notice board (March 2011)
- Marapong Spar complex (August 2010 and March 2011)
- Onverwacht Marula shopping complex (August 2010)
- Department of Labour notice board (August 2010)

Photographs of the site notices are attached in Appendix 1. The site notices contained the same text as the newspaper advertisements.

2.7.5 Registration of Interested and Affected Parties

People and/or organisations were registered as IAPs for the project if they:

- Attended one of the consultation meetings.
- Responded to notification letters and documentation, press advertisements or site posters.
- Own land adjacent to the Grootegeluk Mine.
- Contacted Synergistics telephonically, via fax, e-mail or post.
- Are an authority/organ of state with jurisdiction over an aspect of the activity.

2.7.6 Public Information Meetings

Three meetings were held for the public (conducted in English and Afrikaans) on the 11th of August 2010, the 17th of March and the 19th of May 2011. The March and May 2011 meetings were combined for two projects: (1) the expansion of the existing Char Manufacturing Plant, as well as a separate project – (2) the proposed Market Coke Plant and Co-generation Plant. The purpose of the meetings was to give more detailed information about the projects, to present the environmental processes to be followed and to provide an opportunity for attendees to ask questions and raise concerns. The meetings were facilitated by Synergistics Environmental Services. The minutes of the public meetings and attendance registers are attached in Appendix 1. A summary of the questions and/or issues raised at the public meetings are included in the tables below:

Table 2.3: Questions/Issues Raised at the first Public Meeting on 11 August 2010

Question/Issue Raised:	Answer:
When will the construction of the expansion project begin?	Guillaume de Swart – Exxaro (GS) answered that construction is scheduled to begin in the third quarter of 2011.
Will the pollution control dam remain the same size? Is the capacity adequate for the expansion project?	GS answered that the pollution control dam is currently sized for 8 retorts and the size will therefore be sufficient for an additional 4 retorts. Vivienne Vorster – Synergistics (VV) added that the surface water specialist study, undertaken by Jones and Wagner Engineers, will verify whether the size is sufficient.
Will any additional water be required for the expansion project?	GS said that potable water requirements will remain roughly the same, as employment numbers will only increase slightly. Raw water required for use in the boilers will also remain as per the original water balance since the boiler system will not be expanded for this project.

A statement was made by Filomaine Swanepoel - IAP (FS) that the water service agreement between Char Manufacturing Plant and Grootegeluk Mine will need to be amended, should water use increase.	GS answered that the agreement will be looked into and any changes required will be done accordingly. Charles Linstrom - Exxaro (CL) added that the water balance will be updated as part of the surface water specialist study.
Will the existing Atmospheric Pollution Prevention Act (APPA) Permit be amended?	VV answered that an Atmospheric Emissions License (in terms of the new National Environmental Management Air Quality Act No. 39 of 2004) will be undertaken to amend the existing APPA permit.
There have been complaints about odours from the Char Manufacturing Plant at Grootegeluk Mine. There are also rumours amongst employees that the phenol levels are harmful to people's health and affect the mine personnel. What air quality monitoring is being undertaken at Char Manufacturing Plant?	Edwin Mogoane - Char Manufacturing Plant (EM) answered that air quality monitoring is undertaken bi-annually and assessed according to the conditions within the APPA permit.
What is being done about the waste 'sludge' which is currently being stored?	GS answered that coal fines that accumulate in the cyclones and tar precipitators of the recycle gas system are removed on a scheduled basis to avoid negative impacts on the process. The coal fines mixed with tar are removed as a sludge and stored in 210ℓ drums. These drums were initially sent to Holfontein, but this alternative was stopped due to excessive cost. Testing, with positive results, has been obtained by mixing the sludge with char fines to a dry consistency suitable for blending with Power Station coal. Sludge production volumes +- 0.04% of coal used.
The Grootegeluk Water Use License (WUL) states that the pollution control dam needs to be monitored for phenols. The mine is worried that this is not being done and it is a bad reflection on them.	EM answered that monitoring is being done at boreholes up and downstream from the pollution control dam. There have been no phenols detected in these monitoring boreholes.

Table 2.4: Questions/Issues Raised at the second Public Meeting on 17 March 2011

Question/Issue Raised:	Answer:
Tendani Mufamadi of the Grootegeluk Mine (TM): Are you going to extend the capacity of the pollution control dam?	GS: Yes we are. Charles Linstrom of Exxaro (CL): It is currently under investigation by Jones and Wagener (surface water specialists). We will update the public on the results of the specialists' studies.
Elijah Mabogo (EM): How long will construction of the plant take?	Lomeus Konradie of Exxaro (LK): We use special materials, and thus it can take two years, up to the end of 2014.
TM: Will you need a permit for emissions and electricity generation form the Department of Energy?	SH: We are applying for an Atmospheric Emissions License. With regard to the Department of Energy, I don't think a permit is needed, but we will confirm it.
TM: With regard to water use licenses required, a Section 21 A license is missing. Are you making provision for it?	CL: No, section 21 A applies to the Mokolo and Crocodile Water Augmentation Project (MCWAP). We already have an allocation from MCWAP for the Grootegeluk Mine. We will use the allocated water for the Char, Coke and Co-gen Plants as well.

No issues/questions were raised at the third public meeting held in May of 2011.

2.7.7 Focussed Authority Meetings

A general meeting was held with the relevant authorities on the 12th of August 2010. In addition, the following meetings were held with individual authorities:

- Limpopo Department of Mineral Regulations (DMR) on 16 March 2011;
- Limpopo Department of Economic Development, Environment and Tourism (LEDET) on 16 March 2011;
- Department of Water Affairs (DWA) on 16 March 2011;
- Lephalale Local Municipality on 17 March 2011; and
- Waterberg District Municipality on 17 March 2011.

The purpose of the meetings was similar to that of the public meetings, giving more detailed information about the project, presenting the environmental processes to be followed and to provide an opportunity for the authorities to ask questions. The minutes of the meetings and attendance registers are attached in Appendix 1. A summary of the questions and/or issues raised at the authorities meetings are included in the tables below:

Table 2.5: Questions/Issues Raised at the Authorities Meeting held on the 12th of August 2010

Question/Issue:	Answer:
Masemola Mailetse - Department of Agriculture, Forestry and Fisheries (MM) asked where the water that the Char Manufacturing Plant uses comes from.	Guillaume de Swart – Exxaro (GS) answered that raw, process and potable water is supplied from the Grootegeluk Mine via dedicated pipelines.
MM asked whether the Char Manufacturing Plant has a Water Use License and how much water is extracted?	GS answered that the Char Manufacturing Plant is approved under the existing Grootegeluk Mine Water Use License. The Char Manufacturing Plant does not extract water for any purpose.
MM enquired when construction will begin and when the expansion will be operational.	GS answered that construction is anticipated to start in the 3rd quarter of 2011 and the expanded plant should be operational by October 2012.

Table 2.6: Questions/Issues Raised at the Meeting with the DMR held on 16 March 2011

Question/Issue Raised:	Answer:
Azwi Malaudzi – DWA (AM): What do you produce?	Charles Linstrom – Exxaro (CL): Char. We want to expand our plant and add a coking process (explained process).
AM: Are you using waste coal?	CL: No, we are using coal product from bench 11 and 13 at Grootegeluk Mine which is ideal for process.
AM: So the current plant is a Char Manufacturing Plant, and now you want to expand Char and construct Coke and Co-Generation plants?	Shelley Holt - Synergistics (SH) and CL: Yes, (explained process).
SH: We will do EMP amendment, update closure costing etc. This will be a separate document (from the current EMP update of the entire Grootegeluk Mine). This is due to different pollutants. Do you think this will be acceptable?	AM: For administrative purposes, we want one EMP and not several amendments to the EMP. CL: We will try to align the Char, Coke and Co-gen EMP with the whole Grootegeluk Mine EMP update.
AM: DMR requires the a scoping report, then the EMP. When submitting reports, submit in parallel to DWA, DEA etc. so ensure that you meet all legislation.	SH: We will do this.
AM: What is Coke? Whom are you selling it to?	CL: Coke is formed by compressing coal and then heating it to remove impurities. Coke is used to produce steel. CL: We sell it to many clients, such as chrome producers and smelters.
AM: Will there be water pollution as a result of these plants?	CL: We are decreasing existing water pollution on the mine property. The groundwater pollution plume is being reduced. In our water use license there are stipulations to manage this. We have written a water and waste management plan. SH: The new construction is not likely to have a significant detrimental impact on ground water. CL: Construction is to take place on old coal stockpile site used in the 1970s. We have taken out all coal from the construction area, so no further pollution will leach from this coal to the groundwater.

Table 2.7: Questions/Issues Raised at the Meeting with the LEDET held on 16 March 2011

Question/Issue Raised:	Answer:
Voctor Mongwe – LEDET (VM): Will you burn the coal?	Mike Plaskitt – Exxaro (MP): There are volatile gasses in the coal. We heat the coal to remove volatiles to produce Char or Coke. The gas is then combusted and fed into a boiler, producing steam which drives a generator.
VM: How will you deal with the sulphur from the	MP: 1% of the sulphur is released as SO_2. When tar is precipitated,

coal?	SO_2 goes into the tar and later in the precipitated water called liquor.
Tinyiko Malungani – LEDET (TM): Are you doing separate applications?	SH: Yes, the applications are for the Char, Coke and Co-gen plants. We are also doing AEL applications and an air quality study. Once done we will engage with AEL officers at LEDET.
VM: We must confirm whether the waste is hazardous waste or not. Waste management licensing is not the core of the project. If it is a by-product LEDET will deal with it.	MP: We think it is likely to be hazardous. We may add the tar to the gas for burning, to produce electricity. Tar is a by-product, not waste, as it can also be sold. We will also burn the liquor to produce heat and generate electricity. SH: We do have a waste specialist who is working on the project. MP: The specialist will classify the waste. All our "waste" will be converted to energy. The only "waste" will be atmospheric emissions. No solid or liquid waste will be left.
TM: With PPP, language gaps must be addressed. The dominant language of the area should be identified.	SH: We will do this.
TM: Is it our competency to run with electricity production, or do we need to delegate to DEA?	VM: We must focus on the main process, in this case, to produce Char by erecting the facility.
TM: If applications are submitted separately, the processes should be separate. If it is one process, applications should possibly be combined.	MP: Coke and Co-Gen are interdependent.
TM: How will you align the MPRDA and NEMA processes? If you submit the reports to the DMR and LEDET at the same time, and the report is inadequate, there could be issues.	VM: Let's follow the NEMA process. If we are satisfied, we will give authorisations. TM: I would advise submitting the reports to DMR after we have approved the reports.

Table 2.8: Questions/Issues Raised at the Meeting with the DWA held on 16 March 2011

Question/Issue Raised:	Answer:
V.B. Sengani – DWA (VBS): Will the level of CO_2 released be minimal?	Mike Plaskitt – Exxaro (MP): Yes, much less than a normal coal boiler stack. In our case, only 15% of coal (volatiles) is burnt off, therefore we burn one sixth of the amount of a normal boiler. Thus we have cleaner stacks.
VBS: What is the potential for acid rain from SO_2.	MP: We will design the plant to minimise SO_2 and CO_2. We will comply with regulations. Shelley Holt - Synergistics (SH): We are applying for an AEL,
Charles Linstrom – Exxaro (CL): We will apply for a WULA under section 21 G and B of the NWA. We have a surface water specialist and a groundwater specialist, whose data we will use in the application. We will also update the Integrated Water and Waste Management Plan (IWWMP) for the mine.	
VBS: Can we see a presentation of the results of the surface and groundwater monitoring?	CL: Yes, however we are in the early stages. We can give you the results at a later stage.
MP: Waste water dams will also be constructed.	CL: Does DWA still require a 2 mm HDPE lining on the pollution control dams? Animals at our plant damage the HDPE lining. We may need to make a concrete lining. MM: Give us 3 different options for dam lining and we will recommend the most appropriate one.
VBS: Will there only be section 21 G and B applications?	MP: Regarding section 21 A, the Grootegeluk Mine has a current allocation from the Mokolo and Crocodile Water Augmentation Project (MCWAP).
CL: Does dust suppression fall under section 21 G?	VBS: It is still a section 21 E activity. MP: Some dust may occur, but not large amounts. No crushing or screening takes place at the Char Manufacturing Plant.
CL: Under the stockpile areas, what must we use to mitigate groundwater pollution from the stockpiles? We will also ask the groundwater specialist to recommend suitable measures.	VBS: Concrete. The leaching of sulphates can affect the ground water. We will check the application and whether the mitigation measures will reduce/prevent impacts.
MM: Will you factor in the water balance and salt	CL: The water balance will dictate stormwater constraints, thus we

Question/Issue Raised:	Answer:
balance?	may need to expand the pollution control dam, and ensure that it can withstand a 1:50 year flood. The water specialists will come up with a water monitoring programme. MP: The water specialist's water balance will ensure we recycle as much water as possible and that we have enough water.
MM: There have been issues with the public regarding water in the area, so please include water issues in the public participation.	CL: Water issues will be included in public participation from the start.

Table 2.9: Questions/Issues Raised at the Meeting with the Waterberg District Municipality heldon 17 March 2011

Question/Issue Raised:	Answer:
Lily Mokonyane – Waterberg Municipality (LM): We have Integrated Water and Waste Management (IWWM) plans, Air management plans, and EMPs for our municipal area. The Environmental Management Framework combines all three. You should also consider the health impacts.	Shelley Holt - Synergistics (SH): We would like to obtain copies of those reports. Health impacts will be assessed during the EIA process.
Peter Mphela – Waterberg municipality (PM): What is the potential for air pollution?	SH: We will do an air quality study. There is existing emissions data from the Char Manufacturing Plant. We will send you our reports, and you will be able to comment on them.
Charles Linstrom – Exxaro (CL): Do you want the Char Manufacturing Plant data in the report? Should we include Medupi Power station in the baseline?	PM: Yes, it makes sense to include Medupi. If not included, it will not give a true idea of impacts. Mike Plaskitt – Exxaro (MP): Our plant will have less than 1 % of impact compared to Medupi and Matimba power stations. They contribute 99 % of air pollution due to their size.
PM: How have water issues been considered?	CL: We will compile water balances for the plants. If we don't have sufficient water, we will not go ahead with project. We will update water balances to try save water. I think the water in the Mokolo Dam has been 100 % allocated. DWA has taken over management of the Mokolo Dam, so they allocate the water now. They indicated to us that our existing allocation is the maximum we will receive. MP: We will use the allocated water for the Grootegeluk Mine.
LM: How does the development benefit the community? Short term construction jobs do not sustain people. Ensure the community is included.	SH: We will assess the socio-economic benefits, and jobs that will be created. We haven't assessed this in detail yet. MP: We have a social manager at Grootegeluk Mine. He arranges and deals with all social issues and community projects. SH: We will put those details in the report. MP: We need a lot of labour for these plants, up to 130 jobs will be created at Char and 230 at Coke and Co-Gen.
Edwynn Louw – Synergistics (EL): Would you like to know whether unskilled, local people will be able to be trained to fill the employment opportunities at Char, coke and Co-generation plants?	MP: Yes, we will train the local unskilled people.
PM: You are aware of Waterberg being declared a priority area in terms of NEM:AQA, therefore there may be stricter air quality standards for the area in future. Suitable abatement technology should be in place.	SH: We will take note of this.

Table 2.10: Questions/Issues Raised at the Meeting with the Lephalale Local Municipality held on 17 March 2011

Question/Issue Raised:	Answer:
Joshua Hlapa – Lephalale (JH): The waste and air specialists should ensure that the applicable regulations are complied with. We would like a waste management plan, air monitoring plans and water monitoring plans. I spoke	Shelley Holt - Synergistics (SH): Once the specialist studies are done, we will send you the reports and will update the Grootegeluk Mine IWWMP to include these plants.

Question/Issue Raised:	Answer:
to Filomaine Swanepoel at Grootegeluk mine, they have an IWWMP. Is it not a good idea to incorporate the new plants into the IWWMP?	
JH: What will you use to burn the coal?	Mike Plaskitt – Exxaro (MP): We will use coal gas. Once the coal is in the retort, we use LPG gas to start the process. After that, coal gas will heat the coal. We add a little air to burn the gas. Once the process runs, only coal gas is used.
JH: We will have more questions once you have the draft reports for us.	

2.7.8 Review of the Draft and Final Scoping Reports

The draft scoping report was made available for public and authority review. The public and relevant authorities were given a 40 day period to review the report and to add any comments. It also allowed them the opportunity to assess whether all their issues have been correctly captured.

Registered IAPs were notified that the draft report was available for review at the Grootegeluk Mine main gate, at the Lephalale library as well as electronically on the Synergistics website. IAPS were informed that an electronic copy of the report, on CD-ROM, would be sent to anyone who requested it.

Following the closure of the review period, final modifications were made to this scoping report. There were no comments received on the draft scoping report.

The final scoping report was made available for public and authority review for a period of 3 weeks from the 8th of August 2011 to 29 August 2011. All registered IAPs were notified in writing of the availability of the document for review and were requested to submit comments. However, no comments were received from IAPs. All comments received from authorities on the final scoping report are collated in the table below.

Table 2.11: Comments Received from Authorities on the Final Scoping Report.

Commenting Authority	Comments Received	Section in EIA where addressed
Mantwa Seakamela - LEDET	An in depth Air Quality Study taking into consideration suitable abatement technology should be undertaken.	Appendix 3
LEDET	Proof, which will take into consideration the amendments of the Integrated Water Use Licence Application (IWULA), submitted to the Department of Water Affairs (DWA), must be provided.	This is currently in process, the proof will be provided with the final EIA report.
LEDET	Proof that an EMP in accordance with the MPRDA, submitted to the DMR for approval, must be provided,	Appendix 1 Public consultation report – Appendix H.
LEDET	Proof that a Waste Management Licence application in accordance to NEMWA has been submitted to the Department of Environmental Affairs (DEA) must be provided.	Appendix 1 Public consultation report – Appendix H.
LEDET	Proof of the Atmospheric Emission Licence in accordance with NEMAQA must be provided.	This is currently in process, the proof will be provided with the final EIA report.
LEDET	Proof confirming that South African Heritage Resource Agency (SAHRA) was consulted must be provided.	Appendix 7.
LEDET	The surface water studies undertaken by Jones and Wagener Engineers must be incorporated in the EIR.	Appendix 4, section 4.1.6
LEDET	Feasible methods for managing the existing waste sludge produced at the Char Manufacturing Plant must be adequately addressed.	Section 3.2.1
LEDET	The existing waste management plan must be incorporated in the EIR and the EMP.	Refer to Volume 3, the EMP.
LEDET	Designs of the plant must take into consideration for the minimisation of SO_2 and CO_2 and the possible impacts of acid rain must be addressed in the EIR.	Section 6, Appendix 3.

Commenting Authority	Comments Received	Section in EIA where addressed
LEDET	Alternatives for lining of the waste water dams must be identified and addressed and the best option recommended.	Appendix 4. Please note that an additional waste water dam will no longer be required for this project. The existing dam will be used.
LEDET	The groundwater specialist must recommend suitable measures to mitigate potential groundwater pollution from the stockpiles.	Appendix 5. Volume 3 – EMP.
LEDET	The water specialist study must recommend feasible measures of recycling of water in order to address water and salt balance.	Appendix 4
LEDET	The existing IWWM, as well as the Environmental Management Framework by Waterberg Local Municipality must be incorporated in the EIR.	The current IWWM is being updated. A copy of this will be submitted with the final EIA. The relevant issues in the Waterberg EMF will be included in the final EIA.
LEDET	The EIR must indicate the adequacy of the capacity of the pollution control dam to accommodate the proposed project.	Appendix 4 explains this.
LEDET	Provide proof of where additional water will be obtained as the DWA has indicated that the existing allocation, which is inadequate to support the expansion, is the maximum the Char operation can be provided.	Section 3.2.3. A service level agreement is in place with the Grootegeluk Mine to use part of their existing water allocation. Refer to Volume 2, Appendix 1, Appendix H.
LEDET	Proof of agreements that are in place regarding, for example the provision of water and electricity, must be provided.	A service level agreement is in place with the Grootegeluk Mine to use part of their existing water allocation. Refer to Volume 2, Appendix 1, Appendix H.
DMR	Specialist studies with regard to water, heritage and others must be done.	Appendix 3, 4 and 7.
	All issues and concerns raised by IAPs need to be addressed.	Appendix 1
	The closure objectives must be described.	Volume 3 - EMP
DEA	DEA confirmed receipt of WML application.	N/A
	Requested a copy of the final scoping report and the letter from LEDET approving the final scoping report.	These were sent to the DEA on 9 March 2012.

2.7.9 Review of the Draft and Final EIA Reports

Under the NEMA process, the draft EIA report will be made available for public and authority review in May, June and July 2012 for 8 weeks (60 calendar days). All registered IAPs will be notified in writing of the availability of the document for review and will be requested to submit comments.

Under the NEMA process, the final EIA report will be made available for public and authority review for approximately 3 weeks (21 calendar days). The review periods for authorities are in accordance with GNR 543 for both the scoping and EIA reports (note that these regulations do not specify review periods for final reports).

2.7.10 Public Feedback Meeting during the EIA Phase

During the EIA review phase of the study, a public meeting may be arranged to present the results of the specialist studies if required. Registered IAPs will be directly invited to attend the meeting.

2.8 Study Team

Synergistics Environmental Services (Pty) Ltd (Synergistics) has been appointed by Exxaro Reductants as the independent environmental consultant to undertake the EIA. Matthew Hemming, a director of Synergistics, is the Environmental Assessment Practitioner (EAP) for the project. Several specialists have undertaken specialist studies as part of the EIA.

The environmental study team members and specialists that were involved in the EIA are listed in the table below. Their roles and responsibilities on the project and their qualifications are provided.

Table 2.12: Study Team

Name and Affiliation	Qualification	Role
Environmental Study Team		
Matthew Hemming (during EIA phase) and Mari Wolmarans (during scoping phase) Independent Environmental Assessment Practitioner	MSc Conservation Biology (Matthew) BL Arch, MSAIEE EAPSA (Mari)	- Project Leader - EIA report and EMP
Vivienne Vorster Synergistics Environmental Services	BA Hons Environmental Management	- Project Manager - EIA report and EMP
Shelley Holt Synergistics Environmental Services	BSc Hons Zoology	- EIA and EMP report
Bheki Khumalo Synergistics Environmental Services	BSc Hons Environmental Modelling and Monitoring	- GIS and Mapping
Mike Palmer Jones and Wagener	MSc Eng (Civil)	- Hydrological Impact Report
Johan Kriek ERM **Hanco Roux** ERM	MSc Geohydrology Bacculaureus Technologiae (Geology)	- Geohydrological Impact Report
Gerrit Kornelius Airshed Planning Professionals	PhD Air Pollution Control Technology	- Air Quality Impact Report
Elize Herselman Golder Associates	PhD Soil Science	- Waste Characterisation Impact Study
Cornelia Hutchinson WSP Engineers	B.Eng Hons (Civil)	- Traffic Impact Study

2.9 Specialist Studies

The various specialist studies conducted as part of the Char Manufacturing Plant Expansion EIA process are listed below and are appended to the draft EIA report. The scope of work of the individual studies is explained in each specialist report.

- Hydrological
- Geohydrological
- Air Quality
- Waste Characterisation
- Traffic

3. Project Information

3.1 Scope of Work

The proposed project entails the expansion of the existing Char Manufacturing Plant by increasing the number of retorts (the vessels in which the coal is heated) from 4 to 12. This expansion, in essence, involves an increase in size of the existing plant and thus also an expansion of the existing infrastructure which is shown in Plate 3.1.

The expansion to the Char Manufacturing Plant will be located directly adjacent to the existing plant and

will therefore also be located within the Old Middling coal stockpile area at Grootegeluk Mine. This area was previously used by the mine for the stockpiling of coal. The existing Char Manufacturing Plant infrastructure covers an area of approximately 7.3 ha and the expanded infrastructure and stockpile areas will increase the size of the Char Manufacturing Plant footprint to approximately 54.6 ha (refer to Figure 3.2 for the layout of the existing Char Manufacturing Plant and the expansion).

As previously mentioned, a separate EIA process is being conducted for two additional plants which are proposed to be constructed adjacent to the Char Manufacturing Plant Expansion - the Coke Manufacturing Plant and Electricity Co-generation Plant (Figure 3.2).

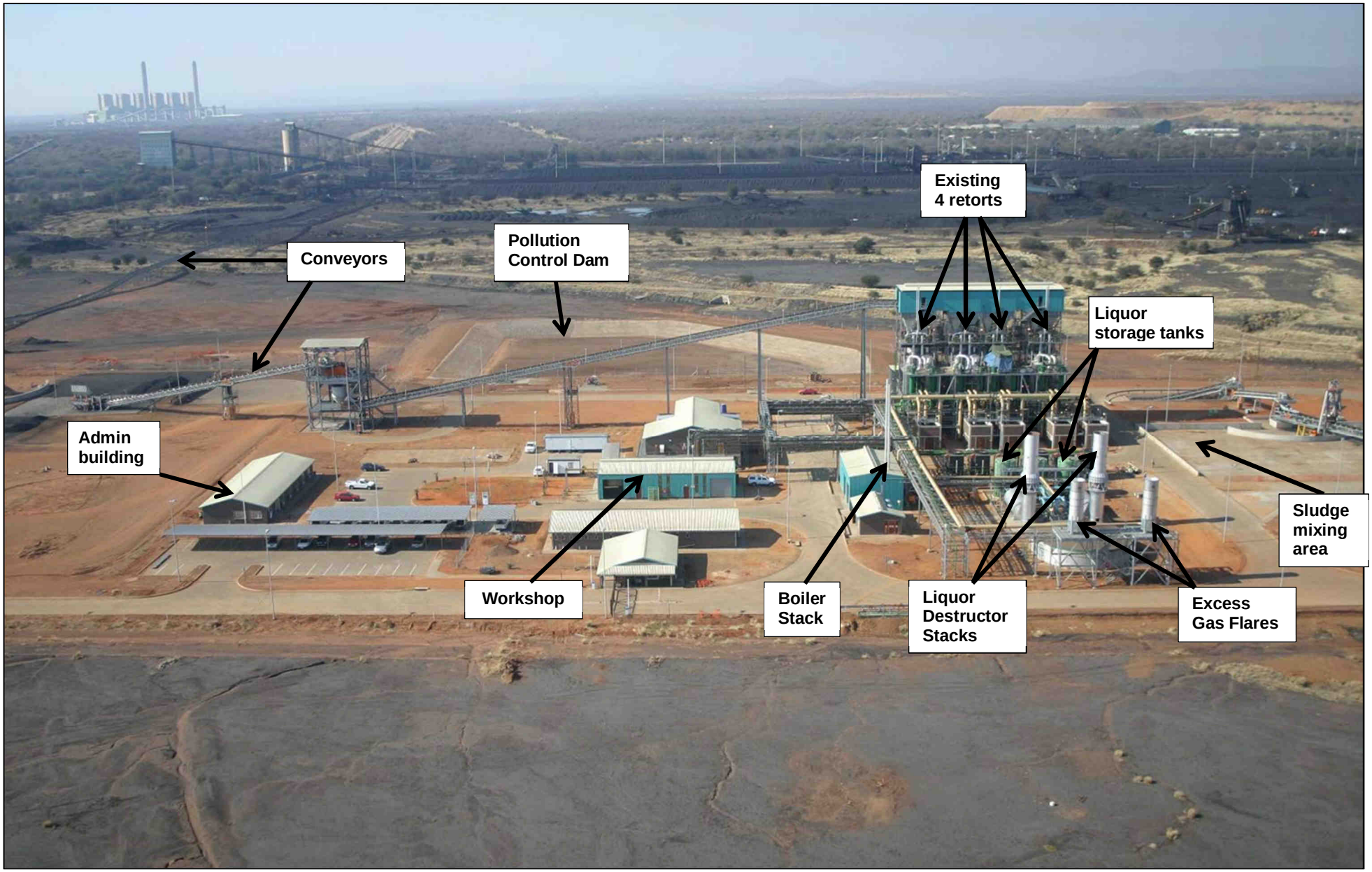
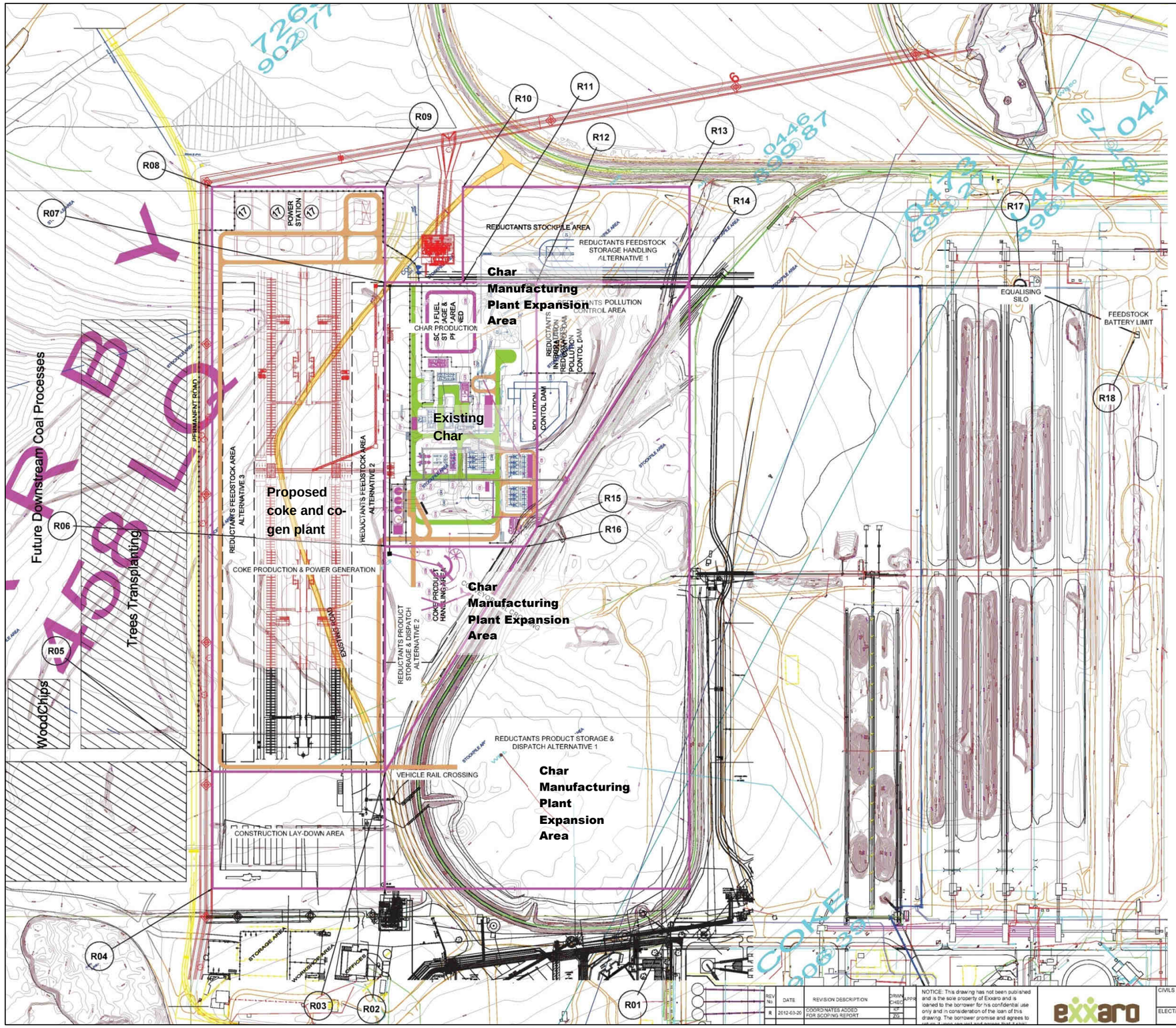


Plate 3.1: Location of key infrastructure at the Existing Char Manufacturing Plant



GPS COORDINATES		
NUMBER	EAST	SOUTH
R1	27.5506	23.6557
R2	27.5471	23.6526
R3	27.5483	23.6514
R4	27.5451	23.6512
R5	27.5463	23.6498
R6	27.5506	23.6491
R7	27.5534	23.6463
R8	27.5523	23.6436
R9	27.5544	23.6453
R10	27.5551	23.6460
R11	27.5543	23.6470
R12	27.5551	23.6477
R13	27.5579	23.6482
R14	27.5569	23.6492
R15	27.5526	23.6504
R16	27.5522	23.6505
R17	27.5607	23.6524
R18	27.5616	23.6540

C1 COAL STOCKPILE & STACKER
C2 CHAR COAL STOCKPILE (BACKUP)
C3 FEED COVEYOR
C4 SETTLING POND
C5 RETORT
C6 WHARF
C7 PLANT FLARE
C8 MCC BUILDING
C9 NEW PLANT CONTROL ROOM
C10 PRODUCT STOCKPILE (EXTENSION)
C11 COOLING TOWERS
C12 LIQUOR BUFFER TANKS
C13 SULPHUR SCRUBBING (FUTURE)
C14 TAR LOADOUT STATION
C15 TRUCK LOADING
C16 RAW WATER STORAGE
C17 SLUDGE MIXING
C18 TAR STORAGE & OUTLOADING
C19 ADDITIONAL LIQUOR DESTRUCTORS
C20 BOILER
C21 WEIGH BRIDGE
C22 ROTARY KILNS
C23 TECHNICAL OFFICES
C24 ADMIN EXTENSION
C25 LINED AREA
C27 33kV YARD 11kV SUPPLY
C28 STOCKPILE AND STACKER
C29 RAMP & HOPPER
C30 CONVEYOR 1
C31 SCREEN HOUSE
C32 CONVEYOR 2
C33 CONVEYOR 3
C34 LOADOUT BIN 1
C35 LOADOUT BIN 2
C36 COAL STOCKPILE & STACKER (EXISTING)
C37 COAL SCREEN (EXISTING)
C38 POLLUTION CONTROL DAM (EXISTING)
C39 RETORT PLANT (EXISTING)
C40 PRODUCT STOCKPILE (EXISTING)
C41 LIQUOR DESTRUCTORS (EXISTING)

Figure 3.2: Site Layout of the existing Char Manufacturing Plant and the Char Manufacturing Plant Expansion (the Coke and Co-generation Plants are also shown on the left – currently undergoing a separate EIA)

3.2 Project Description

3.2.1 Char Process

Char is a metallurgical carbon reductant and is increasingly used to supplement market coke due to the limited availability of imported coking coal. The Char Manufacturing Plant and the expansion is therefore in a prime position, as it has access to suitable coal feedstock as well as being close to major consumers (ferro-chrome, ferro-manganese and platinum producers).

The Char manufacturing process involves the conversion of lumpy coal blends to high quality carbon reductants (char) through de-volatilisation. De-volatilisation involves releasing volatile compounds through heating the coal at approximately 950℃. The process takes place in a closed circuit and involves the re-application of gaseous heat in the absence of oxygen, which maximises the recovery of lumpy carbon – this reaction takes place in vertical retort. The char production plant is designed to recycle and use the off-gas (waste gas) from the process. A simplified version of the char manufacturing process is shown in the figure below.

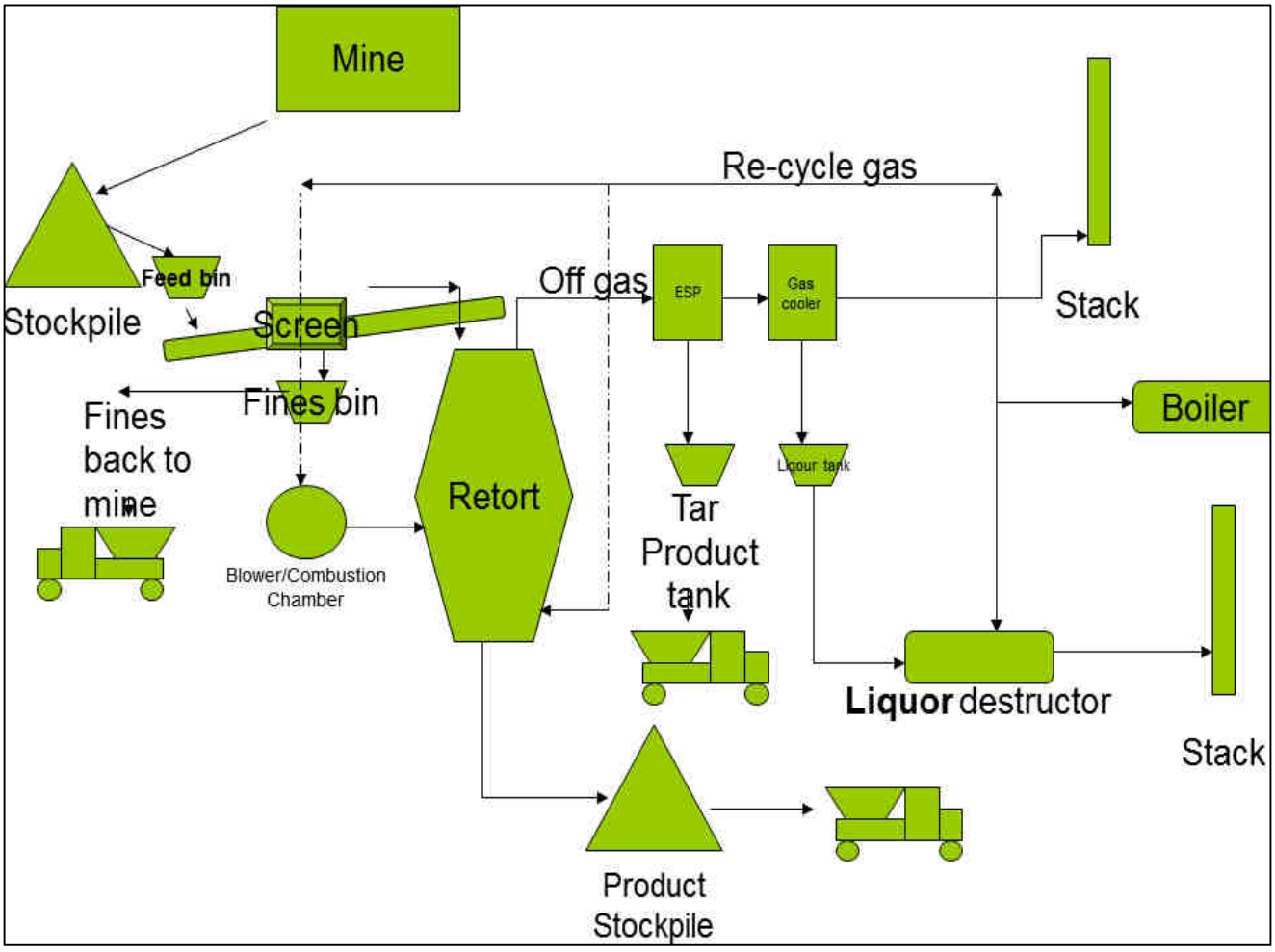


Figure 3.3: Simplified process flow diagram of the Char Manufacturing process

Detailed process flow diagrams are shown in Figure 3.4 and Figure 3.5. Photographs of the infrastructure of the existing Char Manufacturing Plant are shown in the plates below. The Char manufacturing process can essentially be broken down into 4 process streams:

- The coal feed system,
- The retort system,
- The gas system, and

- Liquors.

Please note that the char manufacturing process which is used in the existing Char Manufacturing Plant, and described below, will be the same as the process in the expanded Char Manufacturing Plant. The plant size will essentially be increased to three times its current size i.e. there are currently 4 retorts and with the expansion there will be a total of 12 retorts. Most of the existing infrastructure will be duplicated twice, though some of the infrastructure (e.g. the pollution control dam) has sufficient capacity to also service the expanded Char Manufacturing Plant and this infrastructure will not be expanded, but it will be used to a greater extent than at present.

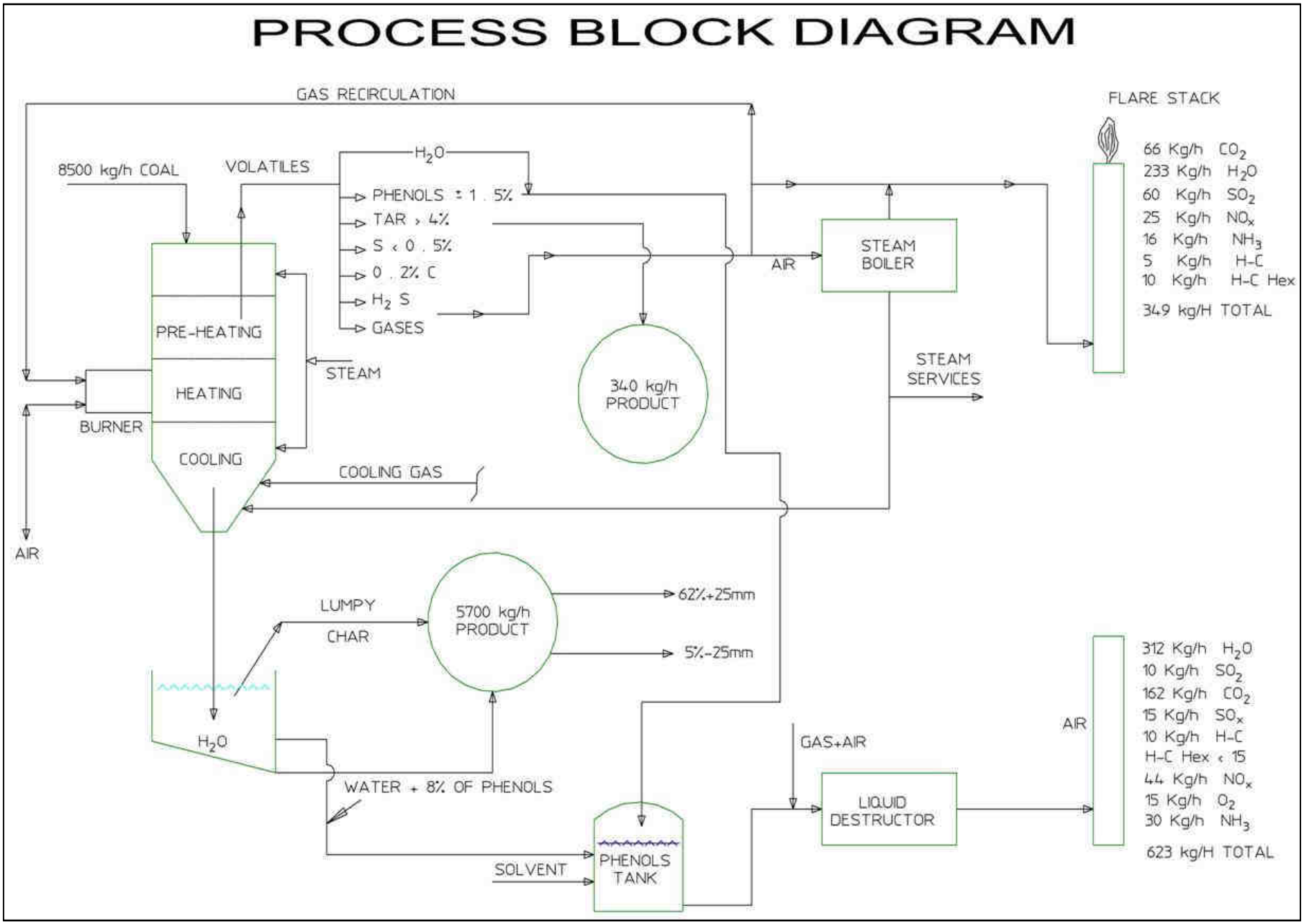
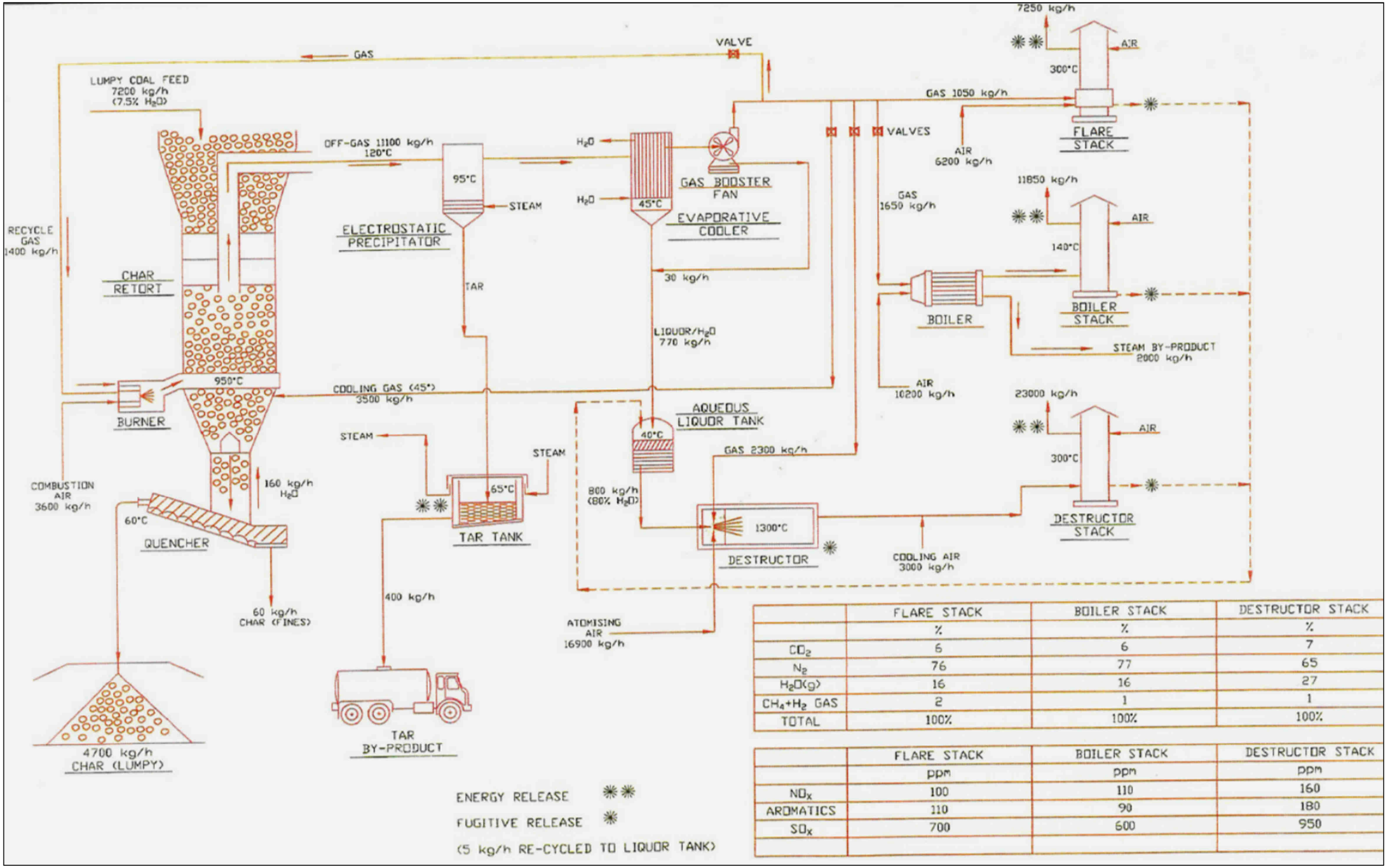


Figure 3.4: Process flow block diagram of Char Manufacturing Plant (per Retort)



	FLARE STACK	BOILER STACK	DESTRUCTOR STACK
	%	%	%
CO_2	6	6	7
N_2	76	77	65
$H_2O(g)$	16	16	27
CH_4+H_2 GAS	2	1	1
TOTAL	100%	100%	100%

	FLARE STACK	BOILER STACK	DESTRUCTOR STACK
	ppm	ppm	ppm
NO_x	100	110	160
AROMATICS	110	90	180
SO_x	700	600	950

Figure 3.5: Process flow diagram of Char Manufacturing Process (per Retort) showing inputs and outputs

3.2.1.1 Coal Feed System

The infrastructure associated with the coal feed system includes:

- Coal stacker and feedstock stockpile
- Front end loader,
- Hopper (loading bin),
- Conveyor belts,
- Magnetic separator,
- Vibrating screen, and a
- Coal bunker hopper.

Suitable coal feedstock from Grootegeluk Mine is transported to the Char Manufacturing Plant via an overland conveyor system (shown in Plate 3.1) and is stockpiled at the Char Manufacturing Plant site by means of a stacker onto the coal stockpile (kidney shaped) (Plate 3.7). This coal is mined from certain benches at the Grootegeluk Mine (benches 11 and 13) and the use of this coal for char manufacturing will not impact on the coal supply to the Eskom power stations which is sources from different benches.

Plate 3.6: Aerial view of the Grootegeluk Coal mine showing the mining benches.

Plate 3.7: The coal from the mine is transported to the Char Manufacturing Plant via conveyor and is stockpiled on a concrete lined area.

The raw material feed coal is likely to produce a limited amount of dust as it has been washed and sized to be free of fines. Water cannot be sprayed onto the coal feedstock as it must be dry before being fed into the retort.

A front end loader is used to load the stockpiled coal into the feed bin from where the coal is fed to the screen house via a conveyor belt (Plate 3.8). The coal is then washed and sized using a vibrating screen (Plate 3.9). Fine pieces of coal, less than 15 mm in size are discarded and transported back to Grootegeluk Mine. Metal within the lumpy coal is removed by means of a magnetic separator.

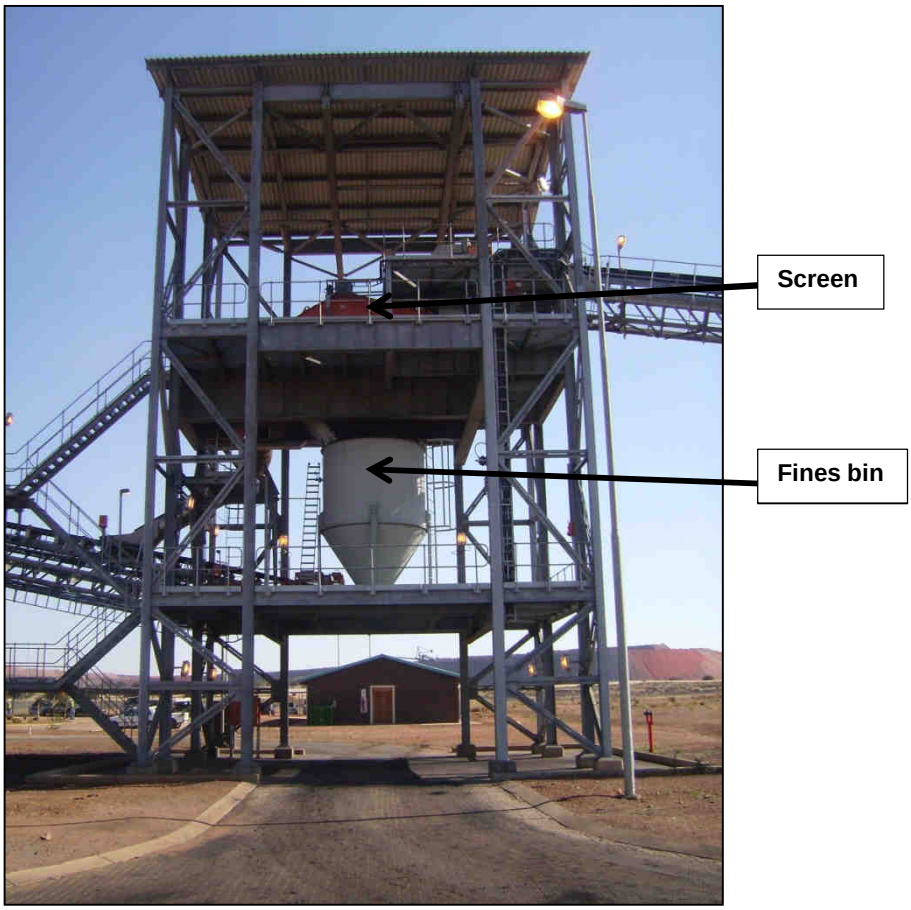


Plate 3.8: The coal screening house with conveyor belts bringing coal in and taking screened coal to the retorts.

Plate 3.9: The vibrating screen – coal is passed over this screen to remove the unwanted fines less than 15 mm in size.

Plate 3.10: The screened coal is transported via conveyor belt to the retort feed bins located above the retorts.

3.2.1.2 Retort System

The main plant items associated with the retort system include:

- Hydraulic knife gate in-feed valves,
- Retort vessel,
- Process heater (combustion chamber with dual fuel burner),
- Out-feed chamber, and an
- Out-feed conveyor belt.

The process in the retort system is initiated by the burning of diesel to pre-heat the retort vessel to the required temperature. No gases from the pre-heating will be emitted from the stack. Once the process is going, some of the volatile gas from the retort will be recirculated and burnt to continually heat the retort. Thus diesel is only required for the start-up of the process.

Once the operating temperature of 950℃ is achieved , the screened feedstock coal is fed into the retorts (Plate 3.11) at a rate of 8.5 tph (per retort) from the retort feed bins (day bins) in a controlled manner to maintain a constant level. The feed rate is controlled by a set of knife gate valves that operate in sequence passing the coal through a feed lock chamber to prevent the escape of gas into the atmosphere and the ingress of air into the retort. The feedlock chamber is purged with steam between each cycle.

The coal is heated within the retort system to a temperature of 950^{o}C which drives off the tar, moisture and volatile gas (Plate 3.12).

The gas in the retort system is typically comprised of:

- Water
- Phenols (1.5%)
- Tar (> 4%)
- S (< 0.5%)
- H_2S

- Other gas

It is important to note that the system is designed to exclude oxygen so that the carbon within the coal does not oxidize (burn).

Plate 3.11: Retort feed bins above the retorts.

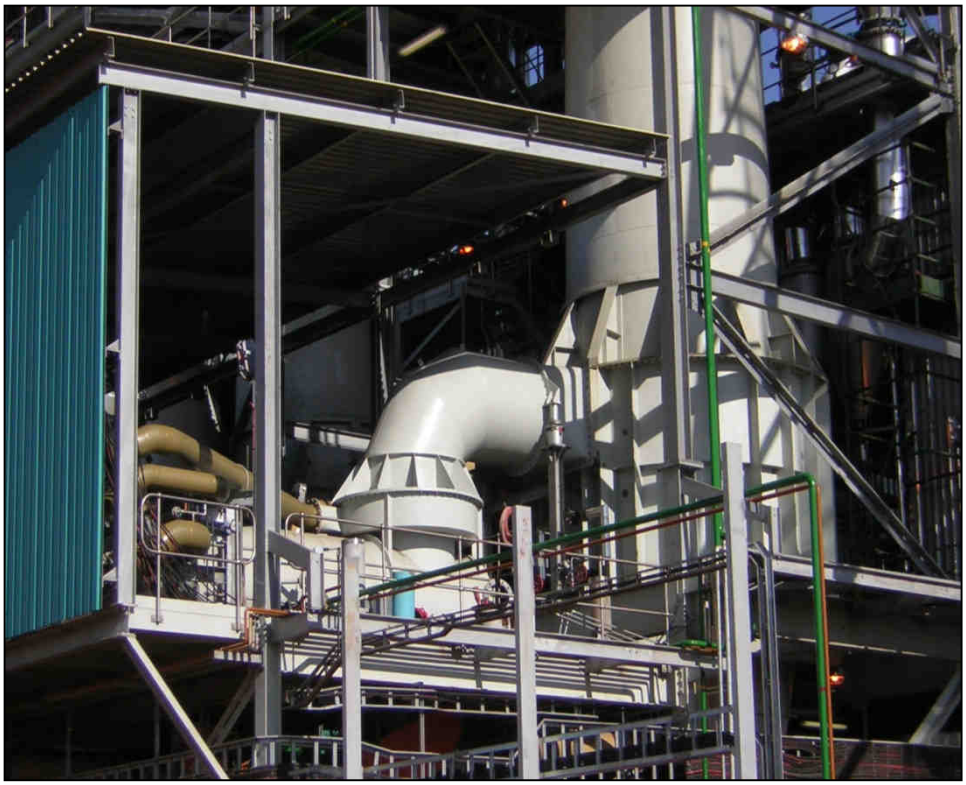


Plate 3.12: The retort in which the coal is heated.

The retorts have vents which allow for emergency releases of gas if necessary.

Raw, potable and process water is supplied from the mine through a dedicated supply. Process water is used to quench the hot char product after leaving the bottom of the retort. The char must be quenched to prevent oxidation (burning) when it comes into contact with the atmosphere. During the quenching process, no steam is released into the atmosphere, though approximately 0.22 tph of steam (per retort) is released into the closed retort.

Approximately 5 700 kg/h product (char) is produced per retort, or roughly 65-68% product yield. The yield is made up of approximately 62% larger than 25 mm (lumpy char) and 5% less than 25 mm (char fines).

Plate 3.13: Quenched char leaving the retort.

Plate 3.14: The product stacker stacking the char onto the product stockpile area.

Plate 3.15: Char is stockpiled and separated (screened) into char fines and lumpy char.

The char product is then transported to customers using road transport.

3.2.1.3 Gas System

The main plant infrastructure for the gas system includes:

- Electrostatic precipitators (ESPs),
- Shell and tube heat exchanger,
- Burner,
- Steam boiler,
- Evaporative cooling system, and
- Circulating water.

Volatile gases released from the heating of the coal, leave the top of the retort. These gases have a temperature of about 120^{o}C and contain methane, hydrogen sulphide, tar, oil gas and a small quantity of sulphur dioxide. The volatile gas from the retort system is first treated by passing it through electrostatic precipitators (ESPs), which separate the tar and light oils from the gas through high tension DC voltage (Plate 3.16). The ESP operates at a temperature of approximately 95^{o}C and produces tar at a rate of approximately 340 kg per retort per hour.

The tar from the ESPs flows down into the tar product storage tanks from where it is collected by customers/contractors by pumping it into to road tankers. It is primarily used in the manufacture of creosote. As the tar is currently sold, it is considered to be a by-product of the char manufacturing process and thus does not fall within the definition of waste as stated in the NEMWA.

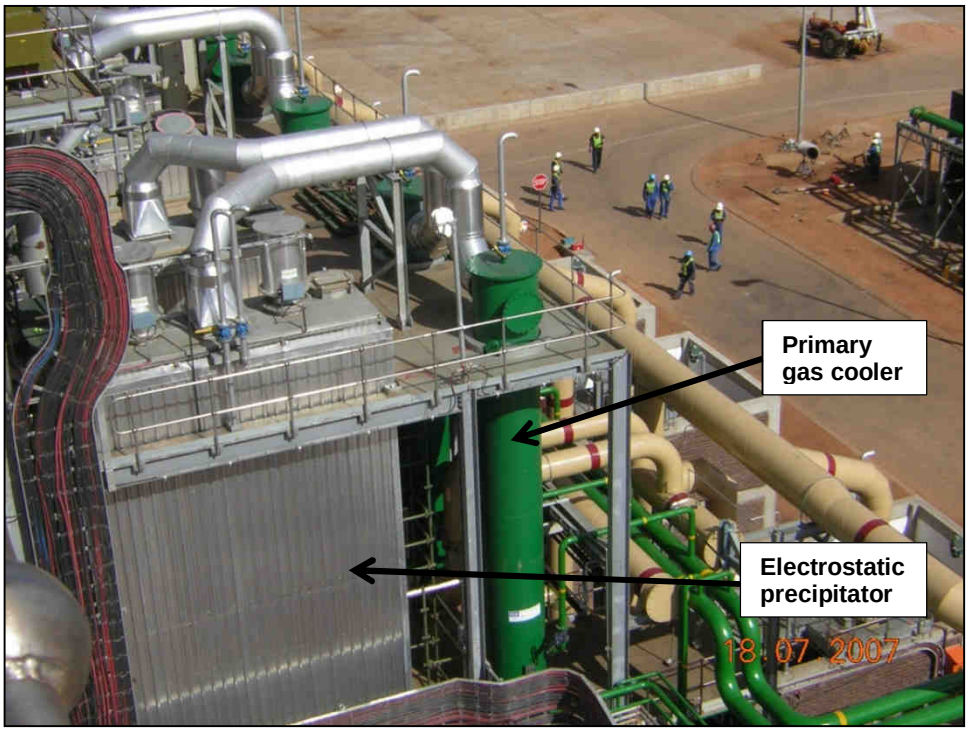


Plate 3.16: Photo showing the electrostatic precipitator which separates the tar from the volatile gas mixture and the primary gas cooler which cools the remaining gas to 40°C.

Plate 3.17: Tar storage tanks.

3.2.1.4 Liquor

The main infrastructure associated with liquor and waste includes:

- Tar System;
- Phenols;
- Pumps;
- Liquor destructor

The remaining volatile coal off-gas is then separated in a cyclonic separator and cooled through a shell and tube heat exchanger to 40^{o}C (Plate 3.18 and Plate 3.16). The temperature of the cooling system is maintained by an evaporative cooling system. This cooling process precipitates water, which will contain hydrocarbon oils, phenols and sulphur. This precipitated water is termed “liquor” and is produced at a rate of approximately 770 kg per retort, per hour. Water condensates from the gas booster fans and other contaminated liquids formed during the char manufacturing process are also collected as liquor. The liquor is stored in the liquor storage tanks shown below.

Plate 3.18: The cyclonic separator.

Plate 3.19: Liquor storage tanks.

The liquor is a waste from the char manufacturing process (it cannot be sold or recycled) and is destroyed in a liquor destructor by burning it with coal gas produced in the retorts during the charring process. The main gases formed during the burning of the liquor are CO_2, H_2O, NO_x, and NH_3 which then exit the liquor destructor stack (refer to Plate 3.1 and Plate 3.20) at a rate of approximately 623 kg per retort, per hour. The liquor destructor stacks are approximately 14.5 m high. It is estimated that the following quantities of gases are emitted to the atmosphere via the liquor destructor:

- 162 kg/h CO_2
- 312 kg/h H_2O
- 10 kg/h SO_2
- 15 kg/h SO_X (This may also represent H_2S)
- 44 kg/h NO_X
- 30 kg/h NH_3
- <15 kg/h H-H Hex
- 10 kg/h H-C (hydrocarbons)
- 15 kg/h O_2

Plate 3.20: Liquor destructor stacks.

The gas which still remains after the tar and liquor has been removed is recycled and primarily burnt as a fuel gas to heat the retorts. Some of the gas is also used to fuel steam boilers which produce approximately 2000 kg/h of steam (per retort). This steam is used in the process of loading the coal into the retorts, for the ESPs and for the purging and maintenance of the system heat. Excess steam exits the boiler stack which is approximately 20.5 m high.

Some excess gas is also used in the liquor destructor or as a cooling gas for the cooling section of the retort. A fan boosts the gas pressure in the system.

The remaining volatile gas is then flared (burnt) and released into the atmosphere from the flare stacks which are approximately 21.5 m in height (Plate 3.21). The flare stacks control the pressure of the recycled gas by burning off excess gas in the system.

Estimated volumes of gas (approximately 349 kg per retort, per hour) flared off include:

- 66 kg/h CO_2
- 233 kg/h H_2O
- 60 kg/h SO_2
- 25 kg/h NO_x
- 16 kg/h NH_3
- 15 kg/h Hydrocarbons

In addition, particulate matter (ash) of between 50 to 100 µm in size is also emitted at a rate of approximately 2 kg/h.

Plate 3.21: Flare stacks.

3.2.1.5 Tar sludge

A sludge formed primarily from a watery mixture of coal particles and coal dust, accumulates in the ESPs, the cyclones and tar precipitators of the gas recycling system. This sludge is removed from the char manufacturing equipment on a scheduled maintenance basis to avoid negative impacts on the production process. The sludge is classified as hazardous waste and is temporarily currently stored in 210ℓ drums in a bunded area at the plant. The sludge is then transferred to a mixing station where it is mixed with char product fines to form a dry consistency (Plate 3.22). The sludge/char fines mix is then transferred to the nearby Eskom Matimba Power Station as part of the coal feed for power generation. A maximum of 88 tons of sludge per day will be produced.

Plate 3.22: Tar sludge mixing area (currently using part of the product storage area)

3.2.2 Plant Infrastructure Expansion

The large-scale layout of the proposed Char Manufacturing Plant Expansion (also showing the existing Char Manufacturing Plant and the proposed coke and co-generation plant) is shown in Figure 3.2. Infrastructure associated with the Char Manufacturing Plant which will be expanded as part of this project includes:

- Administration buildings;
- Canteen and ablutions;
- Workshop;
- Laboratory;
- Utilities – water, electricity, diesel, LPG;
- Gas boosters;
- Gas cleaning and cooling equipment;
- Tar storage tanksand truck loading facility;
- Liquor storage tanks;
- Bunded areas for storage tanks;
- Liquor destructors;
- Liquor destructor stacks;
- Retort vents;
- Excess gas flares;
- Coal and product stockpiles with plant feed conveyors;
- Pollution control dam.

Two smaller scale layouts of the Char Manufacturing Plant Expansion area are provided in Figure **3.23** and Figure 3.25. The existing Char Manufacturing Plant infrastructure is shown as items numbered C36 to C41.

The following expansions will take place:

- 8 additional retorts to be constructed next to the original 4 retort units;
- The char retort and gas circulation process layout will be duplicated twice;
- The gas reticulation system and excess gas flare capacity will be increased;
- New product stockpile areas with in-line screening will be constructed;
- A new tar storage and truck loading facility will be constructed;
- Additional liquor destructor capacity and liquor storage capacity will be installed;
- Construct a tar sludge (coal fines and tar mixture) handling area;
- Construct a tar sludge storage and reclamation facility;
- Increase the size of the coal feed stockpile with automated coal loading;
- Increase the area of non-process buildings;
- The following additional processes have been investigated with regard to their potential inclusion in the Char Manufacturing Plant Expansion Project, though neither of these will be implemented at present:
    - Briquetting of char and coal fines
    - Utilisation of excess process gas

3.2.2.1 Footprint area

Total footprint area of the Char Manufacturing Plant Expansion is outlined below:

8 x Char Retorts:	5100 m^2
Lined Storage area:	6282 m^2
Tech Offices:	425 m^2
Admin Ext:	425 m^2

Rotary Kilns:	600 m^2
Stacker Area:	2240 m^2
Product Stacker:	4300 m^2
Loading Area:	3250 m^2
Total:	22622 m^2

Overall Char Expansion Fenced area: 79600 m^2

Enlarged Char Stockpile: 9300 m^2

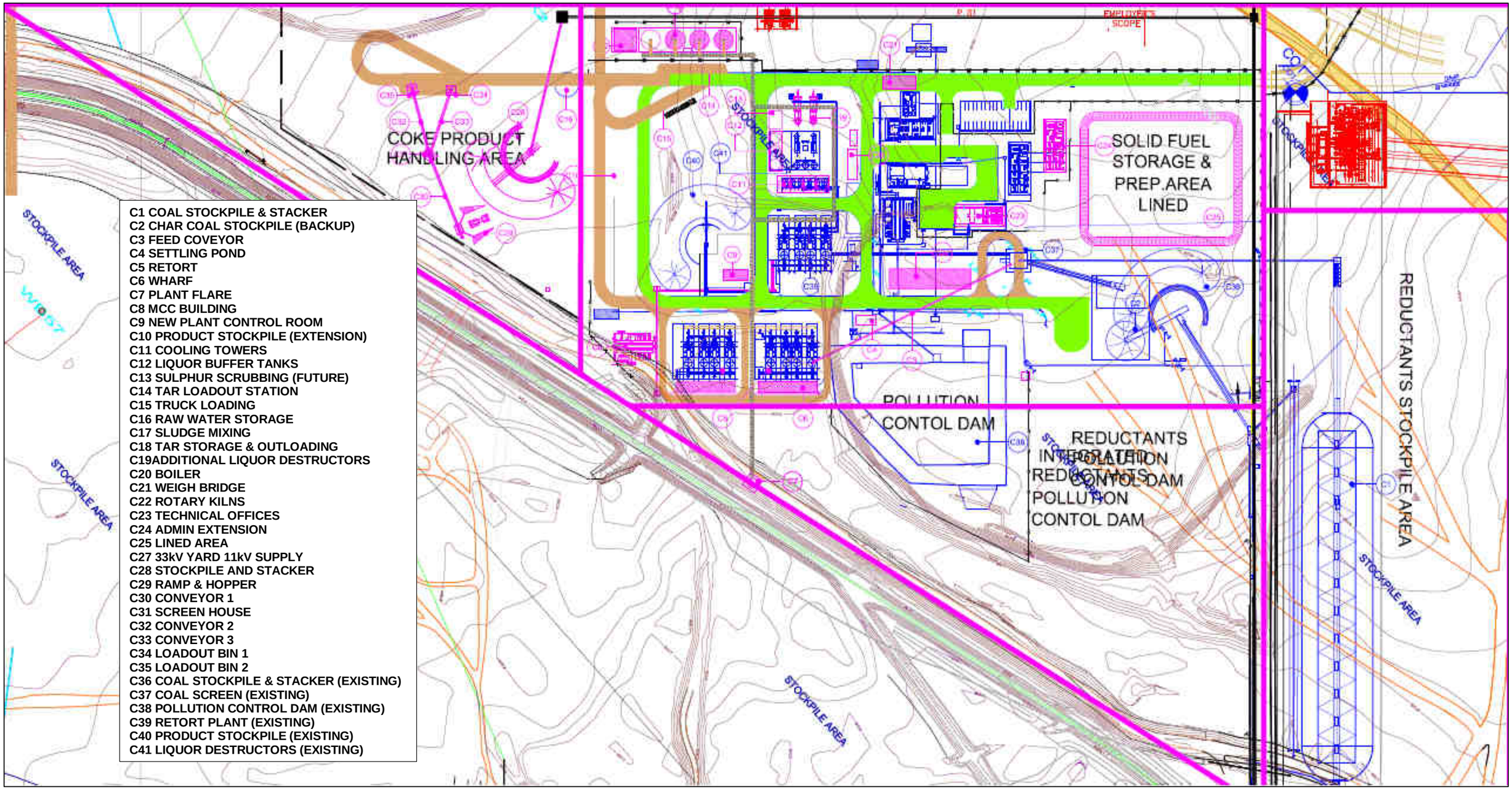


Figure 3.23: Smaller scale layout of Char Manufacturing Plant Expansion showing plant and stockpile areas

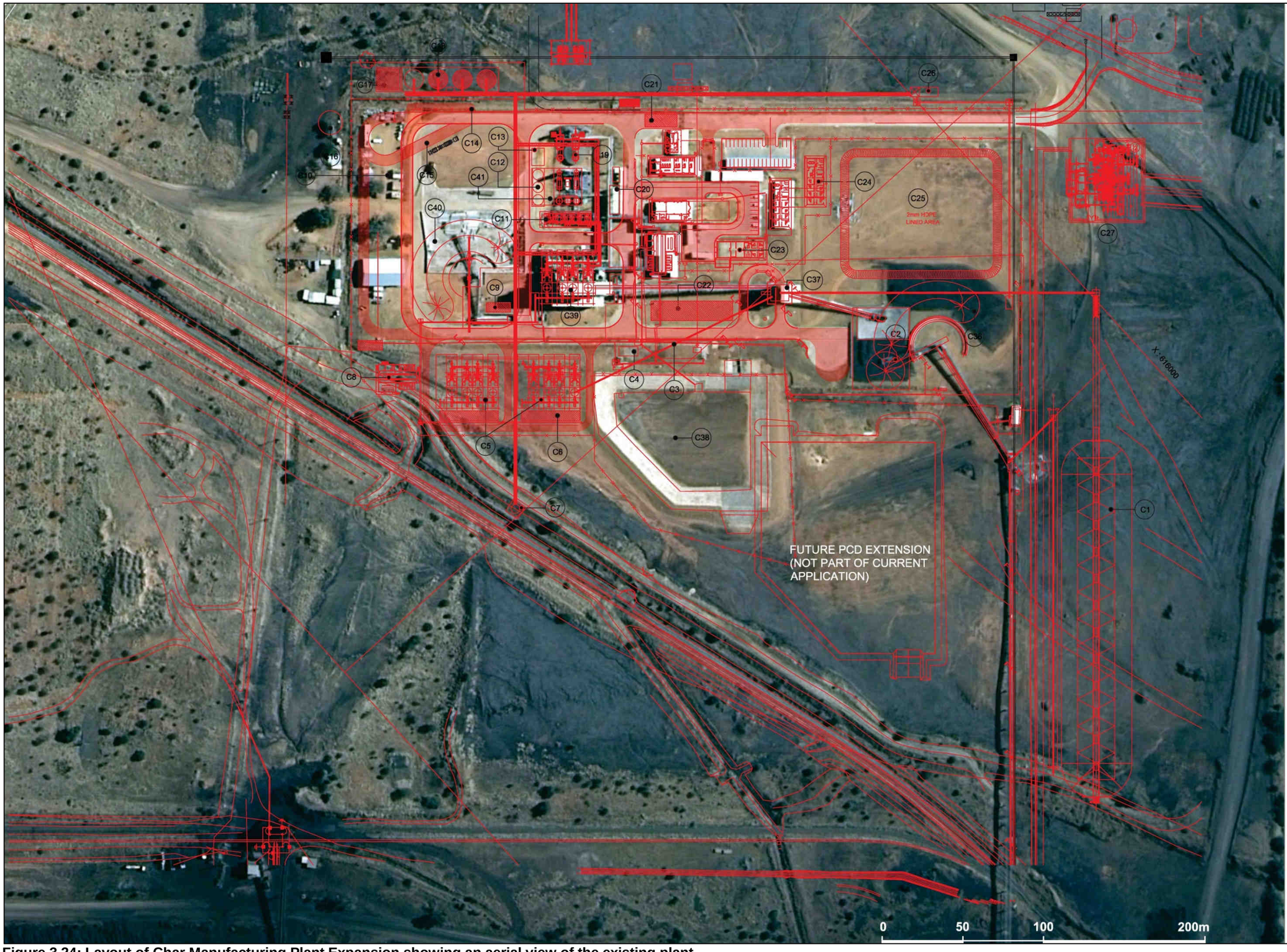


Figure 3.24: Layout of Char Manufacturing Plant Expansion showing an aerial view of the existing plant

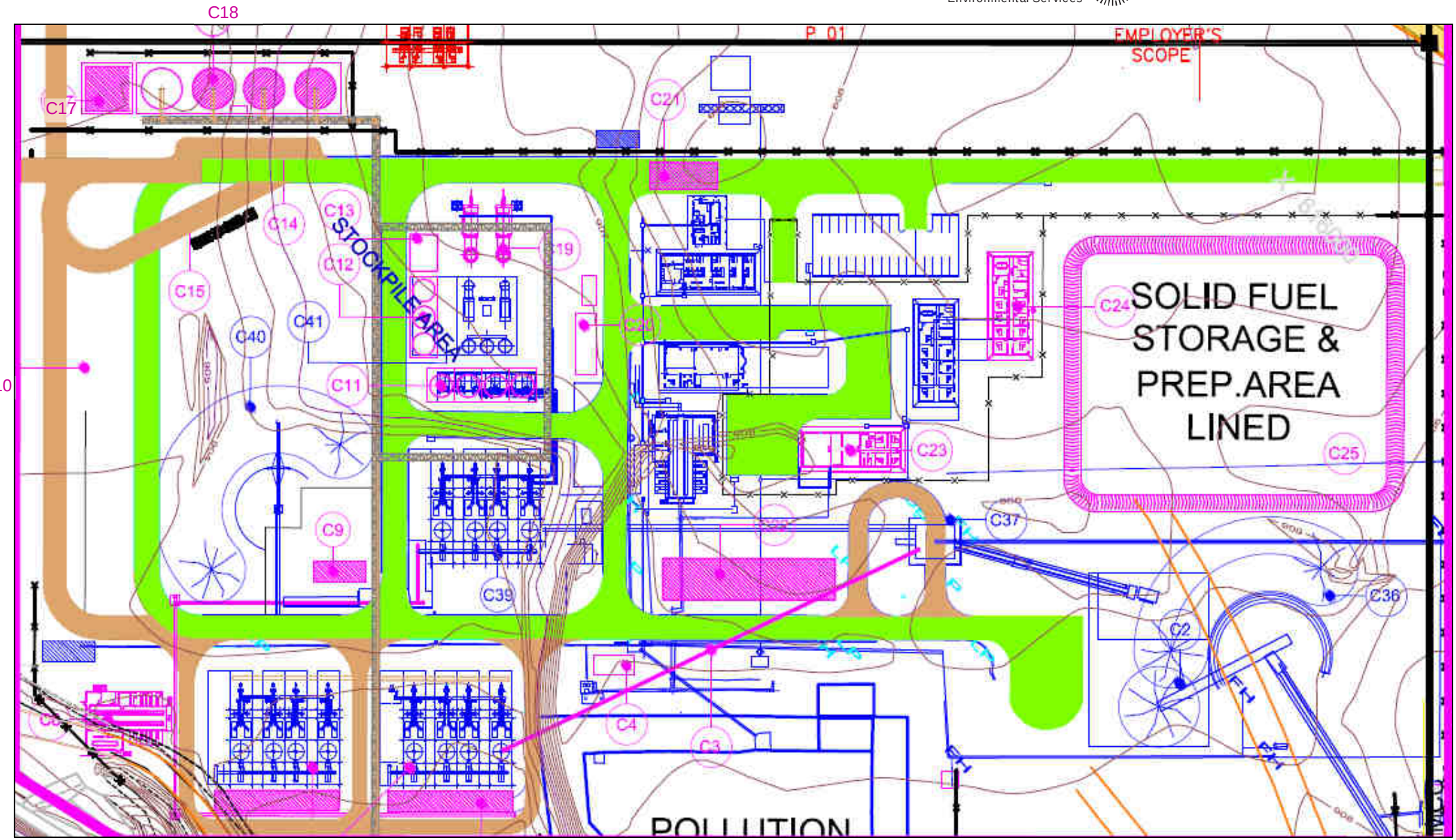


Figure 3.25: Smaller scale layout of Char Manufacturing Plant Expansion showing plant only (see figure above for legend)

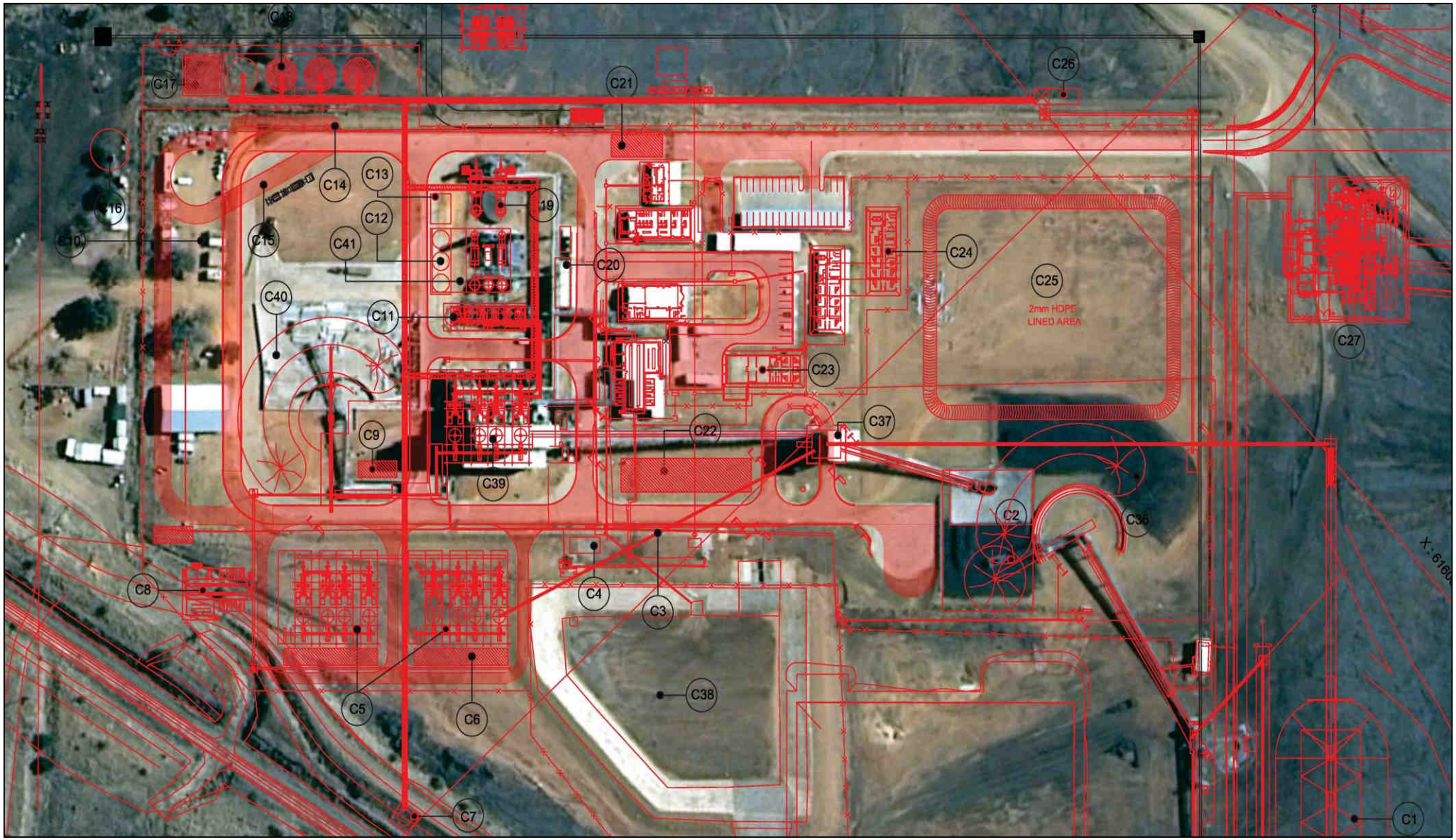


Figure 3.26: Smaller scale layout of Char Manufacturing Plant Expansion showing plant only (see figure above for legend)

3.2.2.2 Expansion of stockpile and storage areas

It is planned to construct a new bottom unloading feedstock stockpile of 370 m x 20 m (7400 m^2) on the south eastern side of the current Char Manufacturing Plant (area labelled C1). This stockpile will also be equipped with a catchment channel and sump to pump coal stockpile seepage water to the existing pollution control dam (PCD) (labelled C38).

The existing coal stacker and feedstock stockpile are located in the area labelled as C36. Adjacent to this is an additional future coal stockpile area labelled as C2.

The char product stockpile will also be expanded. The current stockpile and stacker are in the area labelled as C40 and this stockpile area will be expanded to also include the area labelled C10.

The char stockpile will be positioned on a suitably prepared terrain to accommodate rain water seepage and run-off. Seepage water will be gathered by an underground sump and piping system, routed to the pollution control dam.

3.2.2.3 Expansion of char manufacturing facilities

Quantity Tar: 32 ktpa
Quantity Liquor: 100 ktpa

Table 3.1: Hazardous substances production for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant hazardous substances production (m^3/month)	Additional 8 Retort Expansion
Tar	8338
Liquor	2556
Sludge	3166

Three additional liquor storage tanks will be constructed as shown in C12. The tanks will be contained within a concrete bunded area. Additional tar product storage and loading areas will also be constructed.

A new sludge mixing and storage area will also be constructed in the area labelled C17. The tar, sludge and liquor storage facilities will be provided with bund walls.

Table 3.2: Hazardous substances storage facilities required for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant hazardous substances storage (m^3)	Current Plant (4 Retorts)	Additional 8 Retort Expansion	Plant Total
Tar storage tanks (4 m high x 8 m diameter)	201 x 3 tanks	201 x 3 tanks	201 x 6 tanks
Liquor storage tanks (8 m high x 4 m diameter)	100.5 x 4 tanks	100.5 x 4 tanks	100.5 x 8 tanks

3.2.2.4 Expansion of non-process facilities

Expansion of the admin office building, change rooms, laboratory and workshop is planned to accommodate additional maintenance and operations personnel. Technical support personnel currently being housed in containers will move into the expanded admin office.

A new document control and training building, complete with kitchen and ablution facilities, will be constructed and will also be used to manage and store project documentation during the plant construction period.

Additional infrastructure, not included within the existing Char Manufacturing Plant, but to be included in the expansion project includes:

- An induction and training facility;
- Oil and water separating plant;
- Tar conditioning facility;
- Briquetting plant;
- Spares store; and
- Tar storage and reclaiming facility.

3.2.3 Services Expansion

The majority of the utilities required for the Char Manufacturing Plant expansion are supplied through the Grootegeluk Mmine infrastructure. An extension of the 32 kV electricity ring at the mine, as well as the raw and potable water lines has been approved, and is currently taking place to provide additional capacity and a more reliable supply to the Char Manufacturing Plant. Other utilities are either produced on site or purchased from external vendors.

3.2.3.1 Water

Potable water, raw water, fire water and process water are supplied to the existing Char Manufacturing Plant from Grootegeluk Mine via existing HDPE pipelines. Sufficient potable water is already available at the existing Char Manufacturing Plant for the expansion projects. Additional pipelines which may be required within the Char Manufacturing Plant expansion area will be constructed as required.

Raw Water

Raw water is sourced from the Mokolo Dam and delivered to the Grootegeluk Mine by underground pipeline from where Grootegeluk manages the distribution of water to the various points of use, including the existing Char Manufacturing Plant. Raw water is suitable for use in the production of steam in the boilers and for the gas cooling water circuit.

The table below indicates the existing consumption and planned water needs for the 12 retort production facility.

Table 3.3: Raw water required for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant Raw water usage (Mℓ/year) Point of use:	Current Plant (4 Retorts)	Additional 8 Retort Expansion	Plant Total
Boiler Feedwater	39	78	117
Cooling Tower make-up water	105	210	315
Storage Reservoir (assumed 1 fill per annum)	1	26	27
Char Total	**145**	**314**	**459**

To ensure that the new plant will not be affected by raw water supply shortages from the Mokolo and Crocodile Water Augmentation Project (MCWAP), a buffer dam needs to be constructed. The Department of Water Affairs requires a minimum of 18 days storage capacity on site. Thus a 27,000m³ raw water storage facility will be provided for this project. The envisaged buffer dam size is likely to be 120m x 120m x 1.87m with a volume of 26 928 m^3.

Process Water

Process water is sourced from the Grootegeluk process water circuit via two dedicated pipelines to the Char Manufacturing Plant. This process water circuit draws water from the mine's dirty water dams.

Process water is used in the char quench conveyor system as well as the main source of water to the Char Manufacturing Plant. Process water is further sourced from the Char Manufacturing Plant pollution control dam (PCD). No changes will be made to the pipelines feeding the Char Manufacturing Plant since these were adequately sized during the original plant establishment. The table below indicates the current and future process water demand based on design figures.

Table 3.4: Process water required for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant process water usage (Mℓ/year) Point of use:	Current Plant (4 Retorts)	8 Retort Expansion	Plant Total
Char quench water system	20	40.5	60.5
Firewater (Assumed 1 make-up per annum – kept in reserve)	2.5	7.8	10.3
Pollution Dam Make-up (Assumed 1 fill per annum)	5.7	**8.45**	17.15
Char Total	**28.2**	**56.75**	**87.95**

Potable Water

Potable water is obtained from the nearby Zeeland water treatment plant and is used on site for domestic purposes and washing of small plant spares at the workshop. This water is also used for demineralised make-up water for the boilers and make-up water for the closed circuits in the gas cooling process. The increase in water consumption, based on additional personnel required for operation of the expanded plant given in the tables below.

Table 3.5: Potable water required for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant potable water usage (Mℓ/year) Point of use:	Current Plant (4 Retorts)	8 Retort Expansion	Plant Total
Domestic	1.15	1.15	2.3
Workshop & De-mineralised water make-up	18	22	40
Char Total	**19.15**	**23.15**	**42.3**

Table 3.6: Dams and water storage for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing water storage (m^3)	Current Plant (4 Retorts)	8 Retort Expansion	Plant Total
Settling Pond	0	100	100
Central pollution control dam	12 828 (maximum)	0	12 828 (maximum)
Raw water storage tank	0	27 000	27 000
Char Total	**19.15**	**23.15**	**42.3**

Please note that none of the dams will have walls higher than 5 m.

3.2.3.2 Stormwater Runoff and Pollution Control

The Char Manufacturing Plant and the proposed expansion area fall within the “dirty” water area of the Grootegeluk mine property. The plant was constructed on a disused coal stockpile and the site was filled in, raising it above the ground level. Although it is located within a designated dirty water area, the water quality of runoff and effluent water from the Char Manufacturing Plant differs from that of the dirty water on the surrounding mine, in that it is potentially contaminated with organic hydrocarbons. These contaminants cannot be accommodated in the mine’s dirty (process) water system and must therefore be contained on site. All runoff from the Char Manufacturing Plant terrace is therefore directed via a piped stormwater system to the Char Manufacturing Plant pollution control dam (PCD). From here it is pumped to the Char Manufacturing Plant for use in the process.

Stormwater runoff within the Char Manufacturing Plant is directed towards and runs into the existing PCD with a sediment trap. The capacity of the existing storm water retention dam has sufficient

capacity for the expansion of the Char Manufacturing Plant. The storm water collected in the PCD is recycled into the plants for use as process water.

The PCD comprises a new small settling pond (sediment trap) near the new retorts with a volume of 100 m^3 which allows for the trapping of silt before the stormwater flows into the PCD. This dam is lined with 2mm HDPE lining. The PCD has an existing maximum capacity of 12828 m^3 at a depth of 2.3 m. The dam is normally operated at a depth of 0.8 m to allow sufficient capacity for storm water flooding, with maximum available depth of 2.3 m.

A site water balance has been compiled which indicates that the existing PCD has sufficient capacity to prevent spillage of contaminated water for events up to at least the 1:50 year recurrence interval, for both the current and the expanded operation. No additional dirty water storage capacity is planned at this stage for the Char Manufacturing Plant Expansion Project.

Effluent from the Char Manufacturing Plant process will be disposed via a silt trap to the Char Manufacturing Plant PCD. From here, it will be pumped back to the plant for reuse in the process.

Being located within a dirty water area, there are no clean areas surrounding or within the Char Manufacturing Plant area.

It should be noted that the dam is only part of the overall water management strategy and as such the risk of spilling is dependent on several other components of the water management system, including operational practices in the plant and the rate of reuse of water from the dam. A commitment is made in the impact assessment to calibrate the water balance once actual data is available from the site.

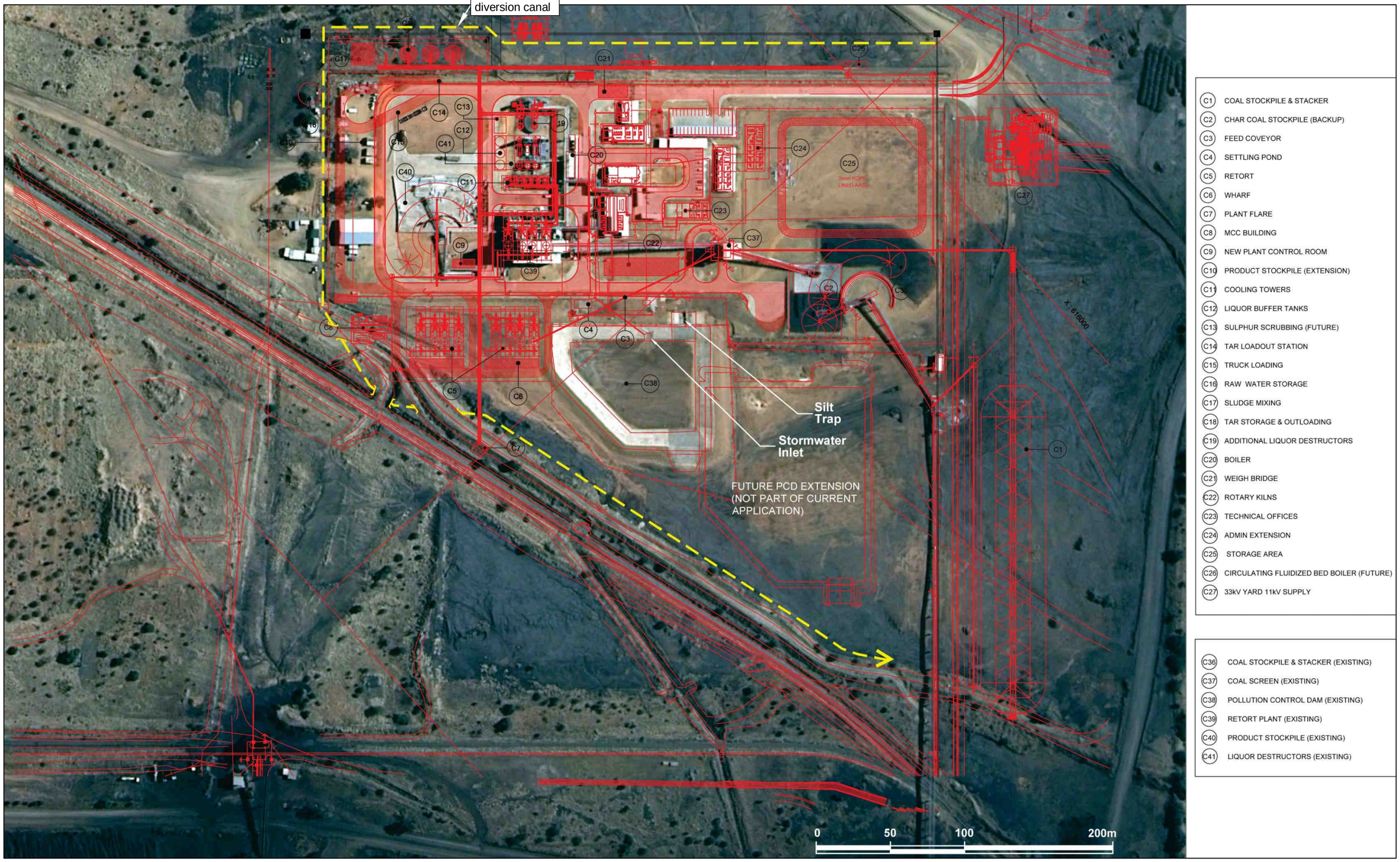


Figure 3.27: Layout of the stormwater management system for the Char Manufacturing Plant Expansion

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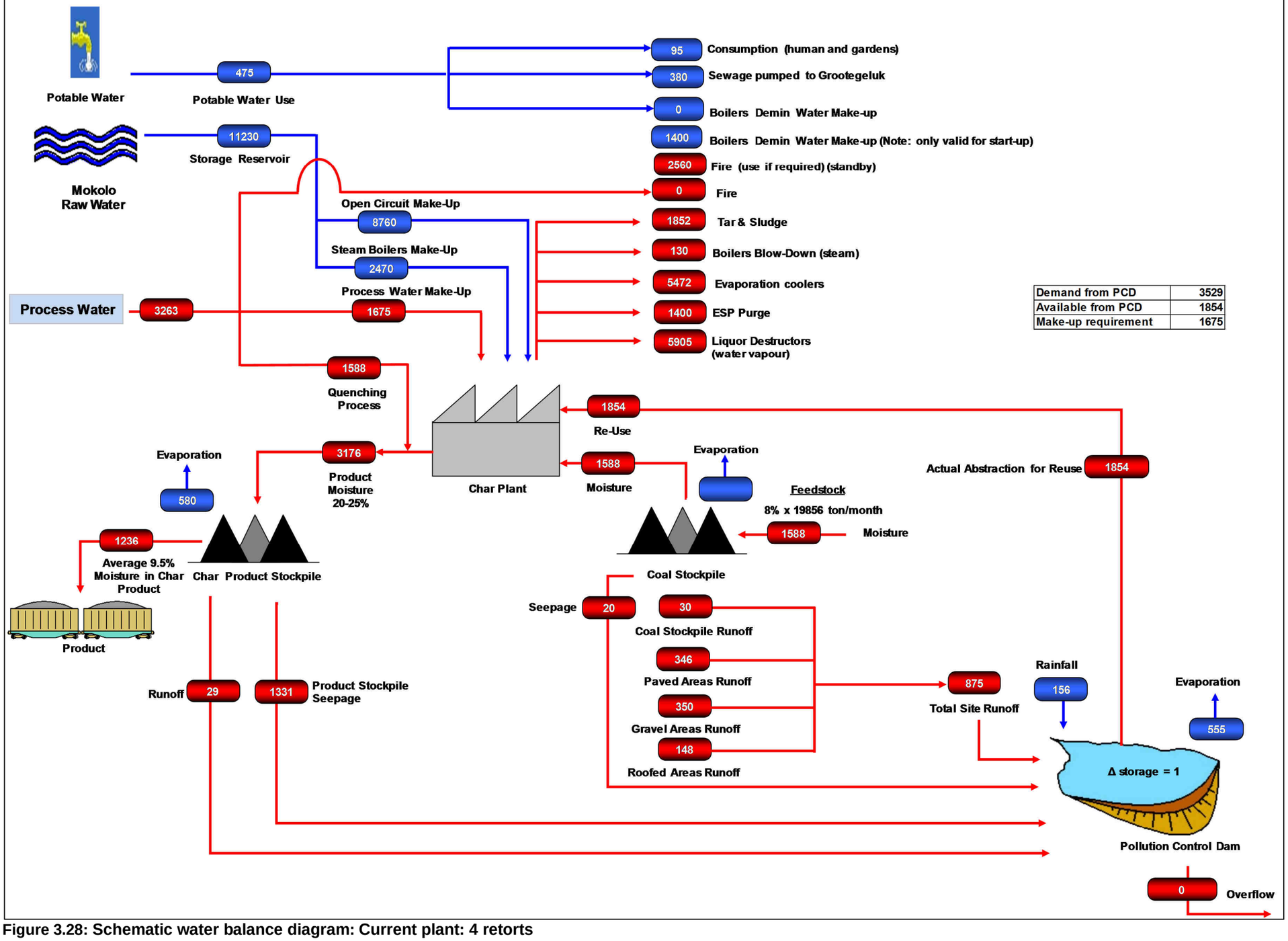
Tel: (011) 519-0200 Fax: (011) 803-1456 email: post@jaws.co.za

Client:	Exxaro Grootegeluk	Our Ref:	C050
Job:	Char, Coke and Co-gen Plant	Set no.:	1
	Char Plant and 4 Retorts Process Flow Diagram	Made by:	HGR
	Phase I: 4 Retorts	Date:	25 January 2012
		Run time:	25/01/2012 15:00

Rainfall Used: Full Record
Analysis Period: 1903 - 2000

All flows in m³/month

Legend: Clean, Dirty



Demand from PCD	3529
Available from PCD	1854
Make-up requirement	1675

Figure 3.28: Schematic water balance diagram: Current plant: 4 retorts

Synergistics Environmental Services

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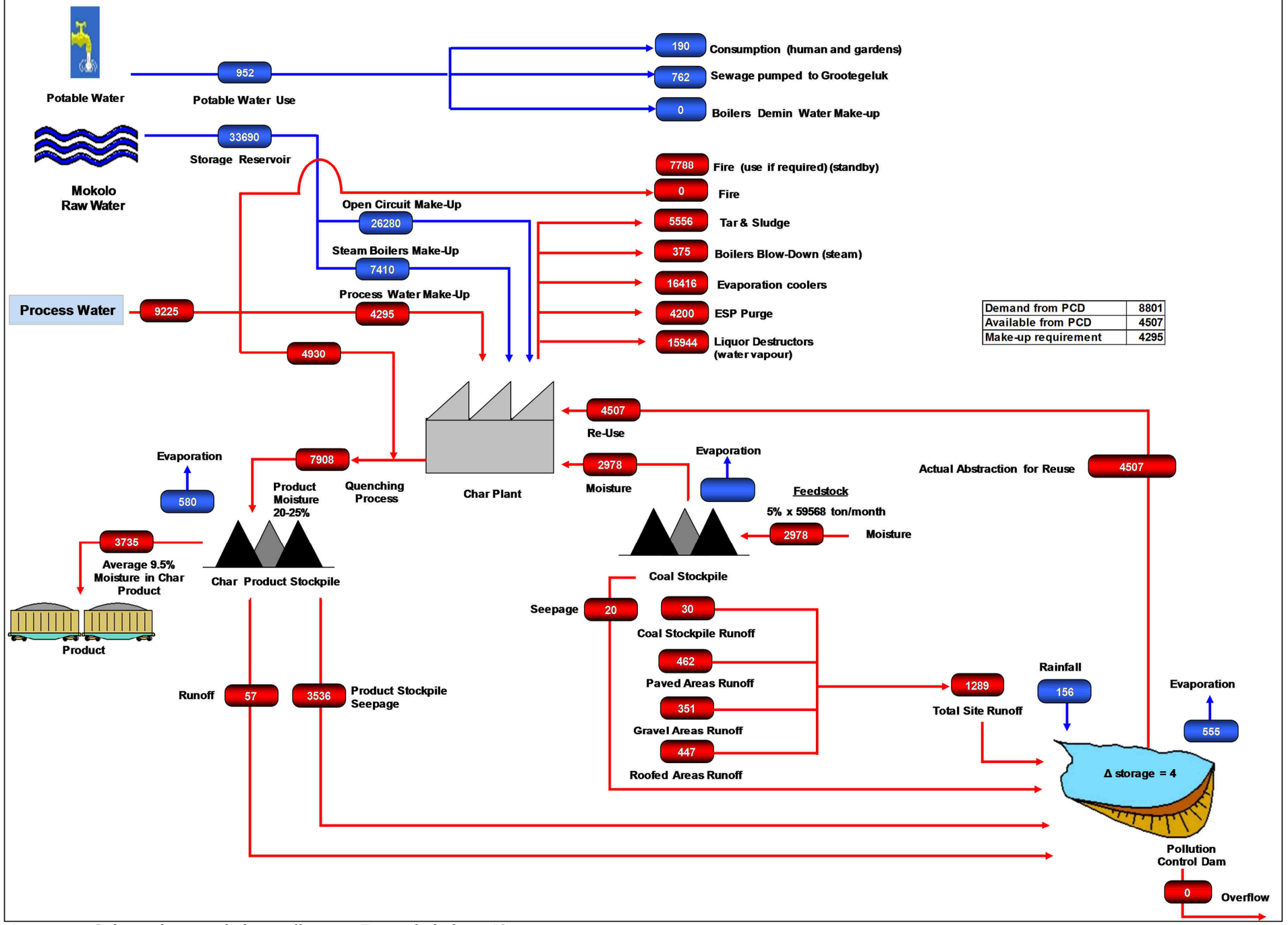
Client:	Exxaro Grootegeluk	Our Ref:	C050
Job:	Char, Coke and Co-gen Plant	Set no.:	1
	Char Plant and 4 Retorts Process Flow Diagram	Made by:	HGR
	Phase II: 12 Retorts	Date:	25 January 2012
		Run time:	25/01/2012 15:00

Rainfall Used: Full Record
Analysis Period: 1903 - 2000

All flows in m³/month

Legend: Clean, Dirty



Demand from PCD	8801
Available from PCD	4507
Make-up requirement	4295

Figure 3.29: Schematic water balance diagram: Expanded plant: 12 retorts

3.2.3.3 Sewage

The site is currently serviced by a conventional waterborne sewerage system. All domestic waste water generated on the site is collected in a sump adjacent to the PCD. This sump has capacity for 300 people and thus has sufficient capacity to also handle the increased demand. From the sump, two pumps (one duty and one standby – already installed) will pump the sewerage via the existing 100 mm diameter HDPE pipeline to the Grootegeluk Waste Water Treatment Works (WWTW). The WWTW is being upgraded as part of a *separate project* at the Grootegeluk Mine.

3.2.3.4 General Waste Management

Solid waste has the potential to impact on surface water through contaminated runoff and the generation of leachate. The waste management proposed for the site is discussed below. The following sources will generate waste on the site:

- The char process
- Site offices
- Workshops

It is anticipated that both hazardous and general waste will be produced. General and hazardous waste disposal will tie in with the current practices and facilities of Grootegeluk Mine.

Domestic waste will be disposed through the colour coded bin system of the Grootegeluk Mine for different types of materials. Domestic waste and scrap metal is collected in rubbish bins and disposal is handled by the mine through a Service Level Agreement (SLA) between the Char Manufacturing Plant and the Grootegeluk Mine. All domestic, commercial, industrial waste, builders' rubble and other waste classified as General Waste (G) under the South African Minimum Requirements for waste disposal (Department of Water Affairs and Forestry, 1998) will be removed from the site by an appropriately licensed waste removal contractor and disposed of at a licensed general waste facility.

3.2.3.5 Hazardous Waste Management

Solid Waste

Some of the waste classified as hazardous (H or h), including grease, oils, acids, fluorescent tubes, medical waste etc. will also be handled by the mine through their existing systems which will involve disposing of the waste at a licenced hazardous waste site.

Liquid Waste

Tar generated during the char production process will be collected in a tar tank near the bottom of each retort. This will be transported to the tar storage and loading facility, where it will be mixed with coal fines, loaded and transported to Grootegeluk Mine to be included with the feed coal to Matimba Power Station. The tar storage area will be bunded to prevent spillage.

Water condensate (liquor) from the cooling systems and gas booster fans will be collected in tanks at the liquor destructors. The liquor is destroyed by oxidation (burning) at high temperature. Bunds will be provided to prevent spillage of liquor.

3.2.3.6 Power and Fuels

The Char Manufacturing Plant expansion will be linked to the existing electricity network of Grootegeluk Mine. Electricity at Grootegeluk Mine is supplied through an Eskom network, from the Matimba Power Station. Electricity for the Char Manufacturing Plant will be changed from the existing 11 kV supply from a substation supplying the Grootegeluk coal stockpile area, to a new supply directly from the Grootegeluk main substation.

An extension of the 32 kV electricity ring at the mine, as well as the raw and potable water lines has been approved, and is currently taking place to provide additional capacity and a more reliable supply to the Char Manufacturing Plant. Construction work of the new 32 kV dual feed and switchyard adjacent to the Char Manufacturing Plant area is part of a separate project and completion is planned for the end of 2011. A 20 MVA transformer will provide electricity through two separate feeder breakers to the existing and new char buildings. Reliability of electrical supply from Grootegeluk Mine has played a major role in production losses at the existing Char Manufacturing Plant, but electricity supply for the expanded Char Manufacturing Plant should improve dramatically from the more direct feed currently constructed.

The Char Manufacturing Plant is currently equipped with four 1.25 MVA 11kV/400V process transformers operating at 50% redundancy. This capacity will be increased as required.

Table 3.7: Electricity usage at the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant electricity usage (MWh/year)	Current Plant (4 Retorts)	8 Retort Expansion	Total
Char Total	28 908	49 932	78 840

Diesel is used to start a retort from cold or any subsequent restarts when insufficient combustible gas is present in the retort recycle gas system.

A 9 000 litre diesel bulk tank is installed in the plant and a service level agreement is in place with Total for the supply of diesel when required. The existing tank capacity is sufficient to handle the increase in demand. The diesel is delivered by road truck and the same SLA will remain in place to provide diesel to the expanded Char Manufacturing Plant through an extended diesel pipe distribution system.

No more than two retorts will be started and running on diesel at the same time and the existing diesel pump installation is therefore sufficient in capacity.

Table 3.8: Diesel usage at the Existing and Expanded Char Manufacturing Plant

Sum of retorts	Litres per year
Existing plant (4 Retorts, 1 Boiler, 2 Liquor destructors)	40 800
Additional diesel required during commissioning year	24 000
Expanded Plant (12 Retorts, 1 Boiler, 4 Liquor destructors)	**112 400**

Heating of the tar storage vessels and tar distribution piping as well as purging of gas from process vessels and piping is done with low pressure steam. Steam is generated by a gas fired flame tube boiler and a second boiler is installed as a standby unit. Boiler feedwater, supplied from the raw water system, is treated for Calcium hardness and stored in the boiler feedwater tank located in the boiler room. No expansion of the existing boiler system is required as indicated in the table below which states the boilers' capacities and consumption figures.

Table 3.9: Steam consumption and generation capacityat the Existing and Expanded Char Manufacturing Plant

Steam generation and consumption figures	Quantity
Boiler 1 capacity	2.6 tph
Boiler 2 capacity	3 tph
Pressure (maximum)	6 000 kPa
Pressure (operating)	2 500 kPa

Existing plant (4 Retorts) usage	0.9 tph
Expanded Plant 12 Retort operation (8 Additional retorts)	**2.7 tph**

Liquid petroleum gas (LPG) is used to fuel all pilot burners required on the various burners located on the retort combustion chambers, boilers, liquor destructors and excess gas flares. The existing installation comprises of a LPG bottle manifold, gas vaporiser and distribution piping.

It is planned to replace the existing LPG bottle manifold with a fixed bulk container in order to reduce the daily change of gas bottles and to reduce the purchase price of LPG. Provision will be made for LPG distribution piping on the new expanded plant connecting pipe racks to the different pilot burners.

Table 3.10: LPG consumption figures for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant LPG consumption	kg per year
Existing plant (4 Retorts, 1 Boiler, 2 Liquor destructors)	18 000
Additional LPG required during initial curing of refractory installation	20 000
Expanded Plant (12 Retorts, 2 Boilers, 4 Liquor destructors)	**54 000**

3.2.3.7 Compressed Air

Two air compressors, two air receivers and refrigeration type air are the source of compressed air required in the existing Char Manufacturing Plant. Compressed air is distributed to all pneumatically activated control valves on the gas recycle system via a dedicated pipe network.

Compressed air, generated by the same compressors without drying, is used for atomising air in the retorts, liquor destructors and boiler diesel burners as well as air for maintenance work in the workshop.

Additional compressor, air dryer and receiver capacity are required for the Char Manufacturing Plant expansion. The compressor room will be extended to house the additional equipment.

3.2.3.8 Equipment, Vehicles and Traffic

During the construction period, which will take place from approximately July 2012 to August 2014, additional traffic will be generated in the nearby area.

Fill material for earthworks will be transported from the Grootegeluk Mine area. Approximately 3000m^3will be required which will be transported in 150 dump truck trips. Building materials will be transported to the site on flatbed trucks (approximately 15trips) and the transportation of large equipment will require approximately 32 abnormal loads. Abnormal load arrangements will be made as required by regulations. Structural steel and refractory material for construction will be transported to the site via approximately 40 truck trips. Process equipment, pumps, motors and sheeting will be transported to site in 3 ton to 30 ton trucks (approximately 200 trips).

During the operation of the expanded Char Manufacturing Plant, loading of the char product will take place 24 hours a day, 7 days a week with 70% of loading during night-time and 30% during daytime. Char will be transported with back tipper trucks (18m long) or side tipper trucks (19m long) which will be covered with tarpaulins. Tar will be transported in tar tankers, 22m in length. The trucks will utilise the same roads as they currently use for product transport.

Regular cleaning of silt traps and handling of by-product material requires the use of a Bobcat with load bucket and forklift attachments. An extendable boom type forklift will also be required for removing of equipment and drums from bunded areas.

3.2.3.9 Roads

No new roads will be constructed outside of the Char Manufacturing Plant boundary for the expansion project. Within the char site, the existing open parking areas around the administration building will be covered. New char product and tar truck loading facilities will be constructed in the existing plant area. Existing Char Manufacturing Plant roads are 1300 m in length and 6 m wide, the roads will be extended by 650 m in length (the road width will remain as 6 m wide).

A new truck loading facility and new weigh bridge will also be constructed as part of the project.

3.2.3.10 Communications

Local expansion of the communication system in the office buildings will take place during implementation of the Char Manufacturing Plant expansion project.

3.2.3.11 Temporary infrastructure

Temporary facilities are required for project team members and contractors during the construction phase of the expansion project. These facilities will include the contractor lay-down area which will be supplied with potable water and power from the existing Char Manufacturing Plant facility as well as a mini substation that was utilised for this purpose during the initial plant construction period. The contractors will however provide for their own communication, chemical toilets and washing facilities.

Project team members will be accommodated in rented temporary offices with telephone, fax and network connections to the existing infrastructure. Ablution and kitchen facilities will be shared with the plant personnel until use of these facilities in the new training building becomes available. Temporary project personnel will be equipped with desktop computers to enable controlled access to the Exxaro network while permanent personnel will make use of laptop computers. Network access will be required to the mail exchange server as well as document control system.

3.2.4 Possible future options

The following future option will be subject to the required applications and authorisations before implementation. Currently the emitted gas from the flare stack of the Char Manufacturing Plant is wasted energy, and at a later stage the Char Manufacturing Plant intends to convert this wasted energy into additional steam to generate electricity by means of a Circulating Fluidized Bed (CFB) Boiler. The tar and about 2/3 of the quantity of liquor will in future be combusted in the CFB multi-fuel boiler, for co-generation power. The multi-fuel boiler would be base-loaded with about 320 ktpa coal, to ensure stable operation, together with 32 ktpa tar, 66 ktpa liquor plus 610×10^6 Nm^3/a excess char fuel gas as thermal energy sources.

3.2.5 Employment

There are currently 151 people employed at the existing Char Manufacturing Plant, 85 permanent staff and 66 contractors. An estimated additional 500 people will be employed during the construction phase and 240 (108 permanent and 132 contractors) people during the operational phase. Contractors are responsible for finding suitable accommodation for their construction personnel.

3.2.6 Land Tenure

Grootegeluk Mine is owned by Exxaro Coal (Pty) Ltd. The Char Manufacturing Plant is owned by Exxaro Reductants (Pty) Ltd, and is a separate entity from Grootegeluk Mine. Exxaro Reductants leases the land on which the existing Char Manufacturing Plant operates and on which the Char Plant Expansion will be built from the Grootegeluk Mine.

3.2.7 Development Alternatives

3.2.7.1 No Go Alternative

The no-go option would be that the expansion of the Char Manufacturing Plant will not be undertaken. The implication of this would be that no increase in production will take place and that the char required by the Ferrochrome industry in South Africa will need to be sourced from overseas suppliers. This will result in negative impacts on national economic growth and development.

3.2.7.2 Locality Alternatives

No locality alternatives have been assessed as part of the EIA report. The proposed expansion will be located adjacent to the existing Char Manufacturing Plant and much of the existing infrastructure will be expanded and utilised in the expanded Char Manufacturing Plant. The Char Manufacturing Plant is conveniently located within the boundaries of the mine and thus it is close to the coal source required to make char. The proposed site is in a highly disturbed old coal stockpile area, and thus is not likely to damage a sensitive environment. Any other locality will require:

- A large amount of additional infrastructure.
- Additional transport of coal and would thus be more expensive.
- It would also require identification of a new site for the Char Manufacturing Plant Expansion and therefore disturbance and impacts on a new, possibly undisturbed area

It is neither sensible nor feasible to evaluate another locality in detail.

3.2.8 Possible future options

Currently the emitted gas from the flare stack of the Char Manufacturing Plant is wasted energy, and at a later stage the expanded Char Manufacturing Plant intends to convert this wasted energy into additional steam to generate electricity by means of a Circulating Fluidized Bed (CFB) Boiler. The tar and about 2/3 of the quantity of liquor will in future be combusted in the CFB multi-fuel boiler, for co-generation power. The multi-fuel boiler would be base-loaded with about 320 ktpa coal, to ensure stable operation, together with 32 ktpa tar, 66 ktpa liquor and $610x10^6$ Nm^3/a excess char fuel gas as thermal energy sources.

3.3 Project Implementation Schedule

The project phases will include: Planning and Design, Construction, Operation, Decommissioning and Post Closure. Construction will involve clearing and levelling of the site and the construction of the Char Manufacturing Plant Expansion and associated infrastructure. The required services will be expanded to the construction site by constructing the necessary trenches and erecting the poles required.

Construction of the Char Manufacturing Plant Expansion is due to begin August 2013 and the first retort should be completed by September 2015. The expansion of the Char Manufacturing Plant should begin operation in March 2016. Current production is 140 ktpa of char and will ramp up from September 2015 progressively to March 2016 to a total of 400 ktpa.

Construction will be phased as follows:

- 2013: Bulk earthworks and civil structures.
- 2014: Structural steelwork and installation of equipment.
- 2015: Construction continuing through commissioning of first section of plant. This period of construction will involve the installation of more electrical and control equipment.

The expected lifetime of the new plant is 25 years.

4. Description of the Affected Environment

The baseline environmental characteristics of Grootegeluk Mine and its surroundings are described in this chapter.

4.1 Physical Environment

4.1.1 Climate

4.1.1.1 Temperature

The area experiences average maximum temperatures of between 30 and 36 ℃ and average minimum temperatures of between 7 and 3 ℃ (Airshed, 2011). The long term maximum and minimum average monthly temperatures recorded at the South African Weather Service (SAWS) station in Lephalale are shown in Figure 4.1 and Figure 4.2 respectively. A visual representation of average temperatures throughout the day and year is provided in Figure 4.3, which depicts data recorded at the SAWS station at Lephalale in 2006. For more detailed temperature information, please refer to the Air Quality Impact Assessment report in Appendix 3.

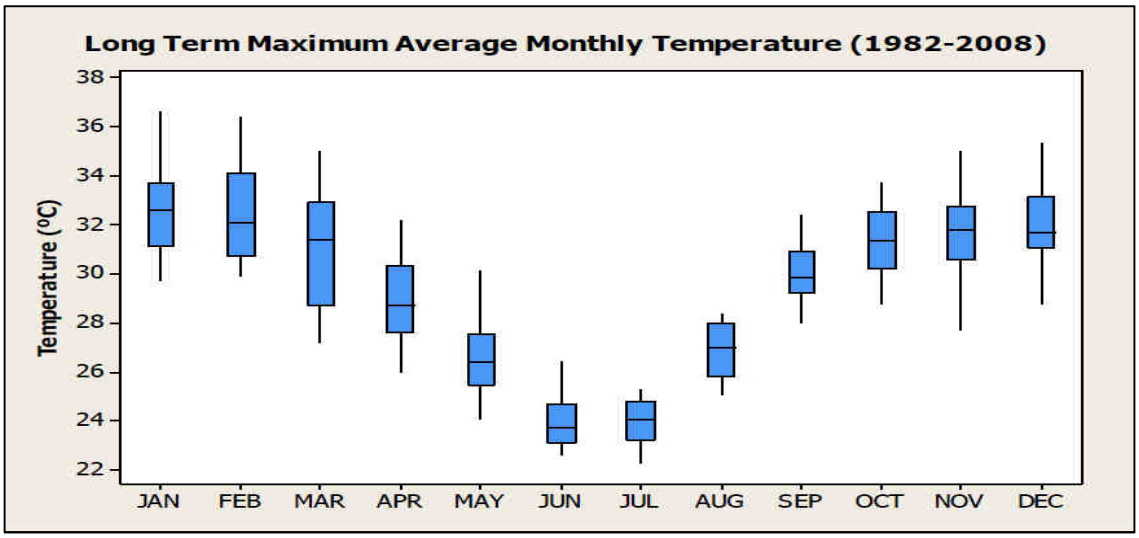


Figure 4.1: Long-term average maximum temperature for Lephalale (1982 – 2008) (Airshed, 2011).

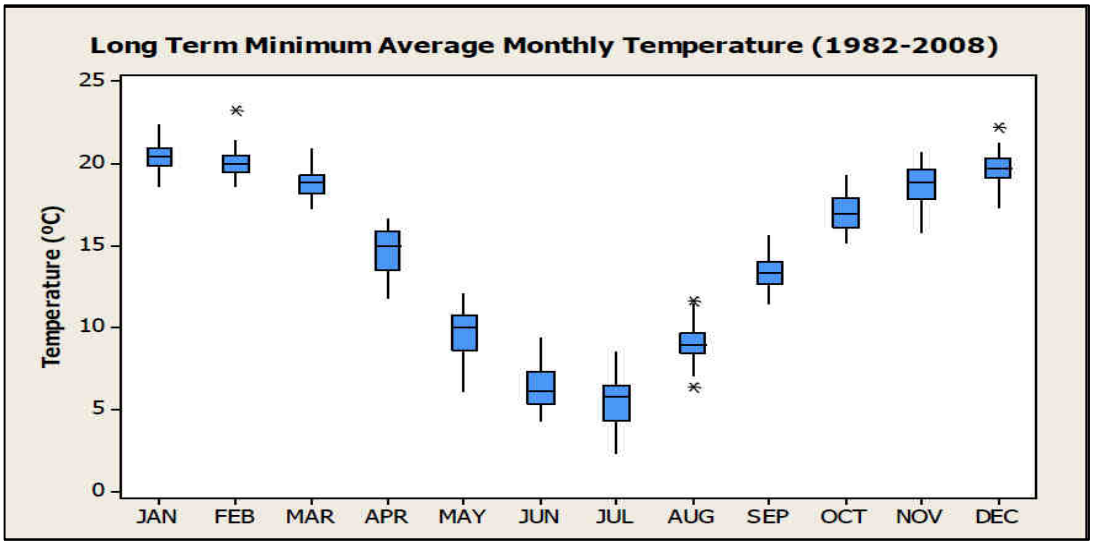


Figure 4.2: Long-term average minimum temperature for Lephalale (1982 – 2008) (Airshed, 2011).

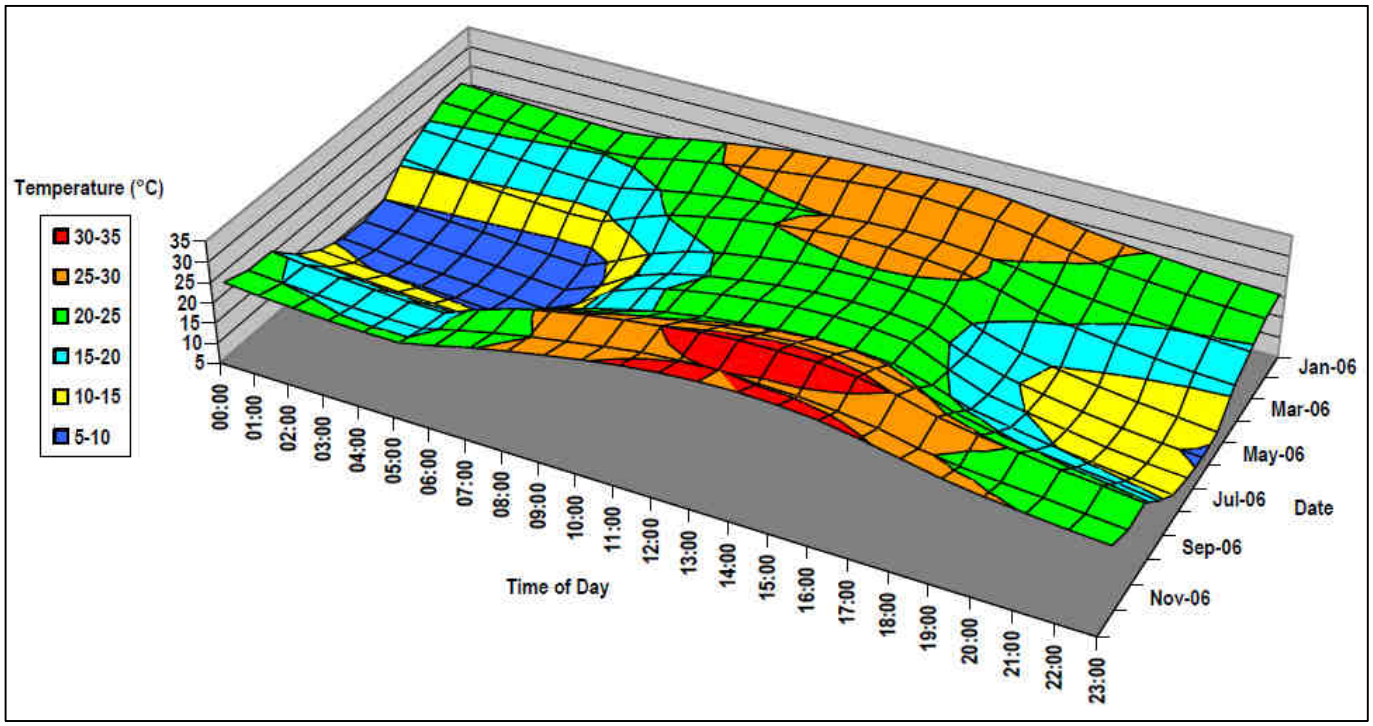


Figure 4.3: Monthly daily temperature profile of Lephalale in 2006 (Airshed, 2011).

4.1.1.2 Precipitation and Evaporation

The study area is characterised by hot, moist summers and mild dry winters. The long-term annual average rainfall is 420 mm, occurring mostly between October and April, with the peak for the area being in January (AGIS, 2002). Long-term average rainfall, as recorded at the SAWS station in Lephalale, is depicted in Figure 4.4.

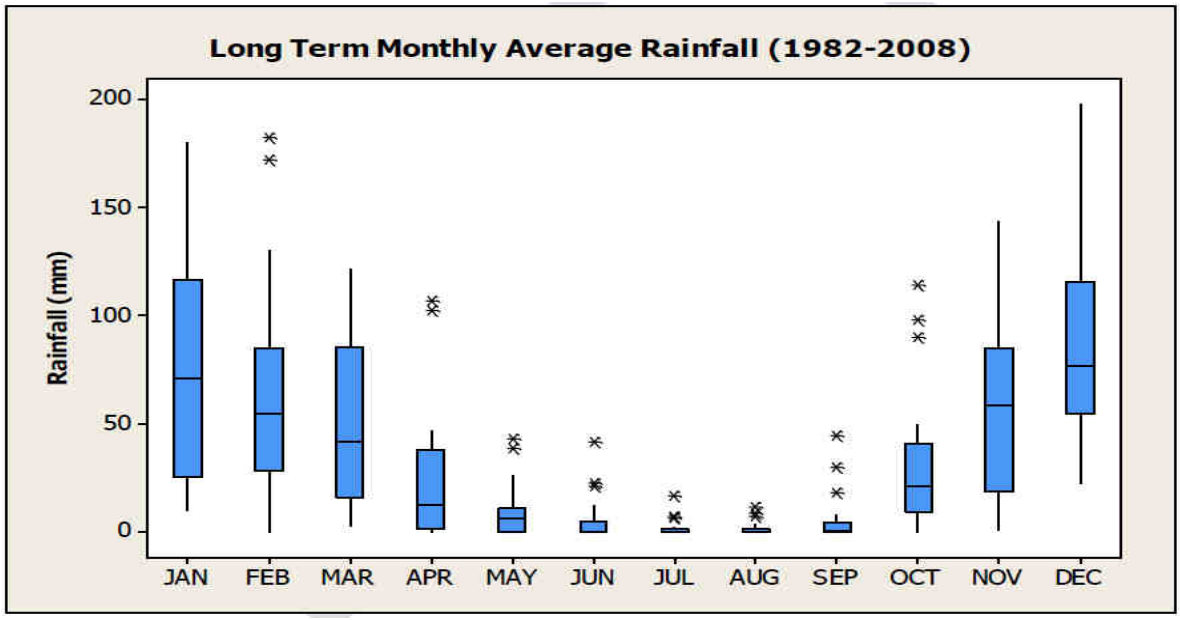


Figure 4.4: Monthly average rainfall for Lephalale (Airshed, 2011).

Evaporation in the area is high, with the annual evaporation being approximately 2 281 mm (refer to Figure 4.5). Average monthly evaporation data for the Limpopo Province is summarised in the table below.

Table 4.1: Monthly average evaporation data for the Limpopo Province (Airshed, 2011)

Month	Mean Value	Maximum Value	Minimum Value
January	237 mm	292 mm	168 mm
February	193 mm	238 mm	146 mm
March	191 mm	222 mm	124 mm
April	152 mm	165 mm	132 mm
May	135 mm	152 mm	120 mm
June	114 mm	128 mm	101 mm
July	125 mm	136 mm	112 mm
August	164 mm	181 mm	142 mm
September	202 mm	239 mm	166 mm
October	233 mm	294 mm	187 mm
November	239 mm	287 mm	179 mm
December	234 mm	288 mm	175 mm

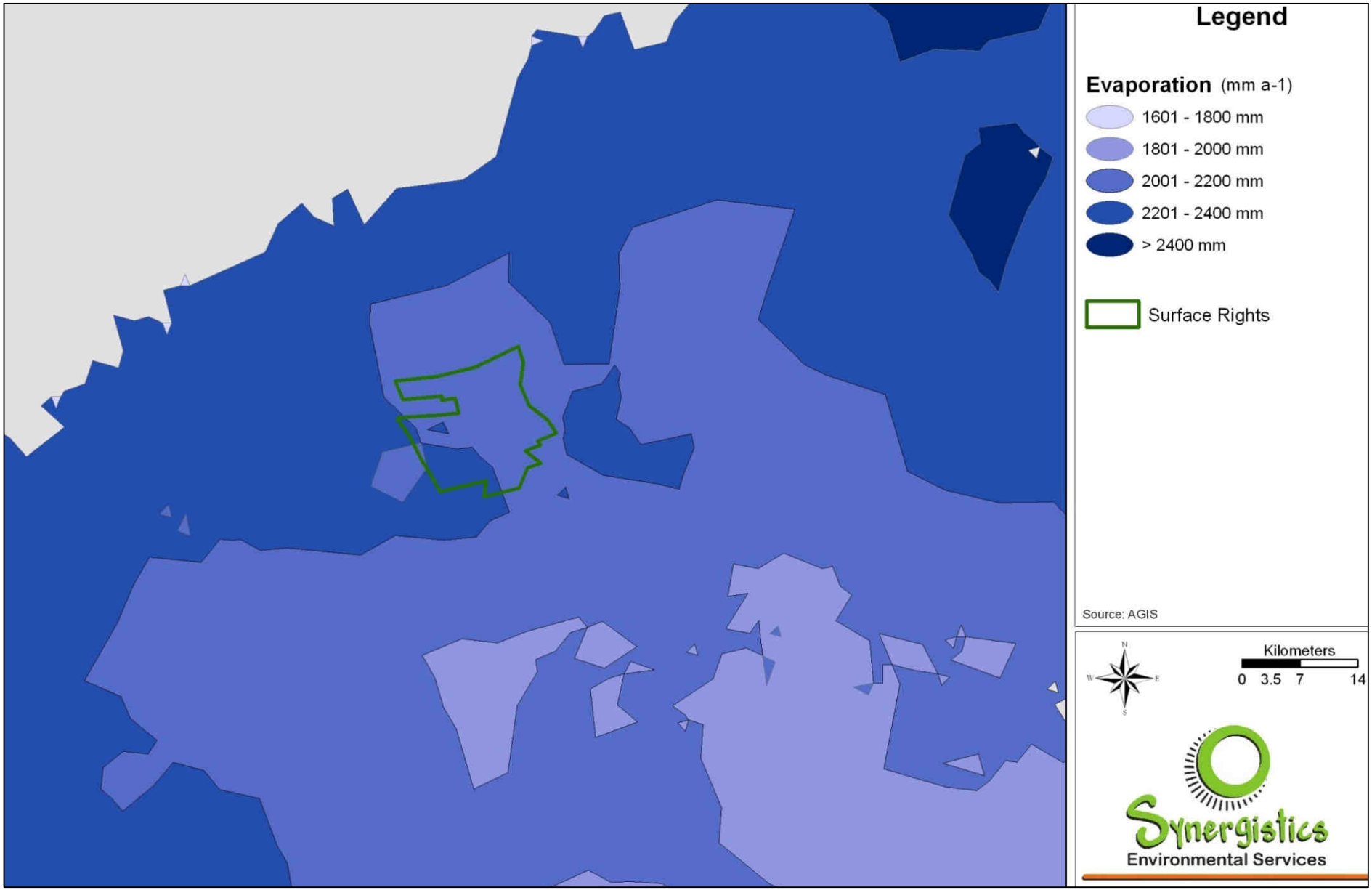


Figure 4.5: Annual Evaporation in the Study Area (from AGIS database, 2002)

4.1.1.3 Wind Patterns

Wind data was obtained from Airshed, 2011, who used hourly average meteorological data recorded at the Lephalale SAWS station, Eskom ambient stations at Grootstryd and Marapong (approximately 10 km west of Lephalale) and the Anglo Coal Station at Bulklip approximately 20 km north of the Grootegeluk mine for the period January to December 2006 (Figure 4.8). The wind pattern of the area is dominated by east-north-easterly and north-easterly winds, as may be expected due to the continental high pressure. Winds are infrequently experienced from a westerly and south-easterly direction. East-north-easterly and north-easterly winds increase in frequency during summer months, and the percentage of north-easterly winds decreases in winter months. The highest wind speeds were recorded during the spring months (August to October). More detailed information can be found in the Air Quality Impact Assessment report in Appendix 3.

An annual average wind rose for the area is depicted in Figure 4.6 and seasonal average wind roses in figure 4.7**Error! Reference source not found.**.

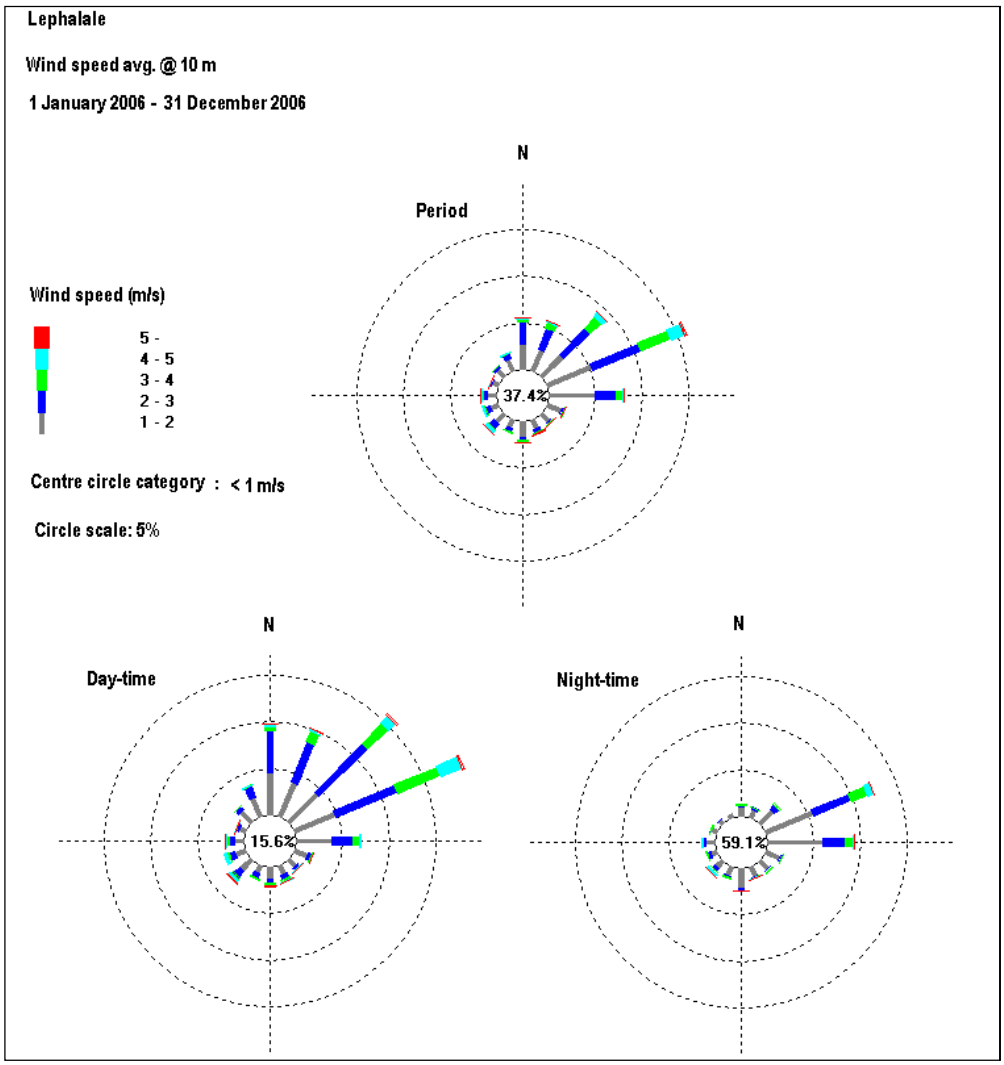


Figure 4.6: Period, Day and Night-time Wind Roses for the Lephalale (Ellisras) SAWS Station (2006) (Airshed, 2011)

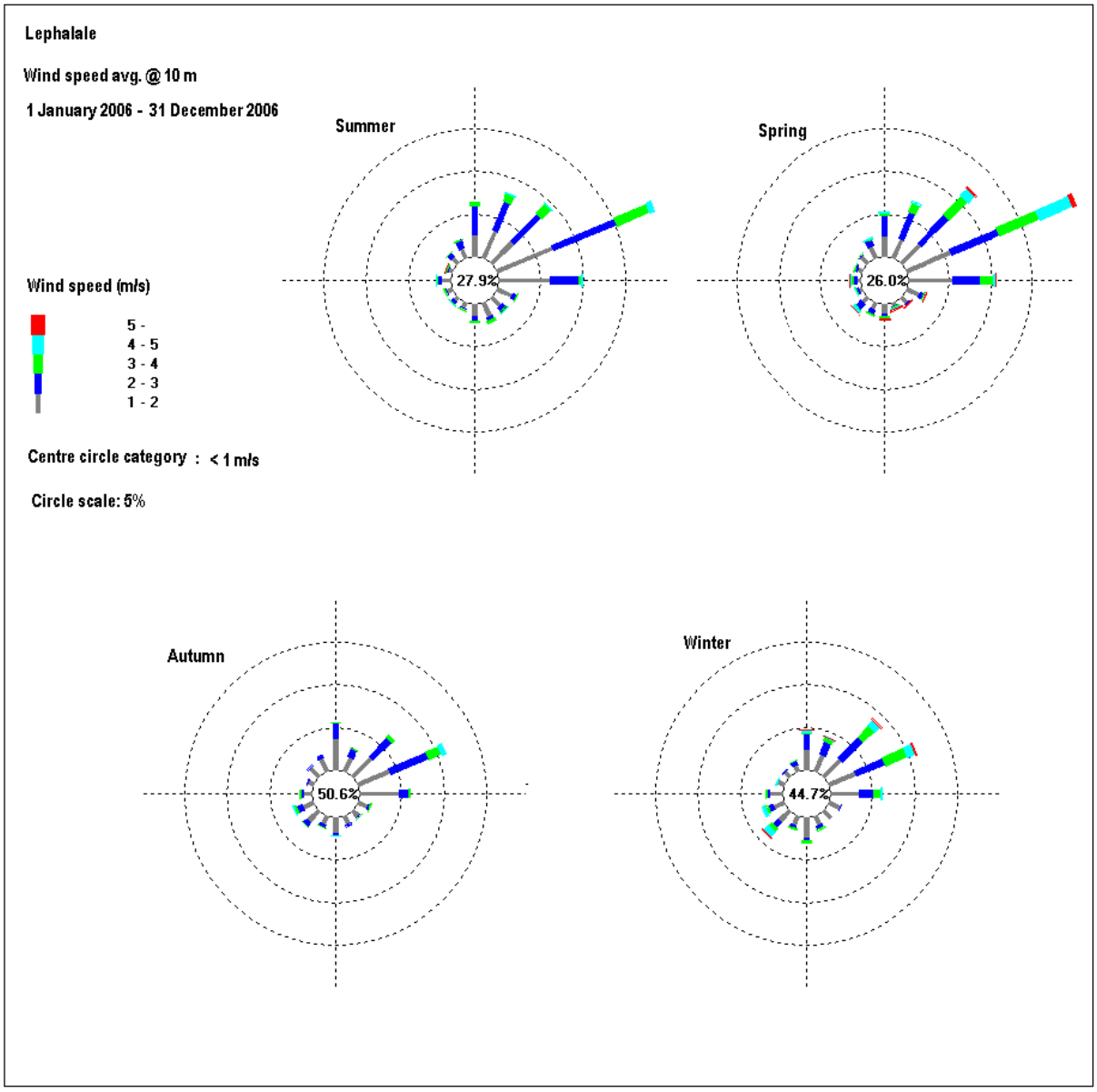


Figure 4.7: Seasonal Wind Roses for Lephalale (Ellisras) Weather Station (2006) (Airshed, 2011).

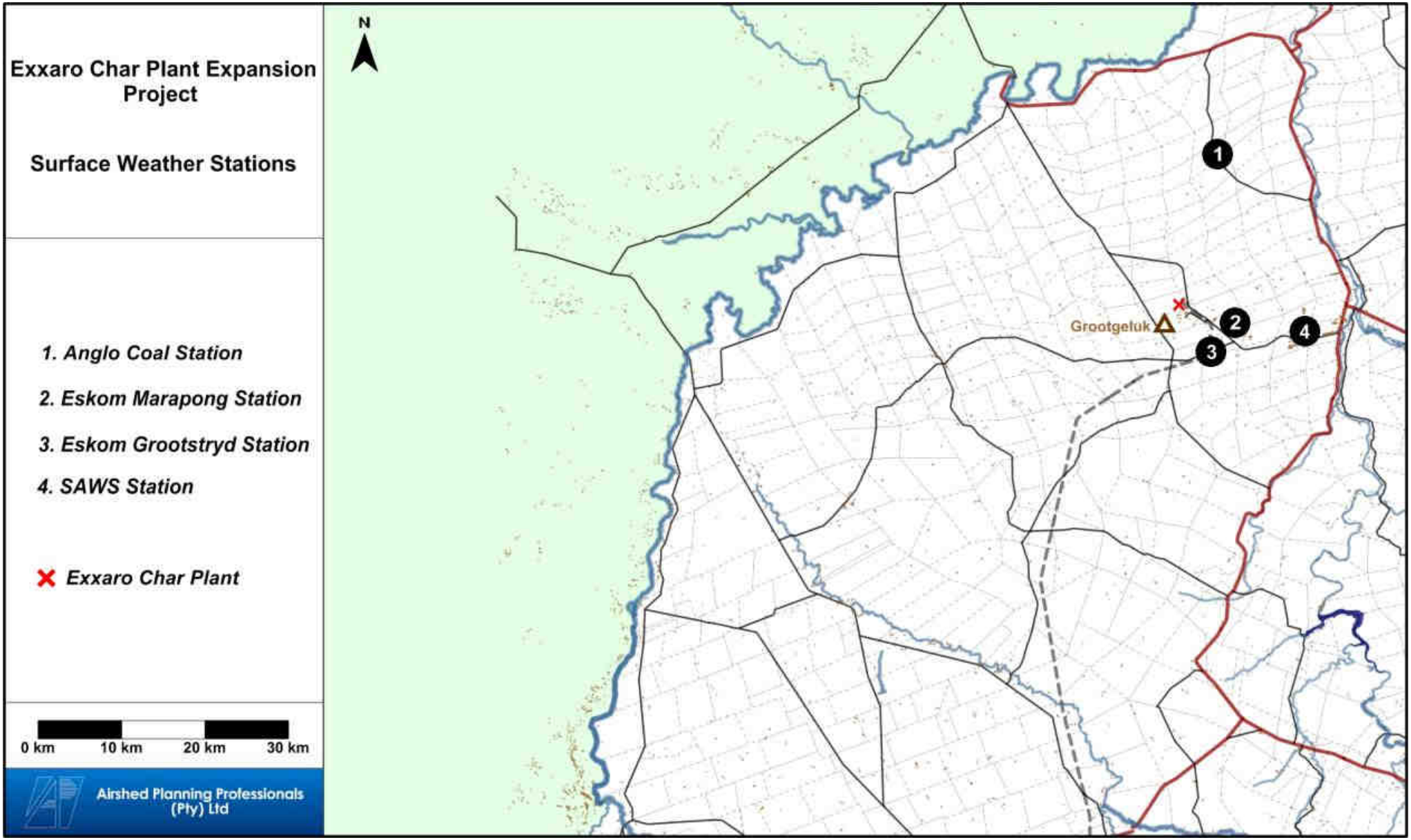


Figure 4.8: Relative locations of regional meteorological stations (Airshed, 2011).

4.1.1.4 Atmospheric Stability

Atmospheric stability relates to the amount of turbulence and mixing in the first few hundred meters of the atmosphere and has a major effect on the movement and dispersion of air pollution. Generally, more turbulent conditions increases the mixing of unpolluted air into a polluted plume and thereby acts to reduce the concentration of pollutants in the plume (i.e. enhances the plume dispersion). Daytime is usually characterised by unstable and turbulent conditions due to convection currents generated by heating. Vertical mixing of the atmosphere is therefore more prolific during the day (Airshed, 2011). Conversely, night times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds.

Atmospheric stability is frequently categorised into one of six stability classes. These are briefly described in Table 4.2.

Table 4.2: Atmospheric Stability Classes (Airshed, 2011)

A	very unstable	calm wind, clear skies, hot daytime conditions
B	moderately unstable	clear skies, daytime conditions
C	unstable	moderate wind, slightly overcast daytime conditions
D	neutral	high winds or cloudy days and nights
E	stable	moderate wind, slightly overcast night-time conditions
F	very stable	low winds, clear skies, cold night-time conditions

The figure below shows the stability class occurrence for the Waterberg region for the period January to December 2006. From the figure it can be seen that very stable atmospheric conditions are the most common, occurring on average 42% of the time. This implies that the dispersion of pollutants at the Char site will likely be minimal for a large percentage of the time.

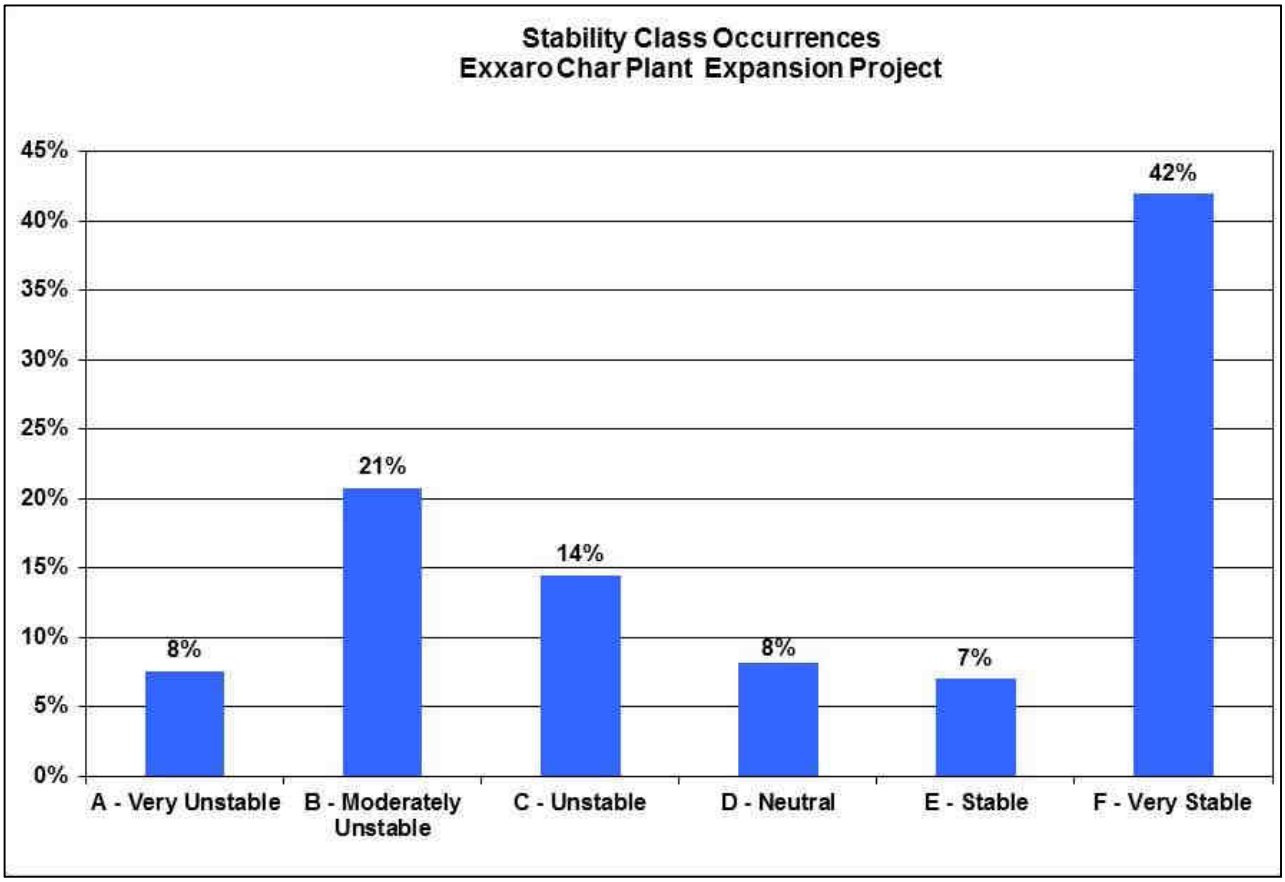


Figure 4.9: Atmospheric Stability Class Occurrence for the Waterberg Region (Airshed, 2011).

4.1.2 Topography

The elevation of Grootegeluk Mine varies from 900 to 922 m above sea level (Figure 4.10). The area is generally flat and featureless, with the exception of Nelsonskop to the north and the Waterberg range to the south, which have elevations of 922 m and 3600 m above sea level respectively (Clean Stream, 2005). The elevation of the Char Manufacturing Plant is approximately 915 m above sea level.

Mining activities at Grootegeluk Mine have influenced the topography of the area in terms of the following created surface features:

- the open pit, which is approximately 135 m deep and 560 ha in extent and advancing at a rate of 80 m to 100 m per year;
- the various discard dumps, which cover approximately 1 000 ha at heights varying between 40 m and 60 m;
- run of mine (ROM) stockpiles;
- infrastructure such as the plant, offices, and workshops which are as high as approximately 50 m and occupy approximately 10 ha; and
- the slimes dam which covers approximately 100 ha with a height of about 25 m.

The development of the existing Char Manufacturing Plant changed the topography of the site, which was originally a large coal stockpile area. The stockpile and top layer of soil containing coal were removed from the site when it was leveled for the construction of the existing plant. For the construction of the expanded Char Manufacturing Plant, some additional remaining coal and soil may need to be removed to level the site.

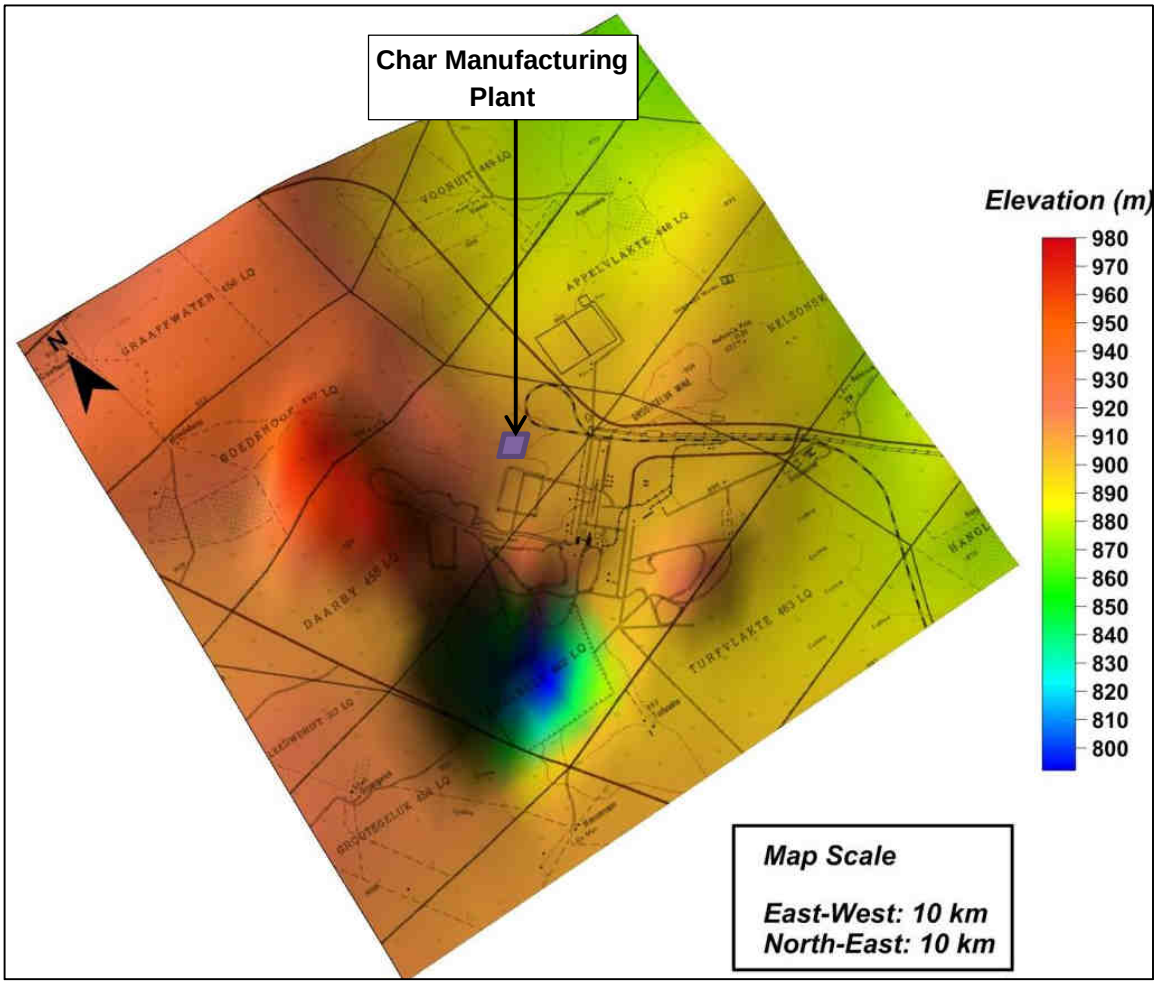


Figure 4.10: Topography of the proposed site (Airshed, 2008)

4.1.3 Soils

The variations in soil form are characterised by differences in the texture (grain size), colour, soil structure, and the effective rooting depths that result from the depth to bedrock and or inhibiting layers that occur. The soils in the area are the Hutton type (Hu35) (refer to Figure 4.11). They are sandy, with 70 to 90 % of sand in the top layer and 50 to 90 % in the sub layer. The clay content ranges from 5 to 25 % in the top layer and 5 to 45 % in the sub layer. This content puts the top layer in the sandy to sandy-clay-loam texture and the sub layer in the sandy to sandy-clay texture. Silt content is low in all the soil types.

A mixture of yellow-brown apedal soils and red apedal soils characterise the area around Grootegeluk Mine (Clean Stream, 2005). These soils are highly permeable. Water filters through the soil very fast, washing out nutrients and making these soil types unsuitable for cultivation. The yellow-brown apedal soils are well to moderately drained and shallow to very deep (0.4 m to >1.8m). They are the most dominant soil type area and generally occur in flat to gently sloping midslope to crest positions. The red apedal soils are relatively well drained soils with intermediate to very deep depths (0.3 m to >1.8 majority).

The soils in the study area have been heavily impacted by the mining activities that have been occurring on the site for approximately 29 years. The existing Char Manufacturing Plant is built on an area that was previously used for coal stockpiling. As such, top 5 to 10 cm of soil over most of the surrounding area is heavily impacted by coal contamination (Golder, 2011). Activities at the existing Char Manufacturing Plant have also led to the contamination of soils in the area by wastes generated at the plant, which include tar, liquor, char fines and fine coal and tar sludge (Golder, 2011). A large amount of infill material has also been imported during the construction of the existing Char Manufacturing Plant (Golder, 2011).

Soil sampling and analysis was conducted at potentially contaminated areas (i.e. where visual signs of contamination were evident) in and around the existing Char site to establish the amount of contamination that has taken place (Figure 4.12). Results of this analysis revealed the presence of potentially hazardous substances in the soils, which included:

- Inorganic Chemicals Of Concern (COC's), e.g. Arsenic (As) and Lead (Pb);
- Polycyclic Aromatic Hydrocarbons (e.g. Pyrene), (PAH); and
- Petroleum Hydrocarbons (TPH), a constituent of coal.

The results were compared to the Soil Screening Values (SSV) detailed in the Framework for the Management of Contaminated Land in South Africa (Department of Environmental Affairs, 2010). SSVs are a conservative measure used to assess whether compounds present in soils are at concentrations high enough to pose a potential risk to the receiving environment. The main findings indicate that:

- The concentrations of COCs (i.e. arsenic, lead etc.) in the TP samples were below SSV values.
- Samples in areas where visual contamination was evident had concentrations of the metals arsenic (As), lead (Pb), and vanadium (V), which exceeded the SSV values.
- The PAHs pyrene, benzo(a)pyrene and TPH (C12-C16) in sample HA01 exceeded SSV values.

It was established that the elevated levels of As, Pb and V concentrations are not a result of the spillage of wastes as the levels of these COC's in samples taken from waste samples (i.e. tar, liquor etc.) were low. Instead, the elevated As, Pb and V concentrations are associated with the infill material that was used during the construction of the existing Char Manufacturing Plant (Golder, 2011). Furthermore, these elevated COC's are unlikely to contribute to groundwater contamination as all these COC's are absorbed by clay particles and only move under acidic conditions (Golder, 2011).

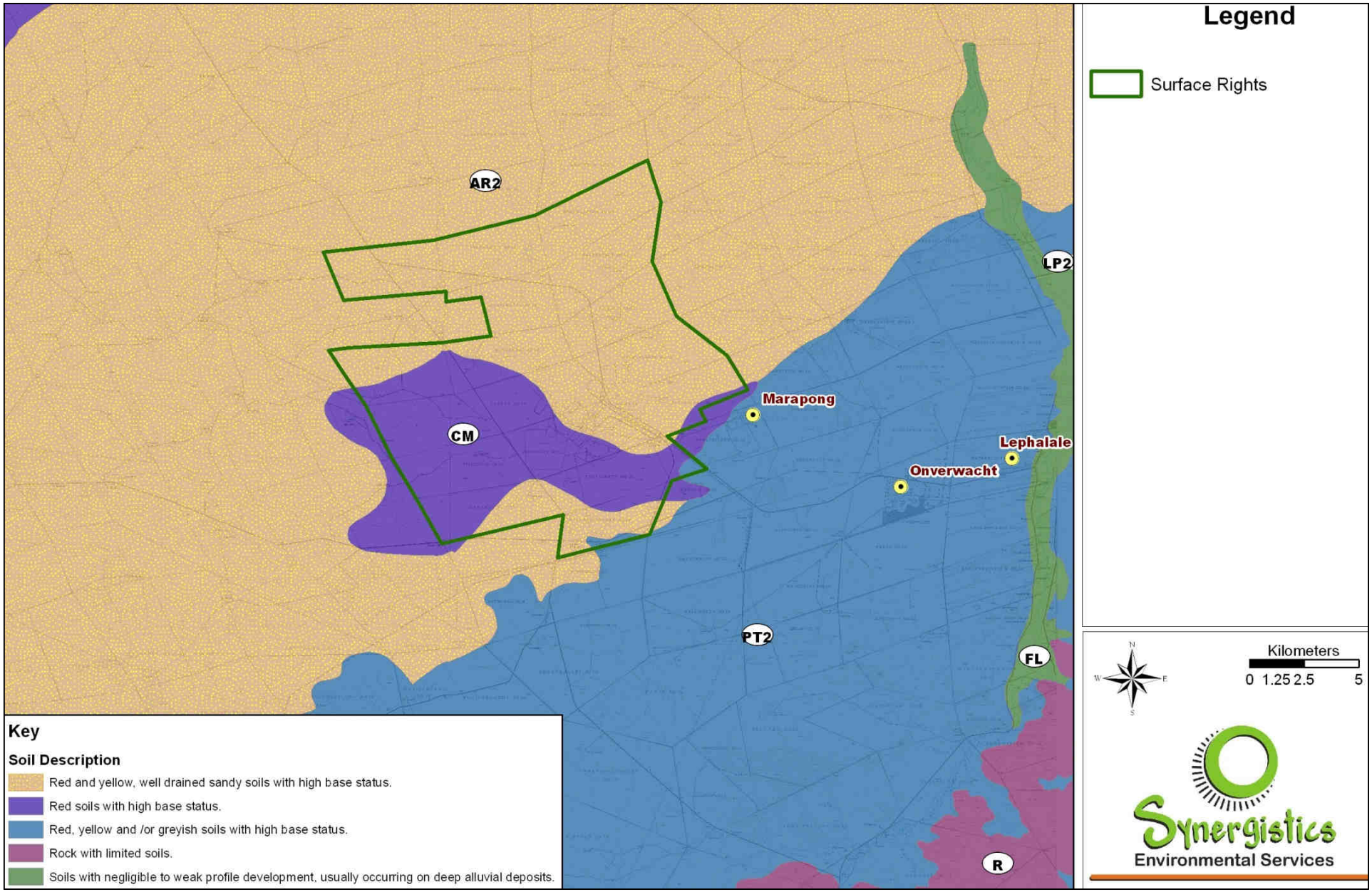


Figure 4.11: Soil types in the study area (the green polygon is the Grootegeluk Mine area)

Figure 4.12: Location of soil sampling points (Golder, 2011).

4.1.4 Geology

The proposed site is located in the Waterberg Coalfield. The coalfield extends westward into Botswana and covers an area of approximately 88 km (east to west) and 40 km north-south (ERM, 2012). The coalfield is bounded by the Zoetfontein fault in the north and the Eenzaamheid fault in the south (ERM, 2012). The Daarby fault subdivided the coalfield in a northwest, then northeast direction (ERM, 2012).

Figure 4.13 illustrates the surface geology of the Waterberg coal field. Figure 4.30 illustrates the cross-section of the Waterberg coal field in an east to west direction across the Daarby Fault.

The formations directly underlying the Char sites are the Letaba Basalt and the Clarens Sandstone formations. A description of each follows:

- The Letaba Formation is preserved as a small wedge of Drakensberg basalt just north of and touching the Daarby fault (see figures below). The formation is comprised of successive lava flows, appearing as distinct beds of dark grey to black (ERM, 2012). Thin layers of sandstone similar to the Clarens Formation occur between the lava flows, especially near the base. The basalts are fractured and weathering is found between successive lava flows. The fractures and weathering present in the Letaba formation make it an aquifer that can produce relatively high groundwater yields in the order of 2 L/s (ERM, 2012).

- The Clarens Formation is comprised of creamy white to yellowish to reddish brown (ERM, 2012), fine grained, well sorted sandstone with a high content of calcareous material (ERM, 2012). The average thickness of the formation is in the order of approximately 80 m and is overlain by the Drakensberg Basalt or the Letaba Formation (ERM, 2012).

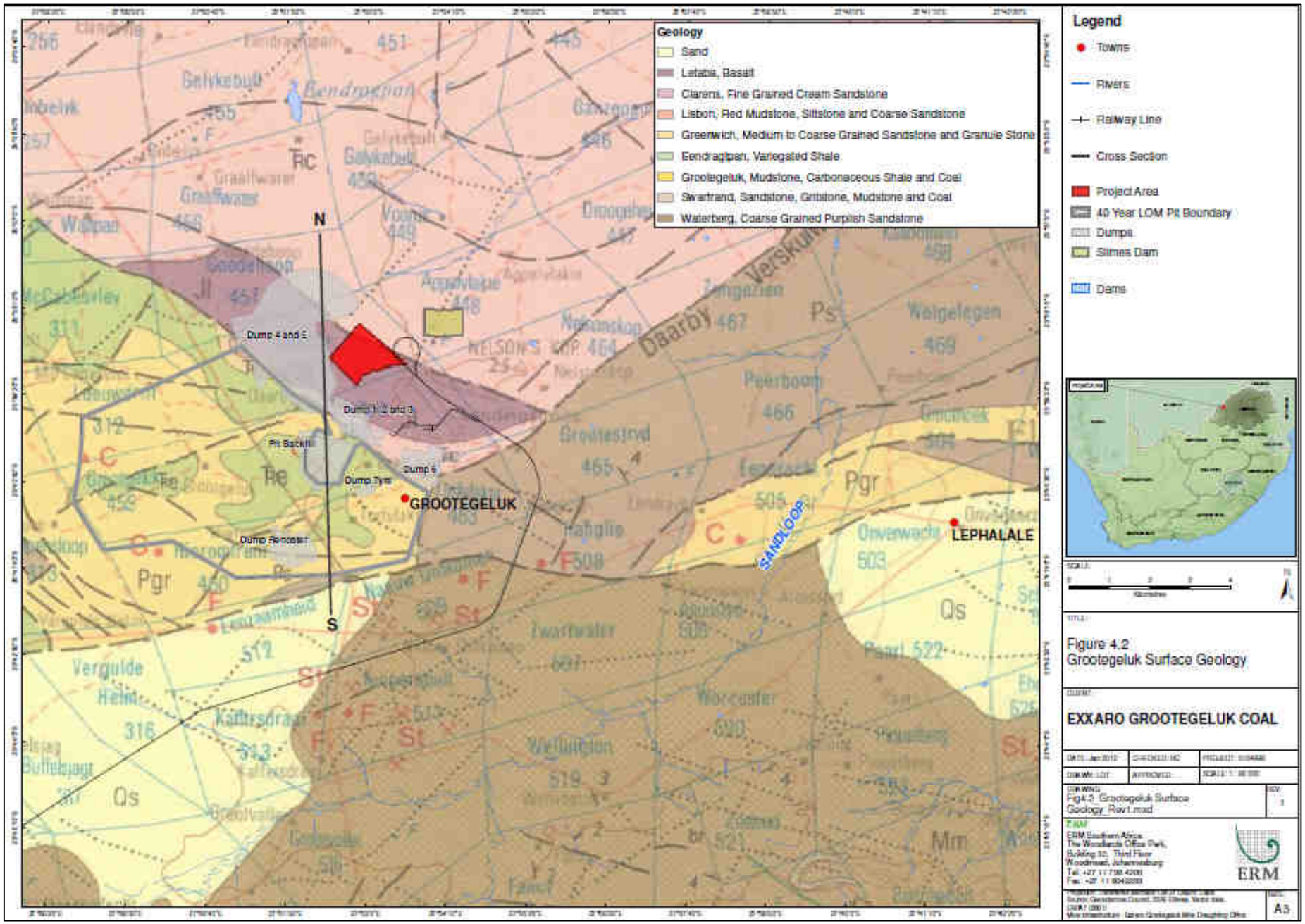


Figure 4.13: Surface geology of the greater Study Area (ERM, 2012)

4.1.5 Air Quality

4.1.5.1 Char Manufacturing Plant Expansion Site

The major source of air pollution within the area of the proposed Char Manufacturing Plant Expansion is from the existing Char Manufacturing Plant. The existing plant has emissions from the two excess gas flare stacks, two liquor destructor stacks and two boiler stacks (figure below).

In summary, Grootegeluk Mine contributes to the baseline air pollution at the char plant site in terms of the following (Airshed, 2008):

- Discard dumps - spontaneous combustion from burning dumps releasing SO_2 and fugitive dust emissions;
- Untarred roads - dust emissions from untarred roads;
- Slimes dam;
- Tyre dump;
- Product Stockpiles – fugitive dust emissions;
- Off-loading activities – fugitive dust emissions.

Refer to the project description section for the process flow diagram of the existing Char Manufacturing Plant. This diagram shows that the emissions from the two existing flare stacks (according to the design criteria of the plant) include:

- 66 kg/h carbon dioxide (CO_2)
- 233 kg/h water vapour (H_2O)
- 60 kg/h sulphur dioxide (SO_2)
- 25 kg/h nitrous oxides (NO_x)
- 16 kg/h ammonia (NH_3)
- 15 kg/h Hydrocarbons

It is estimated (according to the design criteria of the plant) that the following amounts of gas are emitted to the atmosphere via the existing liquor destructors:

- 45 g/s (grams per second) CO_2
- 87 g/s H_2O
- 2.8 g/s SO_2
- 4.2 g/s SO_X (This may also represent hydrogen sulphide - H_2S)
- 12.2 g/s NO_X
- 8.3 g/s NH_3
- 6.9 g/s Hydrocarbons

The emissions mentioned above are currently licenced in terms of an existing Atmospheric Pollution Prevention Act (APPA) permit for the existing Char Manufacturing Plant (refer to Appendix 9 for a copy of the APPA certificate).

Airshed (2011) quantified current emissions from the existing Char Manufacturing Plant (see table 4.3 below). Emission flow rates from the liquor destructors and boiler stacks were quantified based on stack emission sampling conducted by Gondwana Environmental over the period 18-21 May 2010. Emissions from boiler 2 were not monitored due to planned maintenance at the time, however they were assumed to be identical to that of boiler 1 (Airshed 2011). Emissions estimates from the flare stacks were not based on monitoring data, but were estimated from data provided by Exxaro. Total particulate matter (PM_{10}) emissions from dust due to material handling and vehicle movement on paved roads were also calculated (Airshed, 2012).

Table 4.3: Atmospheric Emissions from Existing Char Manufacturing Plant (Airshed, 2011)

Source	Volumetric Flow Rate (Nm^3/h)	Sulphur dioxide (SO^2) (g/s)	Particulates (PM_{10}) (g/s)	Nitrous Oxides (NO_x) (g/s)	Carbon Monoxide (CO) (g/s)
Liquor Destructor 1	108234	17.1	0.41	3.7	252
Liquor Destructor 2	128028	21.3	0.14	4.1	231
Boiler 1	1416	0.98	0.01	0.32	0.85
Boiler 2 [(d)]	1416	0.98	0.01	0.32	0.85
Flare 1 [(e)]	-	0.98	-	0.18	3.73
Flare 2 [(e)]	-	0.98	-	0.18	3.73
Material Handling	-	-	0.00286	-	-
Paved Road Emissions	-	-	0.02444	-	-
Total	**239094**	**42.32**	**0.5973**	**8.8**	**492.16**

[(d)] duplicate
[(e)] estimate based on data provided by Exxaro

SO_2 emissions from the liquor destructor stacks, as calculated by Airshed, exceed the SO_2 emissions stipulated by the design criteria of the plant. However, no exceedance of the SO_2 National Ambient Air Quality Standards (NAAQS) is predicted for long or short term periods as a consequence of emissions from the Char Manufacturing Plant Expansion. There has been an indication that the existing plant has not been running in a stable manner and various operational problems have been experienced, which may have resulted in higher than expected emissions. Exxaro Reductants aims to address these problems through improvements to the design of the expanded Char Manufacturing Plant.

Figure 4.14: Location of Gas Emissions Stacks at the Existing Char Manufacturing Plant.

4.1.5.2 Lephalale and Surrounding Areas Ambient Air Quality

The National Ambient Air Quality Standards (NAAQS) (GN 1210, 24 December 2009) sets limit values on the concentration (in µg/Nm^3) of a number of priority pollutants which are potentially harmful to human health and the environment (Table 4.4). Limit values are average values determined over certain time periods termed "averaging periods" and are fixed on the basis of scientific knowledge with an aim of reducing harmful effects on human health or the environment (or both) (NEMAQA, 2004). However, limit values are often exceeded due to the variability of pollutant concentrations encountered during monitoring. The NAAQS allows for these exceedences by incorporating "frequency of exceedence' values (see Table 30) which allows for a certain number of exceedences as averaged over a calendar year. Therefore, if the number of exceedences are within the tolerances set by the NAAQS (e.g. < 88 exceedences in a year for CO), then there is still compliance with the NAAQS.

Table 4.4: National Ambient Air Quality Standards

Pollutant	Averaging Period	Limit Value (ug/m3)	Limit Value (ppb)	Frequency of Exceedence	Compliance Date
Benzene (C_6H_6)	1 year	10	3.2	0	Immediate – 31 Dec 2014
	1 year	5	1.6	0	1 Jan 2015
Carbon Monoxide (CO)	1 hour	30000	26000	88	Immediate
	8 hour(a)	10000	8700	11	Immediate
Lead (Pb)	1 year	0.5	-	0	Immediate
Nitrogen dioxide (NO_2)	1 hour	200	106	88	Immediate
	1 year	40	21	0	Immediate
Ozone (O_3)	8 hour(b)	120	61	11	Immediate
PM10	24 hour	120	-	4	Immediate – 31 Dec 2014
	24 hour	75	-	4	1 Jan 2015
	1 year	50	-	0	Immediate – 31 Dec 2014
	1 year	40	-	0	1 Jan 2015
Sulphur Dioxide (SO_2)	10 minutes	500	191	526	Immediate
	1 hour	350	134	88	Immediate
	24 hour	125	48	4	Immediate
	1 year	50	19	0	Immediate

Ambient air quality data for the period 2005 to 2007 was obtained from Eskom, who conducted ambient air quality monitoring from their ambient station located at Grootstryd for the period January 2005 to August 2006. The station was later relocated to Marapong in September 2006. The Grootstryd station is located approximately 2km south-west of the Matimba power station and the Marapong station approximately 2km to the north-west. The following air quality parameters were monitored between 2005 and 2007 (Airshed, 2011):

- Ozone (O_3);
- Sulphur dioxide (SO_2);
- Nitrous oxides (NO_x); and
- Particulates with a diameter less than 10 microns (PM_{10}).

Hourly SO_2 concentrations measured at the Grootstryd station for the period January 2005 to August 2006 showed exceedance of 350 µg/m³ (see Figure 4.15), but did not exceed the maximum allowable 88 exceedences of 350 µg/m³ per year (Airshed, 2011). Daily and annual averages complied with the corresponding standards. Similar SO_2 concentrations were measured at the Marapong station for the period September 2006 to December 2007, with fewer exceedances of the hourly standard (see Figure

4.16). It is therefore unlikely that the hourly SO_2 standard of 88 exceedances of 350 µg/m³ will be exceeded at the Char Manufacturing Plant Expansion site (Airshed, 2011).

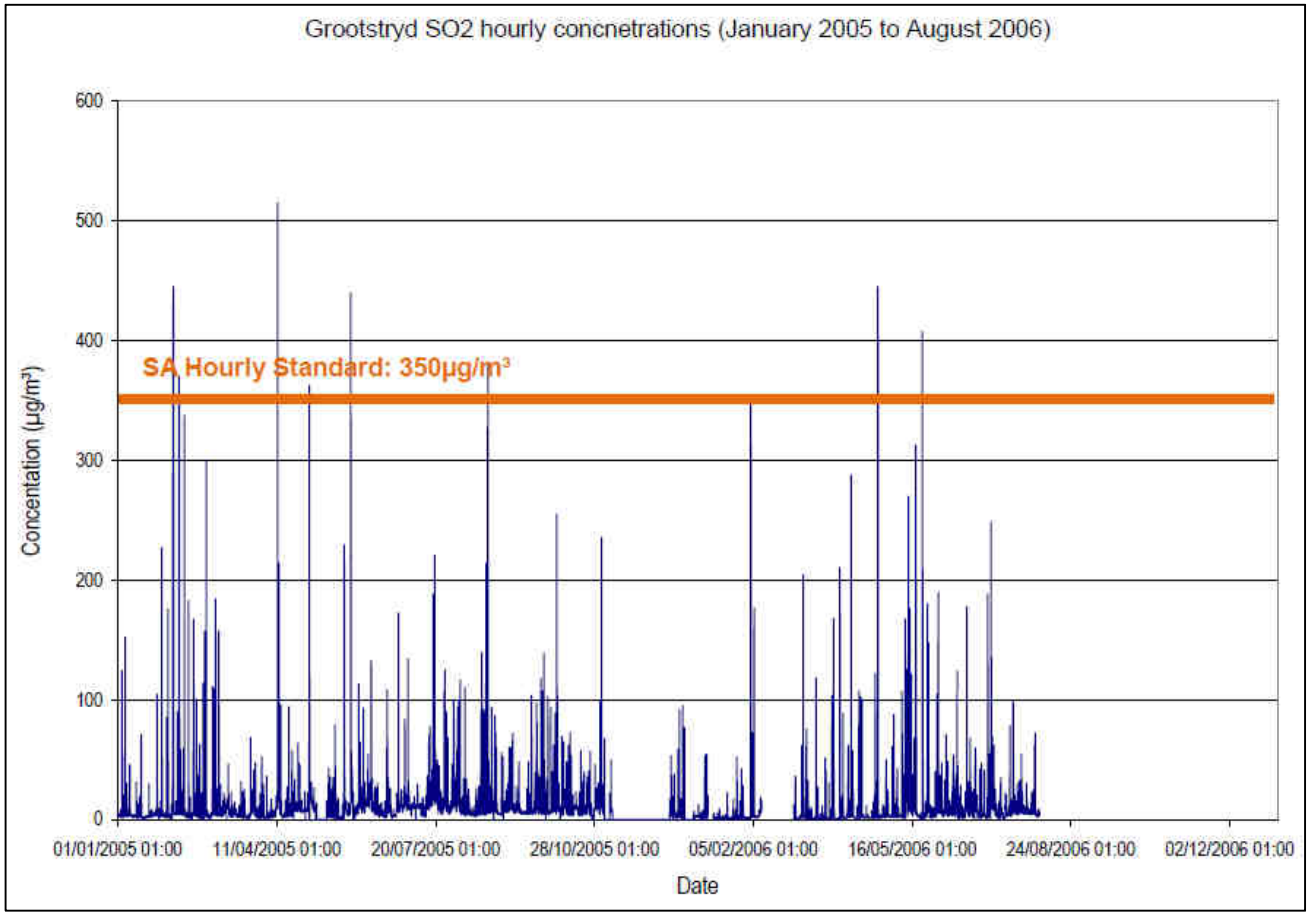


Figure 4.15: Grootstryd SO_2 hourly concentrations (µg/m³) for the period January 2005 to August 2006 (Airshed, 2011).

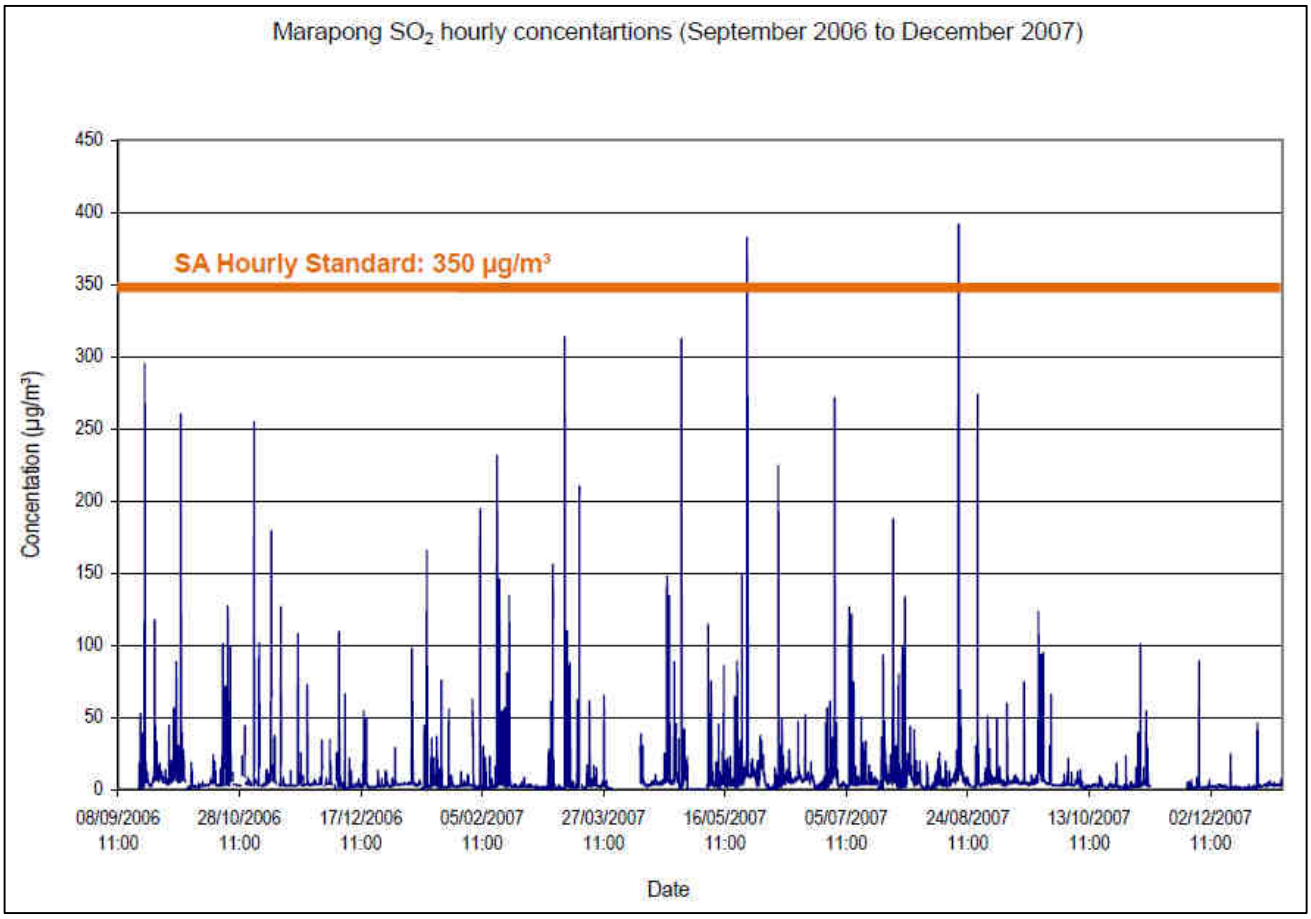


Figure 4.16: Marapong SO_2 hourly concentrations (µg/Nm³) for the period September 2006 to December 2007 (Airshed, 2011)

NO_x hourly concentrations as recorded at Marapong did not exceed the NAAQS standard of 88 hours of 200 µg/m³ per year (see Figure 4.17) (Airshed, 2011).

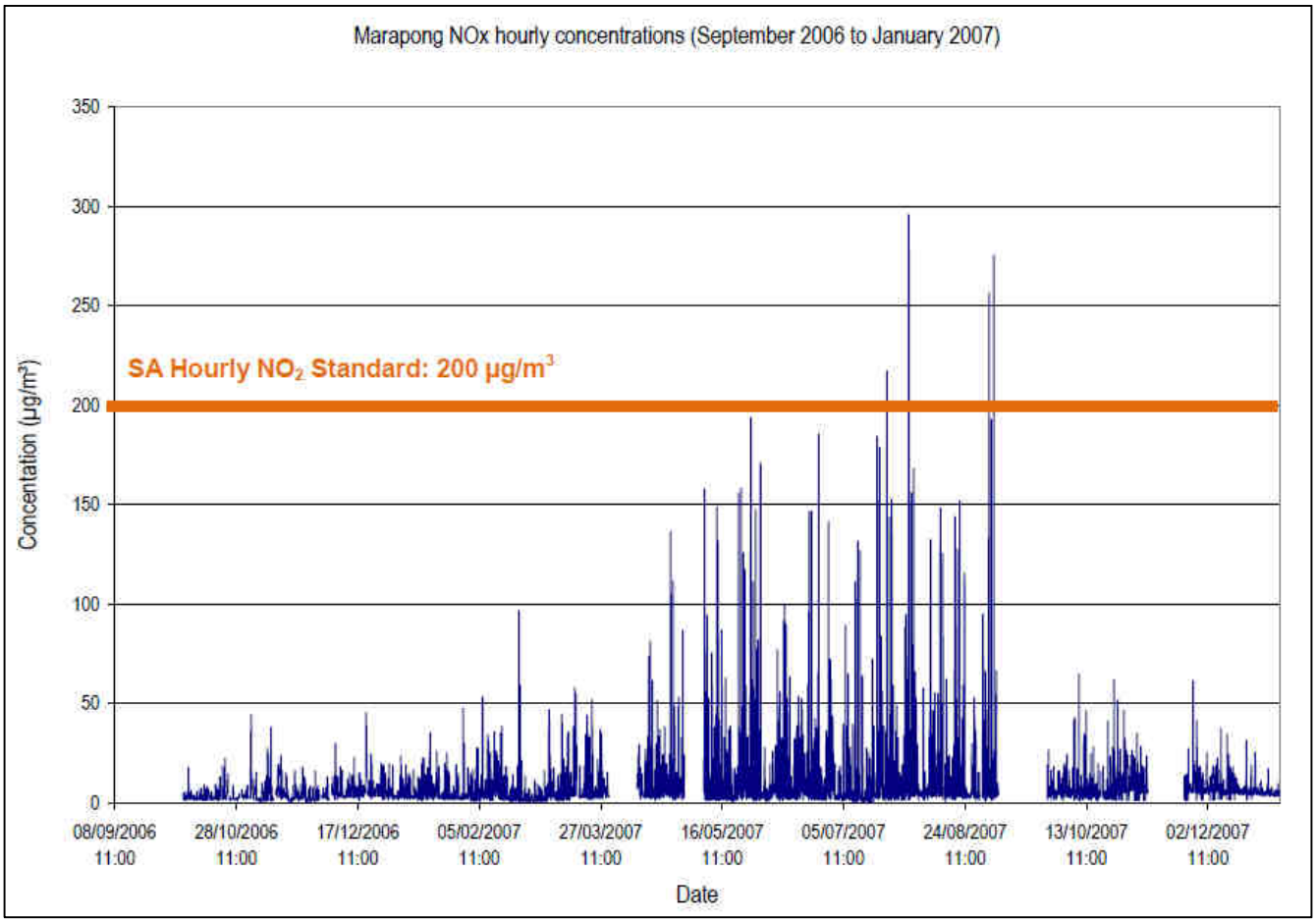


Figure 4.17: Marapong NO_x hourly concentrations (µg/m³) for the period September 2006 to December 2007 (Airshed, 2011)

Exceedances of the standards for daily PM_{10} ambient concentrations were recorded at both the Grootstryd station and Marapong station (see Figure 4.18 and Figure 4.19). The high PM_{10} levels experienced in the area are due to the many air pollution sources in the area, including the current Char Manufacturing Plant. The main sources include the Grootegeluk Mine and the Matimba (existing) and Medupi (under construction) Power Stations and their associated ash dumps (Airshed 2008). Other minor sources of PM_{10} pollution in the vicinity are (Airshed, 2008; Airshed, 2011):

- The brickworks operating at the farm Hangklip (south east of the mine);
- Household fuel combustion from the residential areas;
- Infrequent veld fires;
- Sewage works on the farm Nelsonskop, east of the site;
- Vehicle travel on unpaved roads,
- Vehicle exhausts from the nearby roads; and
- Windblown dust from agricultural activities and bare land.

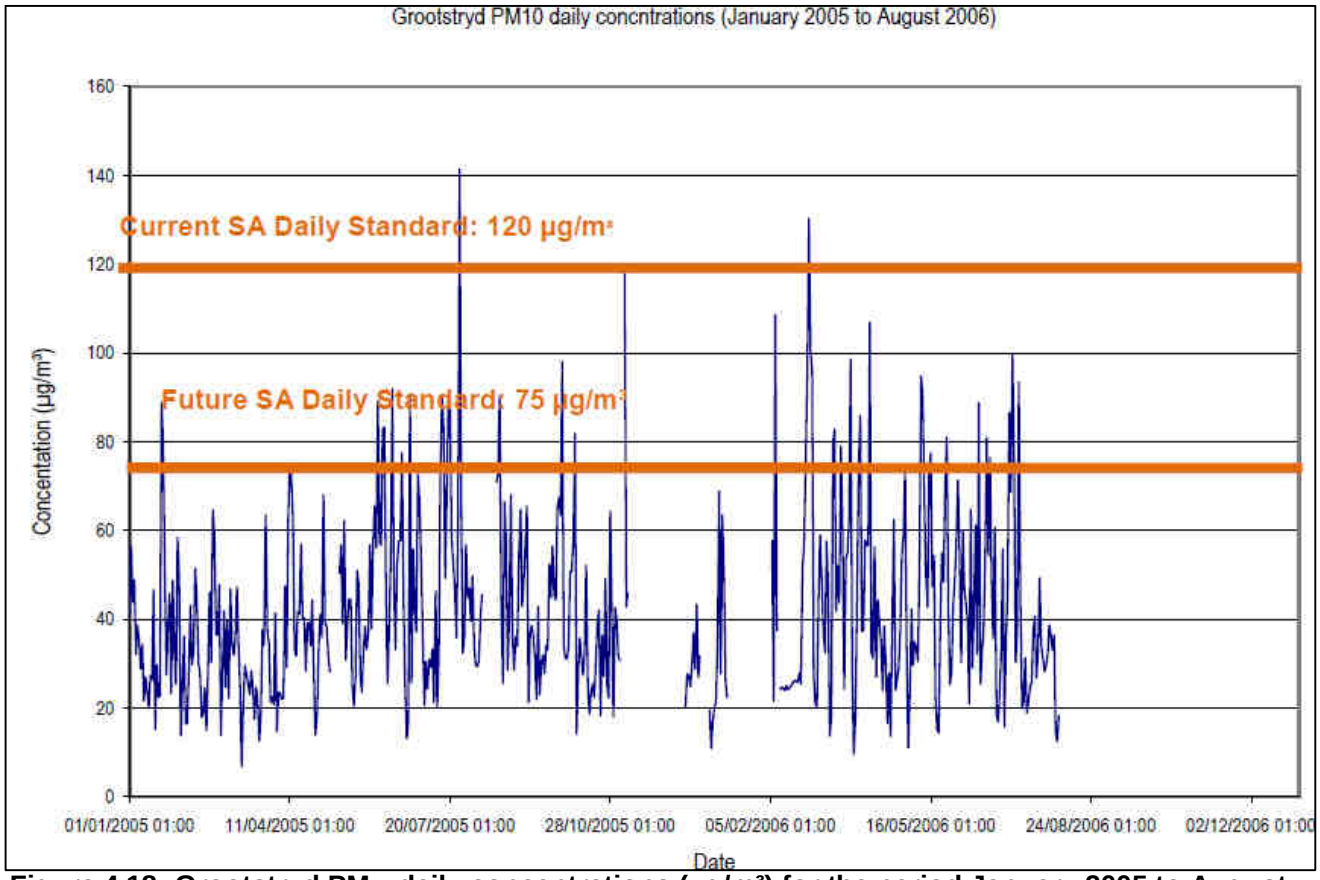


Figure 4.18: Grootstryd PM_{10} daily concentrations (µg/m³) for the period January 2005 to August 2006 (Airshed, 2011)

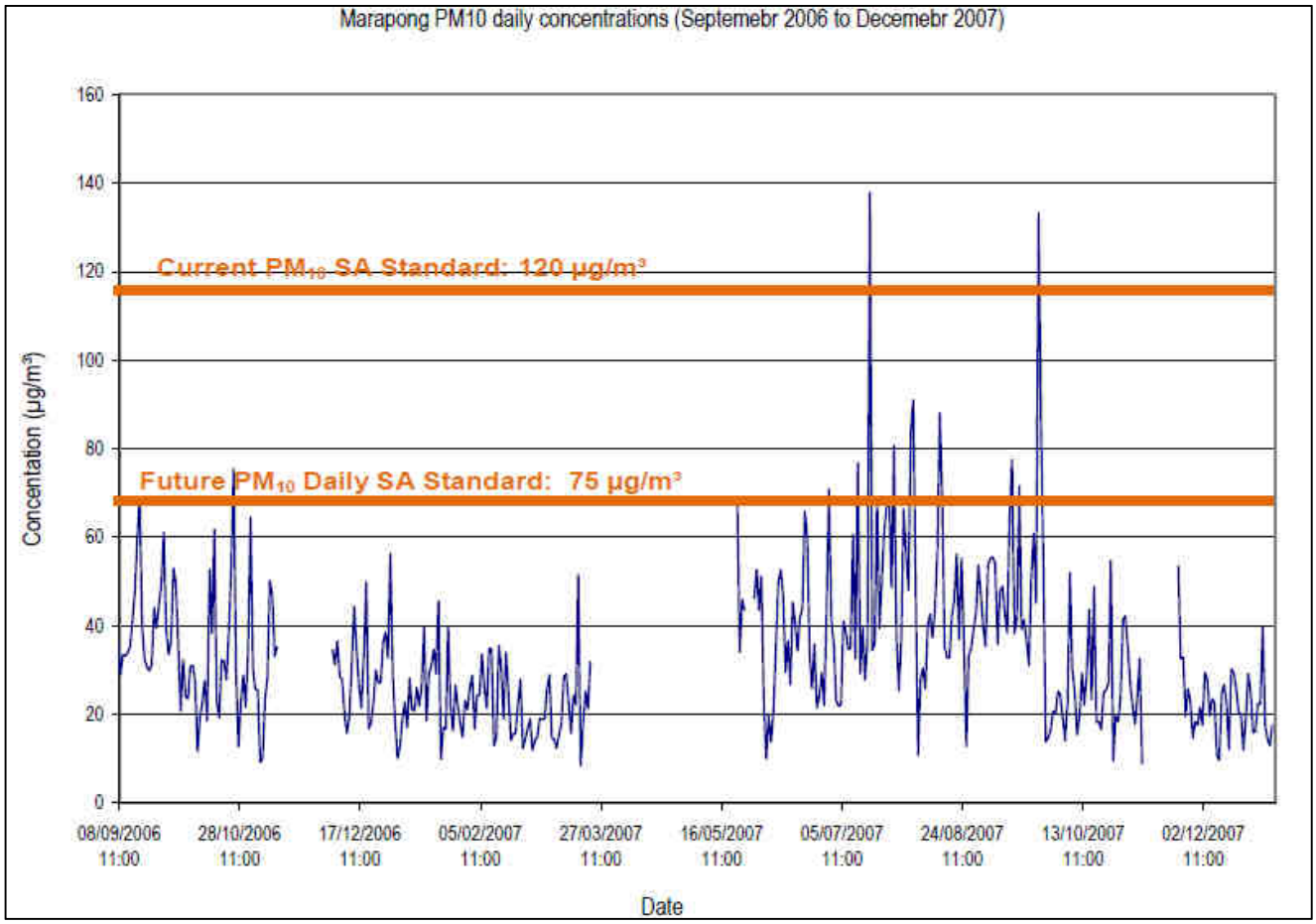


Figure 4.19: Marapong PM_{10} daily concentrations (µg/m³) for the period September 2006 to December 2007 (Airshed, 2011)

The main sensitive receptors identified are the Marapong, Onverwacht and Lephalale residential areas located approximately 6 km, 15 km and 20 km south east, respectively, of the proposed Char Manufacturing Plant expansion. Other sensitive receptors include farm households that are scattered through the area.

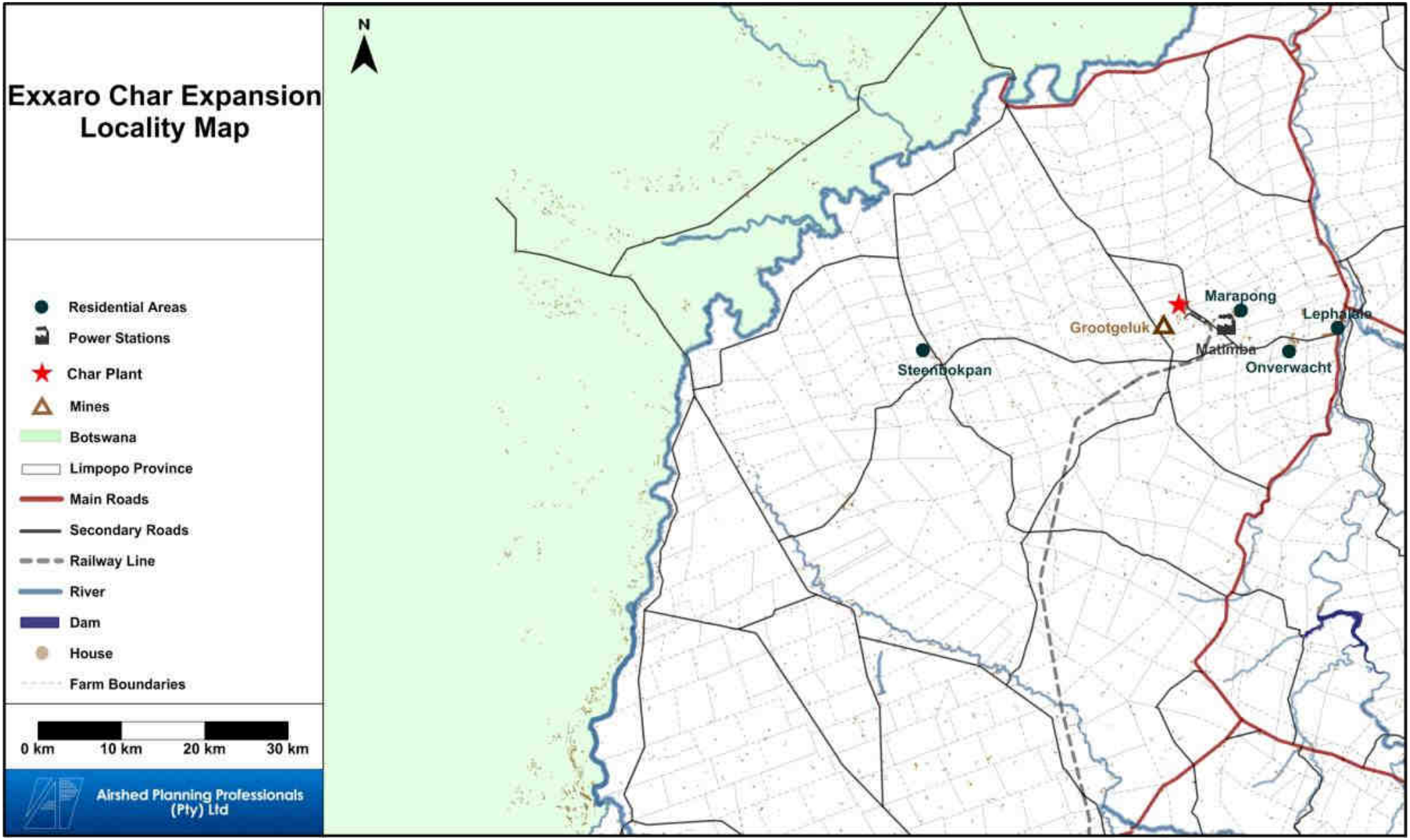


Figure 4.20: Locality Map showing the main sensitive receptors identified in terms of air quality at the Char Manufacturing Plant (Airshed, 2011)

4.1.5.3 Current and Future Baseline Modelling

The current baseline was simulated for the determination of cumulative impacts with current Char Manufacturing Plant operations (Airshed, 2011). The model took into account emissions from the Matimba Power Station and the Grootgeluk mine and ambient data from the Grootstryd (relocated to Marapong in September 2006) monitoring station. For the future baseline (2013-2015), atmospheric dispersion modelling was undertaken which included the following significant sources (Airshed, 2011):

- expanded Grootegeluk operations required to accommodate the future Medupi station;
- existing Matimba Power Station;
- future Medupi Power Station and associated ash dumps; and
- future vehicle tailpipe emissions due to additional power stations.

The current baseline model indicates that SO_2 concentrations exceed the hourly and daily NAAQS limit value of 350 µg/m^3 and 125 µg/m^3 respectively (Figure 4.21 and Figure 4.22). However, the number of hourly exceedences annually is below the NAAQS tolerance value of 88, which indicates that ambient SO_2 levels are in compliance (Figure 4.24).

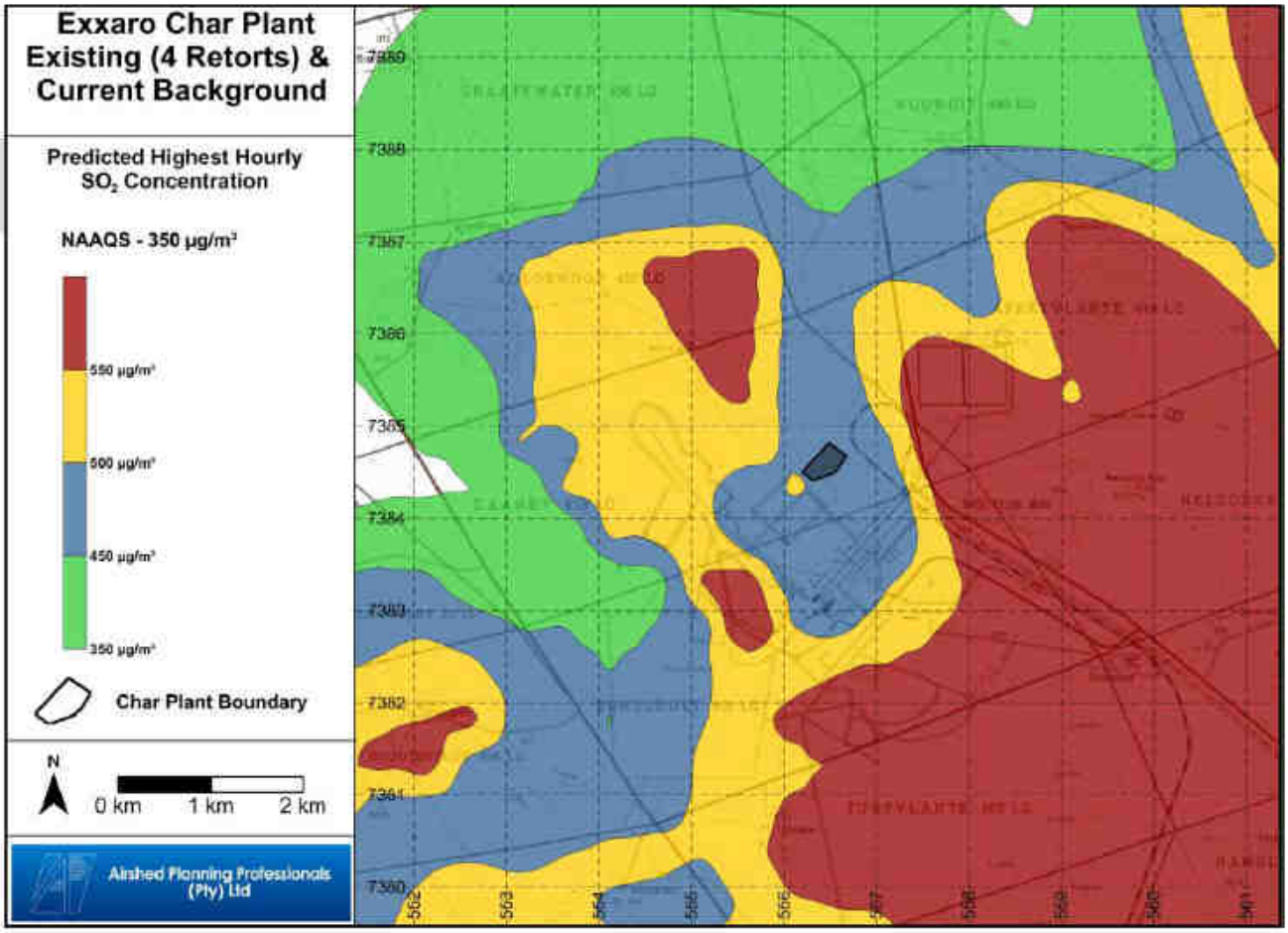


Figure 4.21: Predicted highest hourly baseline SO_2 concentrations (Airshed, 2011)

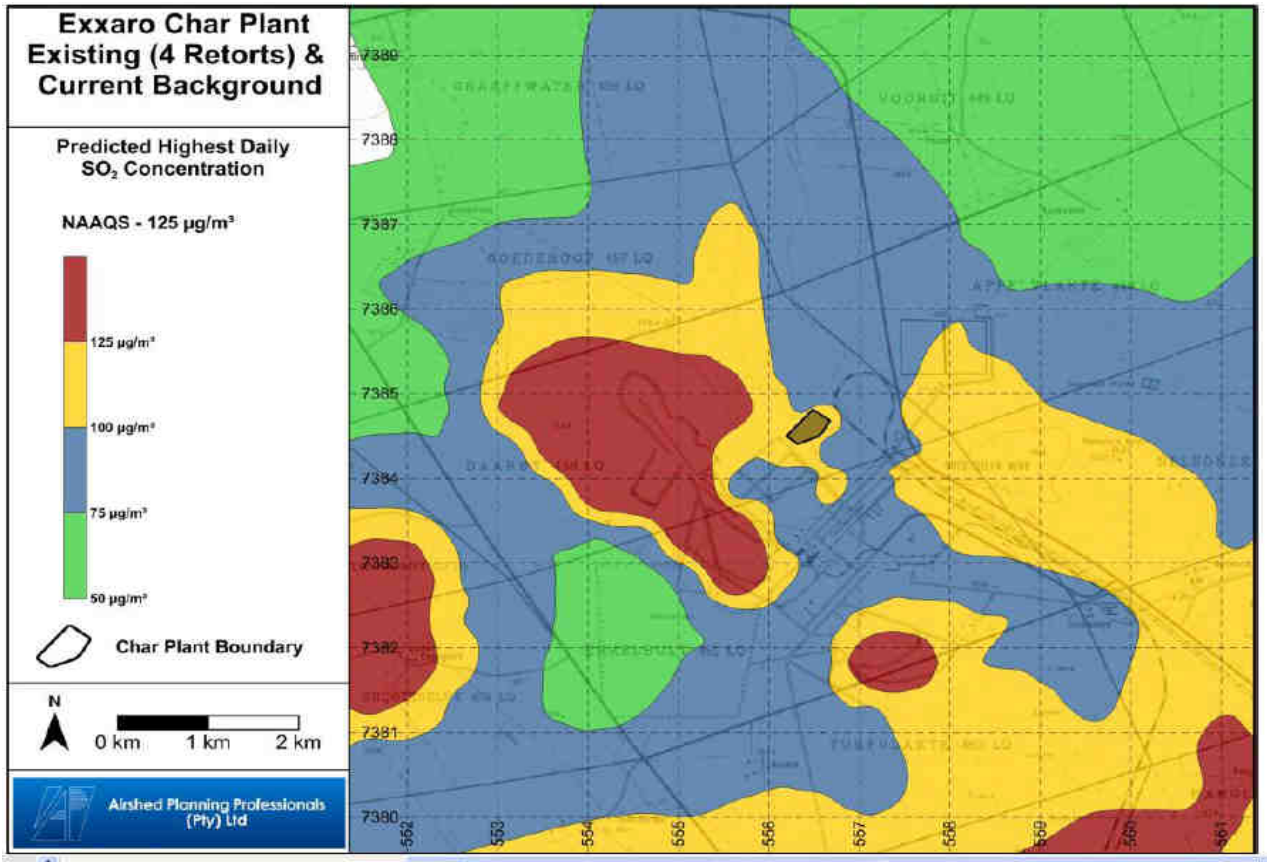


Figure 4.22: Predicted highest daily current baseline SO_2 concentrations (Airshed, 2011)

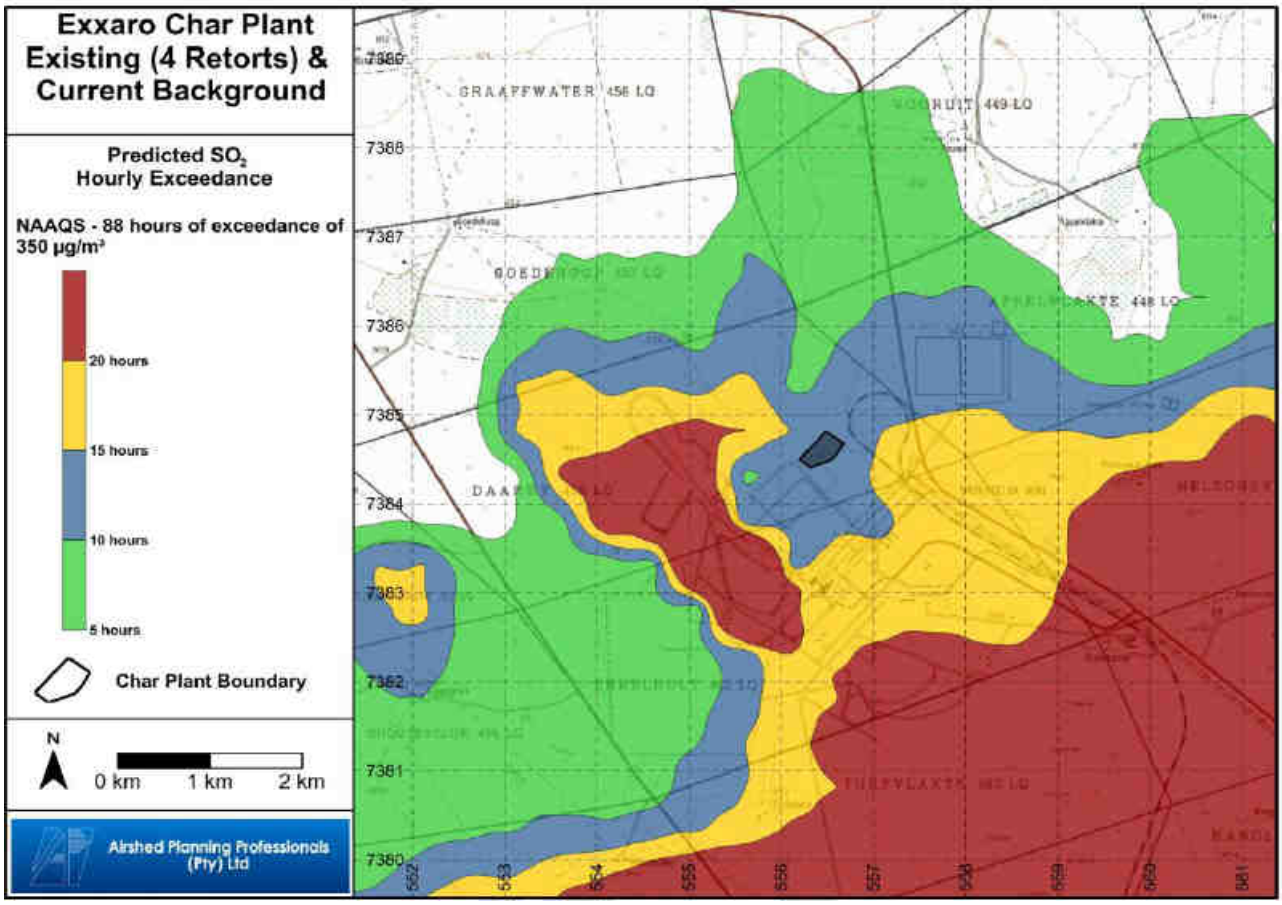


Figure 4.23: Predicted current baseline hourly exceedences of SO_2 concentration (350 µg/m^3) (Airshed, 2011)

Future baseline predictions for SO_2 concentrations are similar to the current predicted baseline, exceeding the hourly NAAQS of 350 µg/m^3 at identified sensitive receptors Onverwacht, Marapong and Grootstryd (Table 4.5). However, the highest number of hourly exceedences predicted (22 at Grootstryd) does not exceed the SA Standard of 88 per year.

Table 4.5: Predicted SO_2 future baseline concentrations due to all sources within the region (exceedances of air quality limits are highlighted) (Airshed, 2011)

Receptor	Highest hourly average (µg/m3)	Number of hourly exceedances per year	Highest daily average (µg/m3)	Number of daily exceedances per year
Onverwacht	**463**	8	63	none
Marapong	**561**	18	96	none
Lephalale	322	none	52	none
Grootstryd	**740**	22	88	none
NAAQS hourly concentration limit value: 350 µg/³m with 88 allowable exceedances per year NAAQS daily concentration limit value: 125 µg/³m with 4 allowable exceedances per year				

Predicted current baseline cumulative NO_x concentrations are low and do not exceed the NAAQS of 200 µg/m^3 more than 88 hours per year (Airshed, 2011). Future baseline concentrations are also all below NAAQS limit values (Table 4.6).

Table 4.6: Predicted NO_2 future baseline concentrations due to all sources within the region (exceedances of air quality limits are highlighted) (Airshed, 2011)

Receptor	Highest hourly average (µg/m³) (a)	Number of hourly exceedances per year
Onverwacht	105	none
Marapong	119	none
Lephalale	61	none
Grootstryd	119	none
75% of total NOx modelled were taken to convert to NO_2 NAAQS hourly concentration limit value: 200 µg/³m with 88 allowable exceedances per year		

Due to the proximity of operations at the Grootegeluk mine, as well as other sources as discussed in the previous section, predicted current and future baseline particulate (PM_{10}) concentrations are very high and do not comply with NAAQS in some areas (Airshed, 2011). Figure 4.24 and Figure 4.25 summarise the current baseline prediction results based on average and maximum hourly concentrations and predicted annual average concentrations of PM_{10}. Predicted current baseline PM_{10} concentrations exceed the daily and annual average values of 75 µg/m^3 and 40 µg/m^3 respectively, mostly to the east of the Char site. Predicted future baseline concentrations are not in compliance with NAAQS at Grootstryd, where daily average exceedences are predicted to be in excess of the tolerance value of 4 per year.

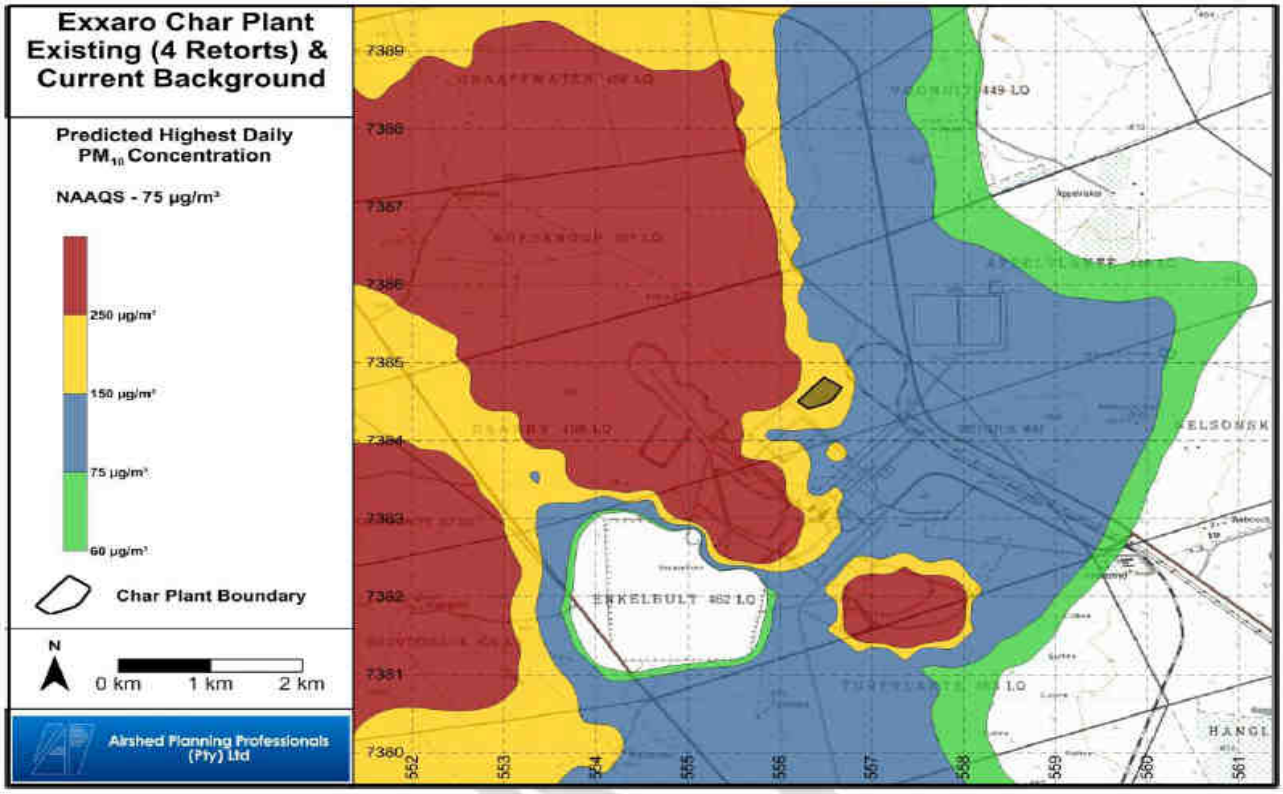


Figure 4.24: Predicted highest daily baseline PM_{10} concentrations (Airshed, 2011)

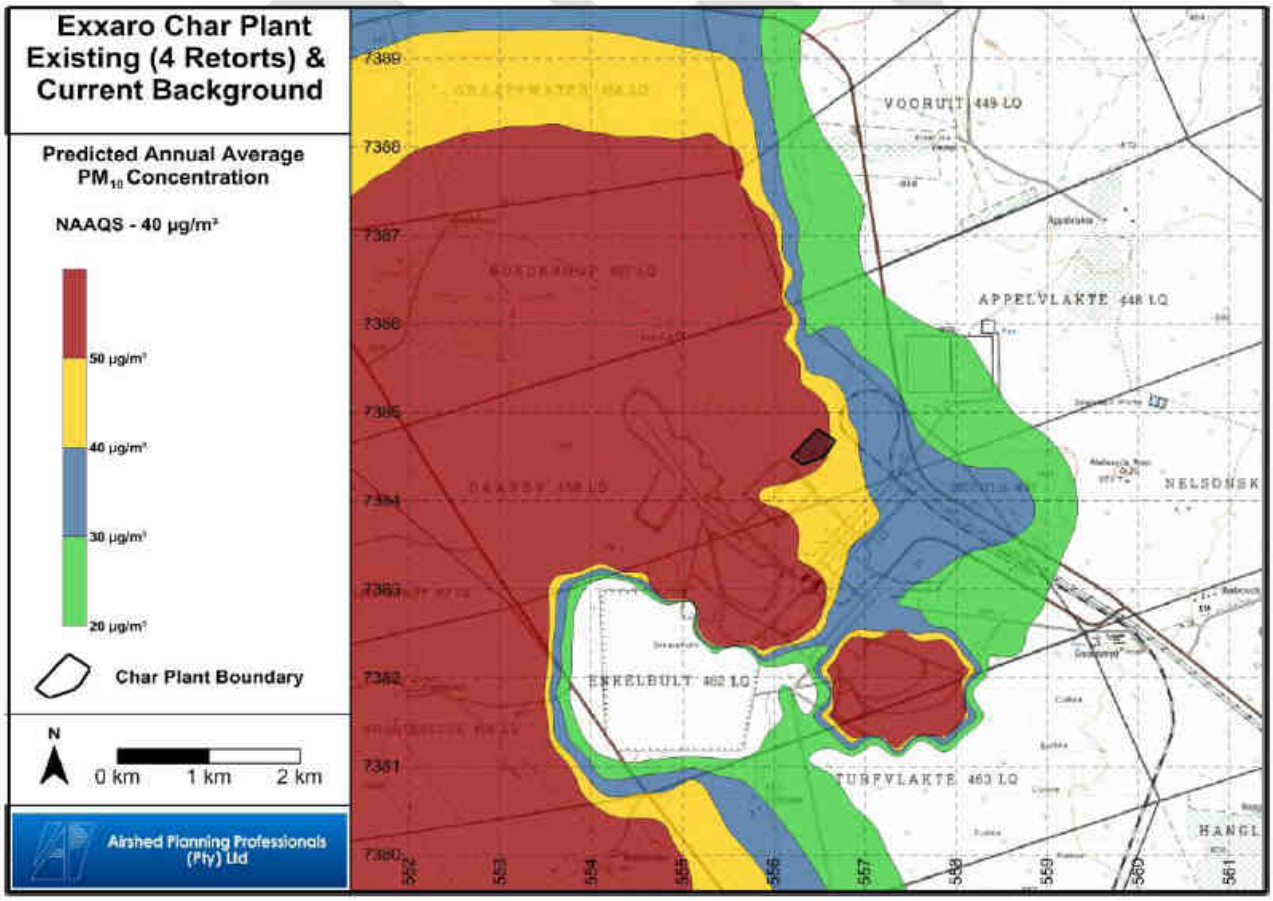


Figure 4.25: Predicted annual average baseline PM_{10} concentrations (Airshed, 2011)

Table 4.7: Predicted PM_{10} future baseline concentrations due to all sources within the region (exceedances of air quality limits are highlighted) (Airshed, 2011)

Receptor	Highest daily average (µg/m³)	Number of daily exceedances per year
Onverwacht	6	none
Marapong	**77**	3
Lephalale	16	none
Grootstryd	**105**	**7**
(a) NAAQS daily concentration limit value: 75 µg/³m was utilised (immediate compliance) with 4 allowable exceedances per year		

4.1.6 Surface Water

4.1.6.1 Surface Water Features

The overall pattern of surface water drainage in the area is north eastwards towards the Mokolo River, which then drains northwards towards the Limpopo River. The area drains via an unnamed tributary, which runs in an easterly direction, discharging into the Mokolo River approximately 20 km east of the site (Jones & Wagener, 2012) (figure 4.26).

The site is located in quaternary catchment A42J and the Sandloop and Mokolo Rivers which fall within this catchment are considered to be critically endangered river ecosystems (refer to Figure 4.27). The Mokolo River is approximately 810 m above sea level, while the mine is approximately 900 m above mean sea level. This results in an almost negligible gradient of 90:21000 m or 0.0043% (Bohlweki Environmental, 2006) and thus there is no fast flowing water and drainage from the area is slow. Surface water is found only after a rainfall event, and due to the relatively flat topography and sandy soil cover, most of the rainwater seeps into the groundwater aquifer. Small shallow pans or depressions occur in the veld where runoff may temporarily collect. There are no wetlands or dams located near the site. The nearest large dam is the Mokolo Dam located 41 km to the south east of the site.

The receiving water body, that is the point below which the project's impact on the catchment is considered to be negligible, is the Mokolo River at the confluence with the unnamed tributary which drains the site (Jones & Wagener, 2012). The receiving water body is an important concept as it implies that aspects related to surface water, e.g. surface water users, need only be defined down to that point. The use of the aforementioned location as the receiving water body is motivated on the following basis (Jones & Wagener, 2012):

- By the time the water reaches the Mokolo River, it is required to be suitable for use for all of the expected uses (drinking water, agricultural, industrial and aquatic ecosystems). Thus, by achieving compliance in terms of these, no additional impacts are expected downstream of the Mokolo River.
- Beyond the confluence with the Mokolo River, the potential impact of the plant becomes small due to the water volumes in the catchment and the dilution effects.
- The total area of the Char Manufacturing Plant Expansion site covers only 0.006% of the Mokolo River catchment and is therefore assumed to have a negligible potential impact on the catchment.

The Char Manufacturing Plant and proposed expansion site are located within the greater Grootegeluk Colliery dirty water area. Any spillage of contaminated water from the site is collected in Grootegeluk Colliery's Bosbok Dam and a Pollution Control Dam (PCD) (Jones & Wagener, 2012).

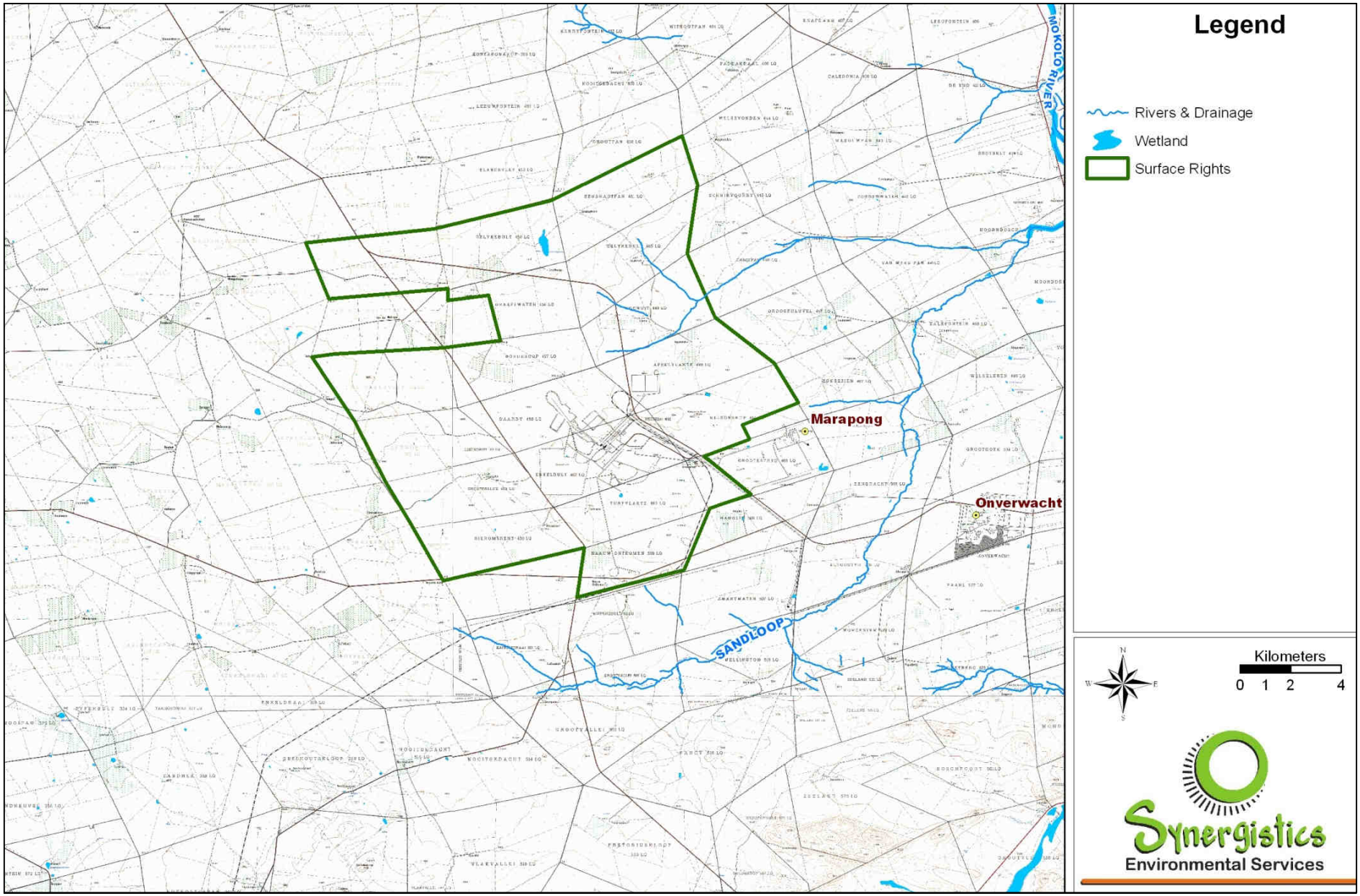


Figure 4.26: Surface Water Features in the Study Area

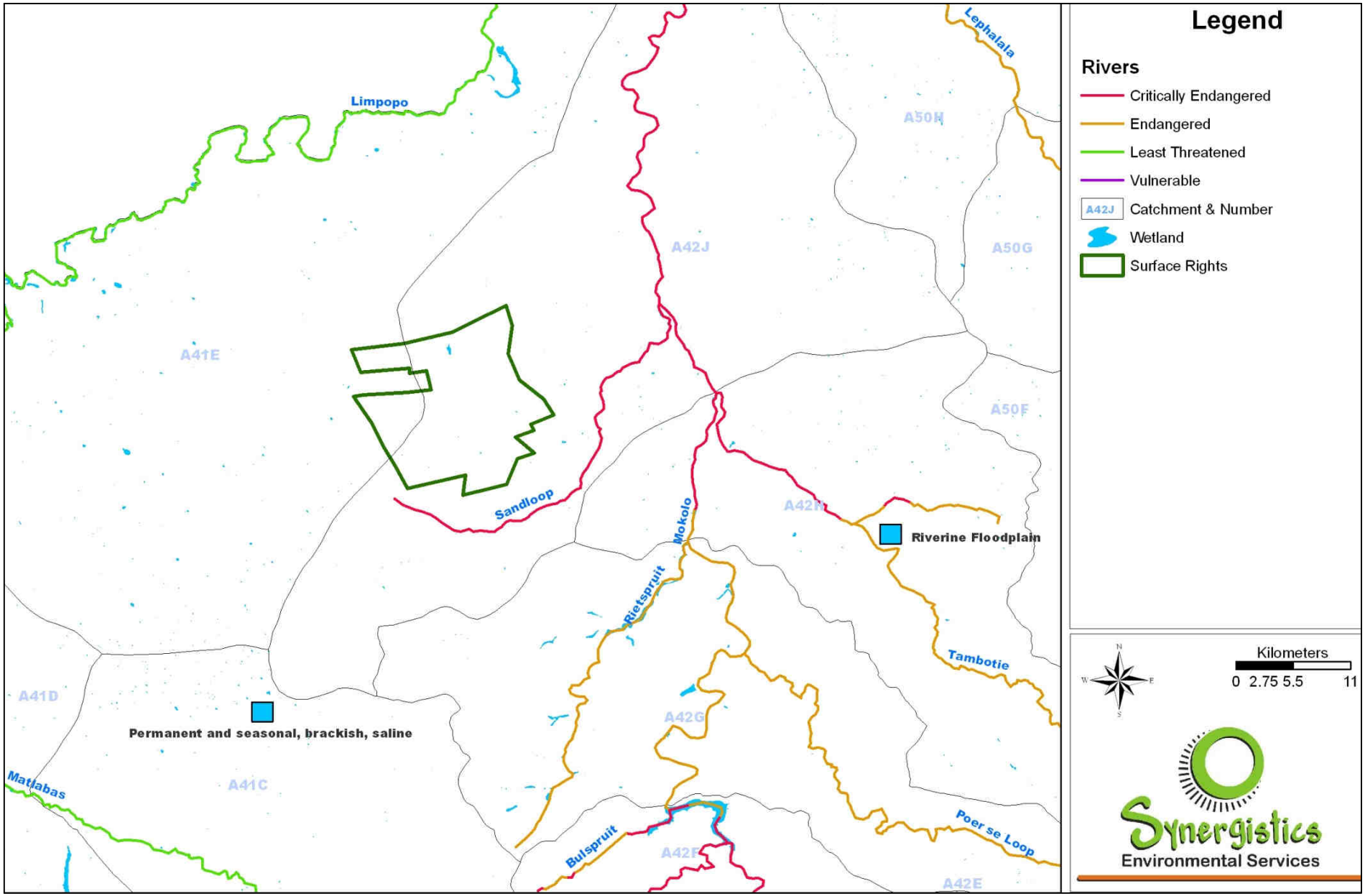


Figure 4.27: Quaternary Catchments and Conservation Status of River Ecosystems

4.1.6.2 Surface water quality

Sampling of the Existing Char Manufacturing Plant Pollution Control Dam (GES01 and GES02) (Figure 4.28) was carried out by Gondwana Environmental Solutions on 11 October 2010 and 16 March 2011, with analysis for selected inorganics and total hydrocarbons. As part of the surface water impact assessment, conducted by Jones and Wagener (2011), a single water quality sampling run was also undertaken on 14 October 2011, when grab samples were taken from the Sintel Char Manufacturing Plant Pollution Control Dam and Bosbok Dam (Figure 4.28). These were analysed for both inorganics and hydrocarbons.

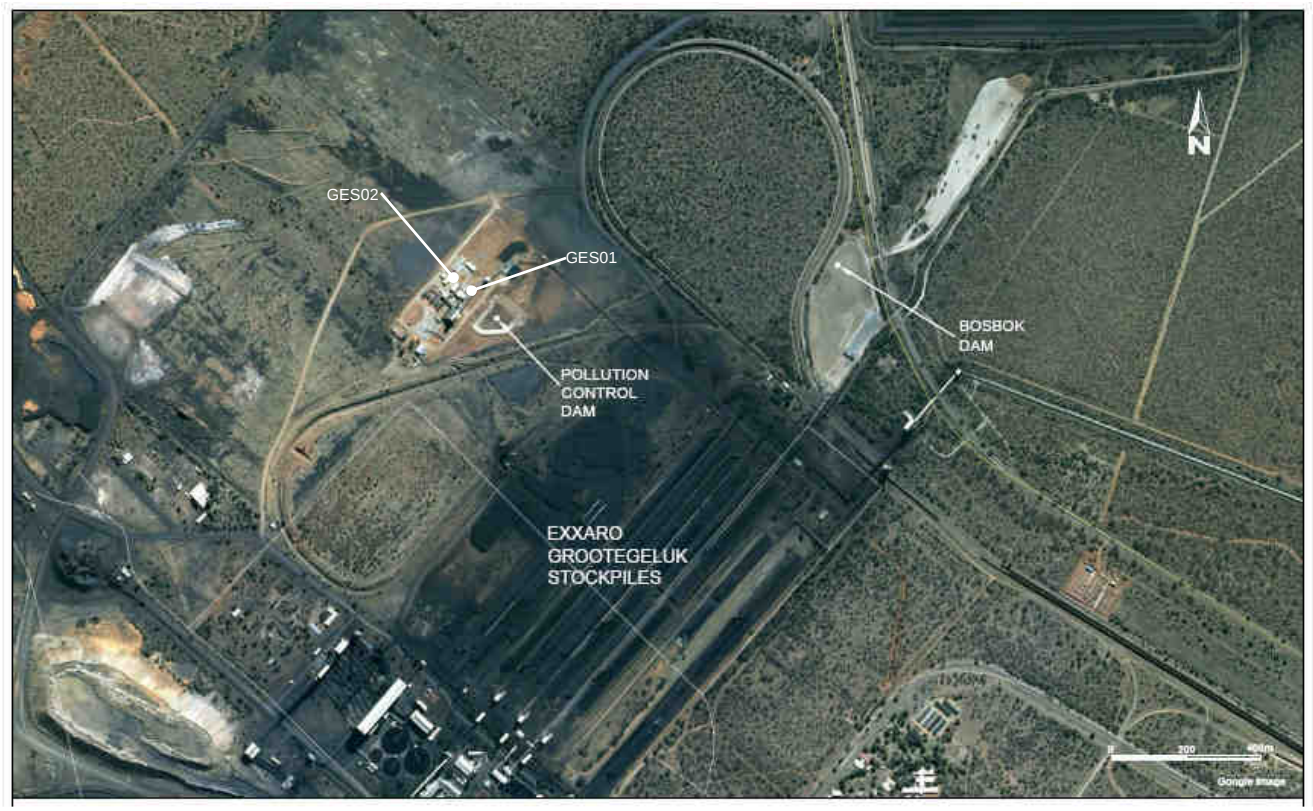


Figure 4.28: Water Quality Monitoring Sample Locations.

The results of the water quality monitoring conducted by Gondwana Environmental Solutions (Gondwana, 2010), are detailed in Table 4.8 below. Values shaded in red exceed the SANS 241: 2011 Standard limits for drinking water.

Table 4.8: Surface water quality for the Grootgeluk Char Manufacturing Plant, sampled by Gondwana (2010).

Parameter	SANS 241: 2011 Standard limits	Char Manufacturing Plant PCD			
		11 October 2010		16 March 2011	
Sample Code		GES01	GES02	GES01	GES02
pH (pH units)	≥ 5.0 to ≤ 9.5	6.56	6.59	7.22	7.17
Conductivity (mS/m)	≤170	207.1	206	260.7	261.4
Total Dissolved Solids (µg/L)	≤1200	1652	2190	2553	2224
Chloride (µg/L)	≤200	22.6	26.2	49.1	47.3
Nitrate (mg/L)	≤11	5.66	5.86	5.49	3.36
Sulphate (mg/L)	≤500	1115	1112	1904	1956
Aluminium as Al (µg/L)	≤300	<0.031	<0.031	<0.031	<0.031
Magnesium as Mg (µg/L)	≤70	106.69	110.04	68.62	66.09

Total Hydrocarbons (µg/L)		<1	<1	<1	<1

Levels of sulphate and magnesium were significantly above the upper limit prescribed for drinking water in SANS 241:2011 and thus posed a health risk. However, magnesium levels were below the Standard limits in samples taken in 2011. Levels of conductivity, total dissolved solids and nitrate were elevated and also exceeded the Standard limits. Conversely, hydrocarbons tested were all less than 1 µg/L. According to Gondwana (2010), this result was unexpected, since a visual inspection of the dam showed that hydrocarbons were, at least, on the surface of the dam.

The results of the water quality monitoring conducted by Jones and Wagener (2012) are detailed in Table 4.9 below.

Table 4.9: Surface water quality for the Grootgeluk Char Manufacturing Plant, sampled by Jones & Wagener (2011).

Parameter	SANS 241: 2011 Standard limits	Char Manufacturing Plant PCD	Bosbok Dam
Inorganics			
pH	≥ 5.0 to ≤ 9.5	8.7	8.1
Conductivity (mS/m)	≤170	370	290
Arsenic (mg/L)	≥ 0.010	0.0038	
Barium (mg/L)	NG	120	26
Cobalt (mg/L)	≥ 0.50	0.0026	0.0028
Molybdenum (mg/L)		0.012	0.0042
Nickel (mg/L)	≥ 0.07	0.0079	0.0072
Selenium (mg/L)	≥ 0.01	0.0092	0.012
Vanadium (mg/L)	≥ 0.2	0.0021	
Volatile Chlorinated Hydrocarbons	**Dutch Intervention Screening Guideline**		
Dichloromethane (µg/L)	0.2	0.8	-
Total Petroleum Hydrocarbons (TPH)			
TPH C10-C12 (µg/L)	15	13	
TPH C12-C16 (µg/L)	15	57	
TPH C16-C21 (µg/L)	15	54	
TPH C21-C30 (µg/L)	15	38	
TPH (sum C10-C40) (µg/L)	100	180	

Key: Screening Guidelines are according to the Dutch Intervention Limits.

Conductivity in the in both the PCD and the Bosbok Dam significantly exceeds the SANS standard, however this is not considered to be excessive considering the dams are designed to collect polluted water. A number of trace elements were detected at both the PCD and the Bosbok Dam, although none were found to exceed screening guidelines. Concentrations are generally lower in the Bosbok Dam than in the Char Manufacturing Plant.

In terms of the organic constituents measured (petroleum hydrocarbons, volatile chlorinated hydrocarbons), South Africa does not have health risk based screening guidelines. The Dutch Intervention Limits were thus used for screening purposes. The screening guidelines for drinking water have been included with the data in Table 4.9.

As was expected, petroleum hydrocarbons and volatile chlorinated hydrocarbons were detected within the Char Manufacturing Plant pollution control dam, with all measured parameters significantly exceeding the screening guideline values in the Char Manufacturing Plant PCD except for TPH C10-C12 (Table 4.9). Conversely, no hydrocarbons were detected within the Bosbok Dam, indicating that there is no overflow from Char Manufacturing Plant pollution control dam reporting to this dam.

4.1.6.3 Surface water quantity

As illustrated in the figure below, the Mean Annual Runoff (MAR) in the study area is approximately 4.1 mm per year (AGIS, 2004). The expected MAR for the site, the unnamed tributary into which water from the study site drains, and the Moloko River is presented in Table 4.10.

Table 4.10: MAR for catchments relevant to the Grootegeluk Char Manufacturing Plant (Jones & Wagener, 2012)

Description	Catchment area (km^2)	MAR ($m^3 \times 10^6$)	% of MAR at receiving water body
Existing Char Manufacturing Plant site	0.555	0.004	0.001
Unnamed tributary at confluence with Mokolo River	70.78	0.52	0.17
Mokolo River at Limpopo River	8 395	312.3	100

Because of the dry climate, the dry weather flow (flow that is equalled or exceeded 70% of the time) is expected to be zero.

Peak flows were calculated based on the parameters of the upper catchment of the unnamed tributary where the Char Manufacturing Plant is located. The catchment is small, with an area of 0.555 km^2 (Jones & Wagener, 2012). Table 4.11 presents the calculated peak flows for the catchment.

Table 4.11: Peak flows determined for the catchment draining past the Char Manufacturing Plant

Recurrence Interval	Peak flow (m^3/s)
1:2 year	1.7
1:5 year	2.5
1:10 year	3.4
1:20 year	4.4
1:50 year	6.0
1:100 year	7.8

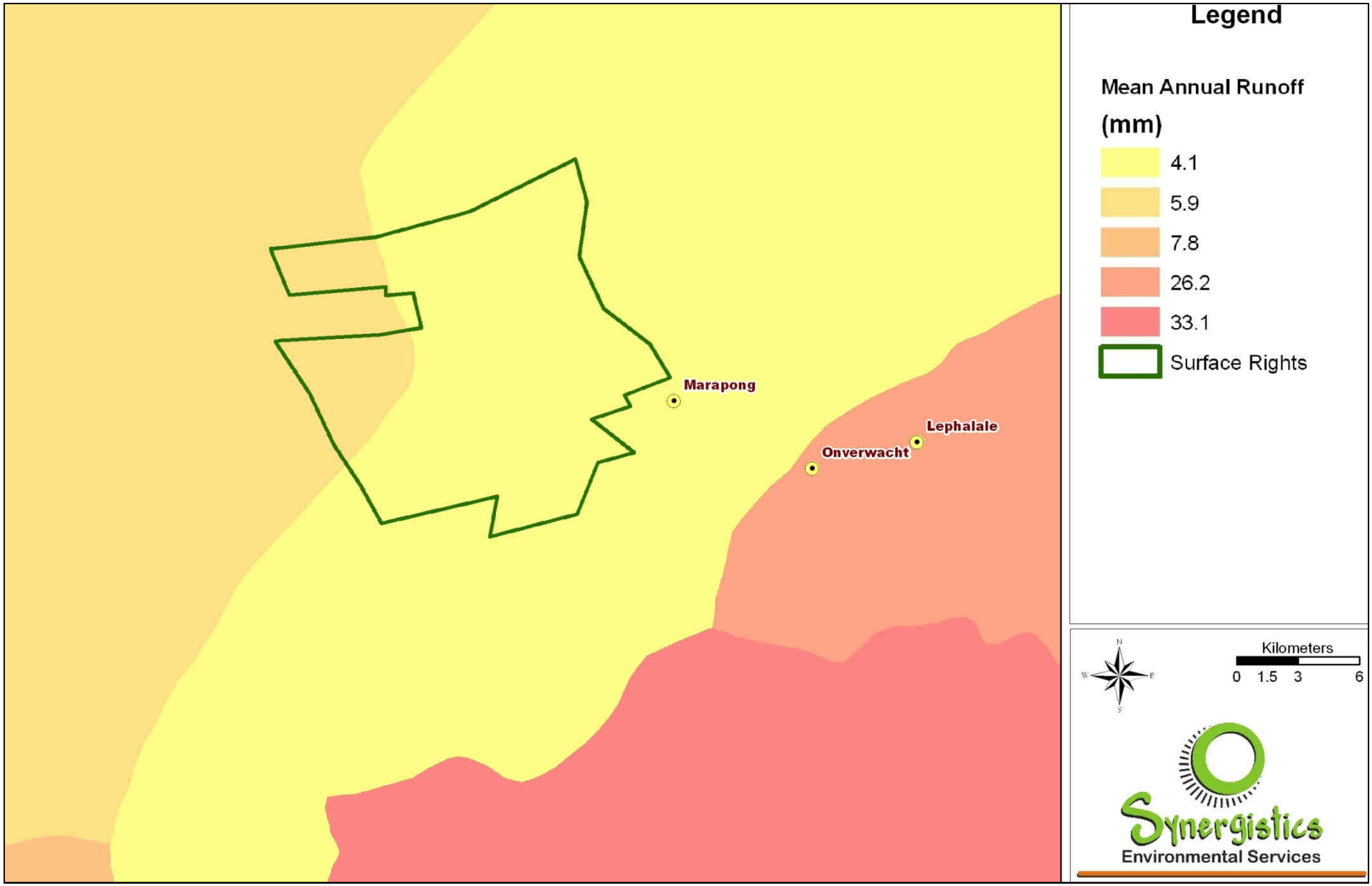


Figure 4.29: Mean Annual Runoff in the Study Area (AGIS Database, 2004)

4.1.6.4 Surface water use

The majority of the area surrounding Grootegeluk Mine is utilised for cattle and game farming. No crop cultivation (either dryland or irrigation) occurs due to the sandy soils and relatively low rainfall. The surrounding landowners are heavily reliant on groundwater (boreholes) since surface water is only available for a short period after rainfall events. Some of the surrounding landowners are supplied with water piped from the Mokolo Dam.

4.1.6.5 Water authority

The water authority responsible for the study area is the Department of Water Affairs, Limpopo Regional Office.

4.1.7 Groundwater

4.1.7.1 Regional Aquifers

The main feature from a geohydrological perspective is the Daarby fault, which divides the area into two major water compartments, described historically as the Northern and Southern water compartments (ERM, 2012). The Char Manufacturing Plant Expansion site is situated on the Northern Compartment and is underlain by the Letaba and Clarence formations.

Letaba Formation

This aquifer has the highest sustainable yields and transmissivity values as a result of fracturing and weathering (ERM, 2012). Sustainable yields of this aquifer are often above 2 L/s and ranging up to 12.7 L/s. The significance of the high transmissivity of this aquifer lies in that it could result in increased mobility of possible contaminants leaching into the groundwater zone (ERM, 2012).

Clarence Formation

The Clarens Formation has a lower transmissivity (0.01 – 10 m^2/d) than the Letaba Formation and is expected to be less conductive in terms of contaminant transport (ERM, 2012). It exhibits typical mounding in areas below unlined surface water features. Contamination is expected to be localized in relation to potential surface pollution generating areas. Faulting, fractures and joints within this unit will be more conductive to the movement of groundwater and transportation of possible contaminants.

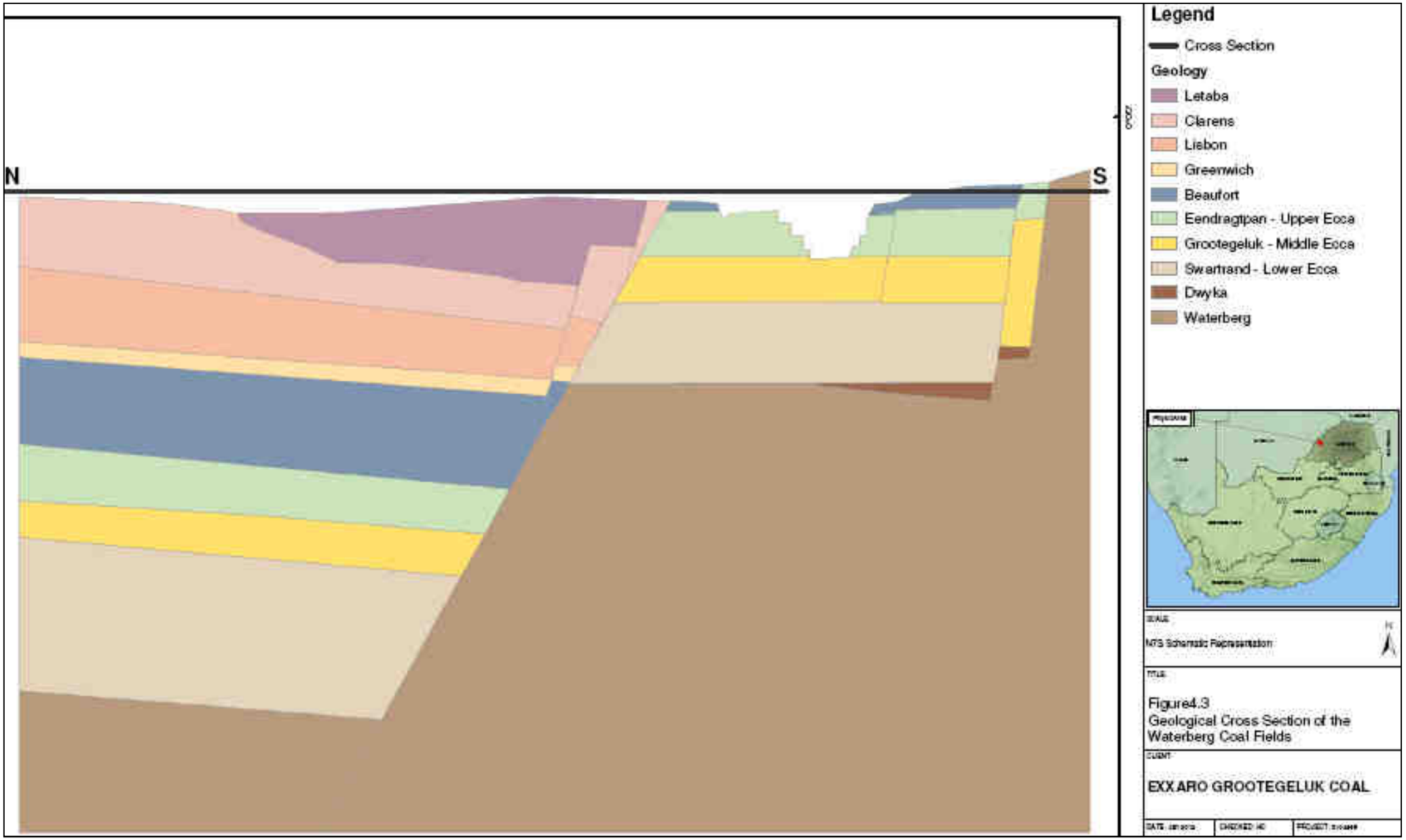


Figure 4.30: Geological Cross Section of the Waterberg Coal Fields (from ERM, 2012).

4.1.7.2 Groundwater Levels

Groundwater monitoring conducted at Grootegeluk Mine has revealed that groundwater levels in the underlying aquifer vary between 1.98 meters below ground level (mbgl) and 33.12 mbgl with 80% of boreholes sampled having a water level shallower than 20 mbgl (ERM, 2012). The groundwater level at the current Char Manufacturing Plant site is more than 14 mbgl with an average depth of approximately 20 mbgl (ERM, 2012)

The main feature identified is a cone of depression that has formed around the Grootegeluk mining pit due to abstraction of water to keep the pit dry (Figure 4.31). The cone extends for approximately 8.0 km from the exposed pit faces because of groundwater seepage towards the pit and the subsequent abstraction from the pit to enable dry mining conditions. Groundwater levels for 2009 show that the areas affected by groundwater depression still remain within land owned by Exxaro Coal (Figure 4.31).

4.1.7.3 Groundwater Receptors

Groundwater in the Lower Mokolo catchment area (catchment A42J), is used mainly for domestic supply, limited watering of gardens and livestock watering (ERM, 2012). Groundwater use in the catchment is relatively low due to the low aquifer yields as well as the abundant surface water available in the region. The low population density and low aquifer yields limit large-scale abstraction for irrigation and/ or other uses. As a result, the groundwater resources in the region are fairly underutilised (ERM, 2012).

The main receptor in the immediate vicinity of the Char Manufacturing Plant is the Grootegeluk Mine, which extracts groundwater through dewatering boreholes in the Letaba Basalt for use in dust suppression and the mine's processing plants (ERM, 2012).

Groundwater contribution to streams in Lower Mokolo catchment area (catchment A42J) is zero (DWAF, 2009). This implies that contaminants in the groundwater are highly unlikely to impact on streams in the area.

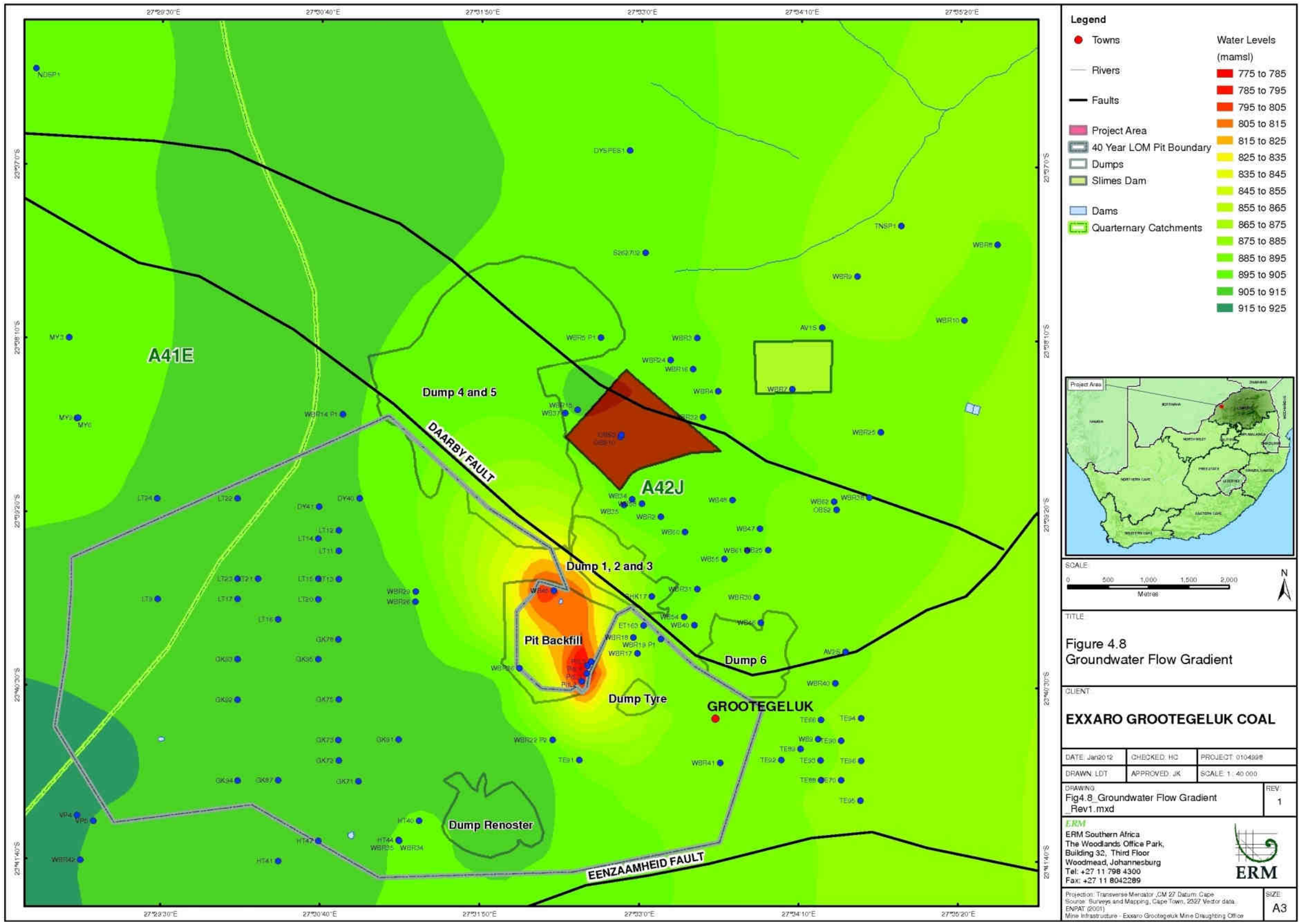


Figure 4.31: Groundwater Levels Around the proposed Char Manufacturing Plant (ERM, 2012)

4.1.7.4 Groundwater Quality

Contaminant Sources

The major sources of potential groundwater pollution associated with the existing Char Manufacturing Plant include (ERM, 2012):

- contaminated storm water runoff;
- process or quenching water contained within the dirty water containment facility (silt trap and PCD) possibly containing high phenol concentrations; and
- recharge of contaminated water by means of seepage from the PCD and any unlined storm water channels.

In addition, there are other potential surface pollution sources in the vicinity of the existing Char Manufacturing Plant, which are summarised in Table 4.12. The locations of the potential sources are shown in Figure 4.32. The summary includes the hydrochemisty of the water contained in/ at these facilities and highlights their most likely contaminants of concern.

Table 4.12: Source Areas and Contaminants of Concern (ERM, 2012)

Source Areas	Facilities	Contaminants of Concern
Hydrometallurgical plants	Existing Char Manufacturing Plant	Volatiles and hydrocarbon contaminants
Pollution control Dams	Bosbok dam, Olifants dam, dam 20 000	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se
Contaminated water, hydrocarbons from Diesel, oil and lubricants used in machinery	Mine workshop areas, plant areas	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se Hydrocarbons & Organic compounds
Fine residue	Slimes dam	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se
Course residue	Waste rock dumps 1 – 6, Coal stockpile area	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se
Stockpiles	Char feed and Char product	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se

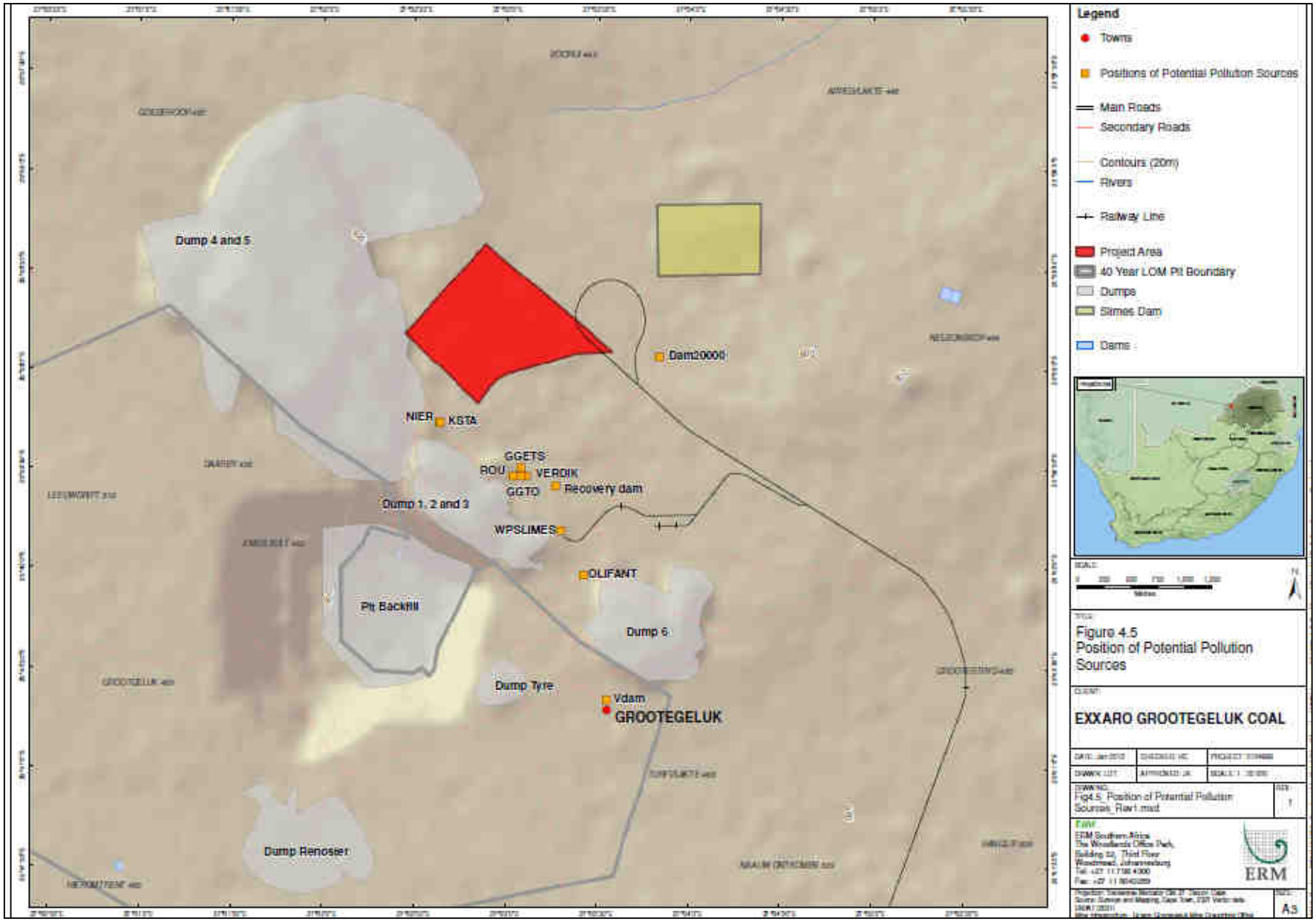


Figure 4.32: Position of Potential Groundwater Pollution Sources (ERM, 2012)

Historical Data

A large water quality database for Grootegeluk and surrounding areas exists from sampling conducted as part of Grootegeluk Mine's EMP. Due to the large database, ERM (2012) screened the data set to highlight water quality issues both from the site and the surrounding borehole users. Figure 4.34 depicts the boreholes that have been monitored for Grootegeluk and surrounding areas.

The groundwater quality results have been compared to the South African National Standards (SANS) 241 for drinking water (2011). This SANS standard is representative of water that is deemed to present an acceptable health risk for lifetime consumption (this implies an average consumption of 2 L of water per day for 70 years by a person that weighs 60 kg) (SANS 241-1, 2011).

pH and Alkalinity

The pH measured in all but two boreholes in November 2008 falls within the SANS drinking water standards and vary between pH 6 and pH 8 with an average pH of 7.4 (ERM, 2012). Boreholes WBR9 and WBR24 are situated directly west of Waste Dump No 4 and the Slimes dam respectively and had values of 3.2 and 3.4 in November 2008. Overall, a declining trend in pH has been noted in the two samples (Figure 4.33).

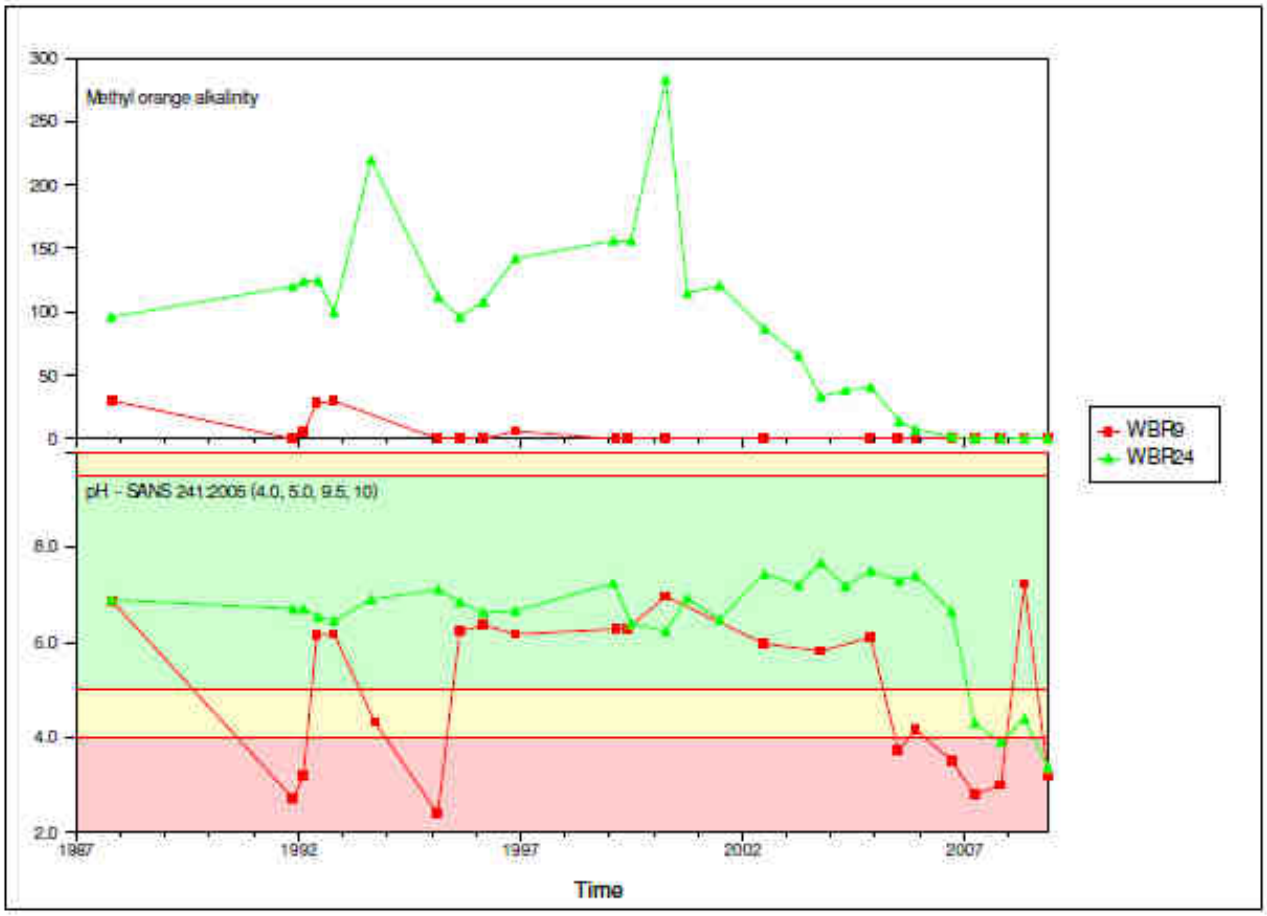


Figure 4.33: pH and Alkalinity in Samples WBR9 and WBR24 (ERM, 2012)

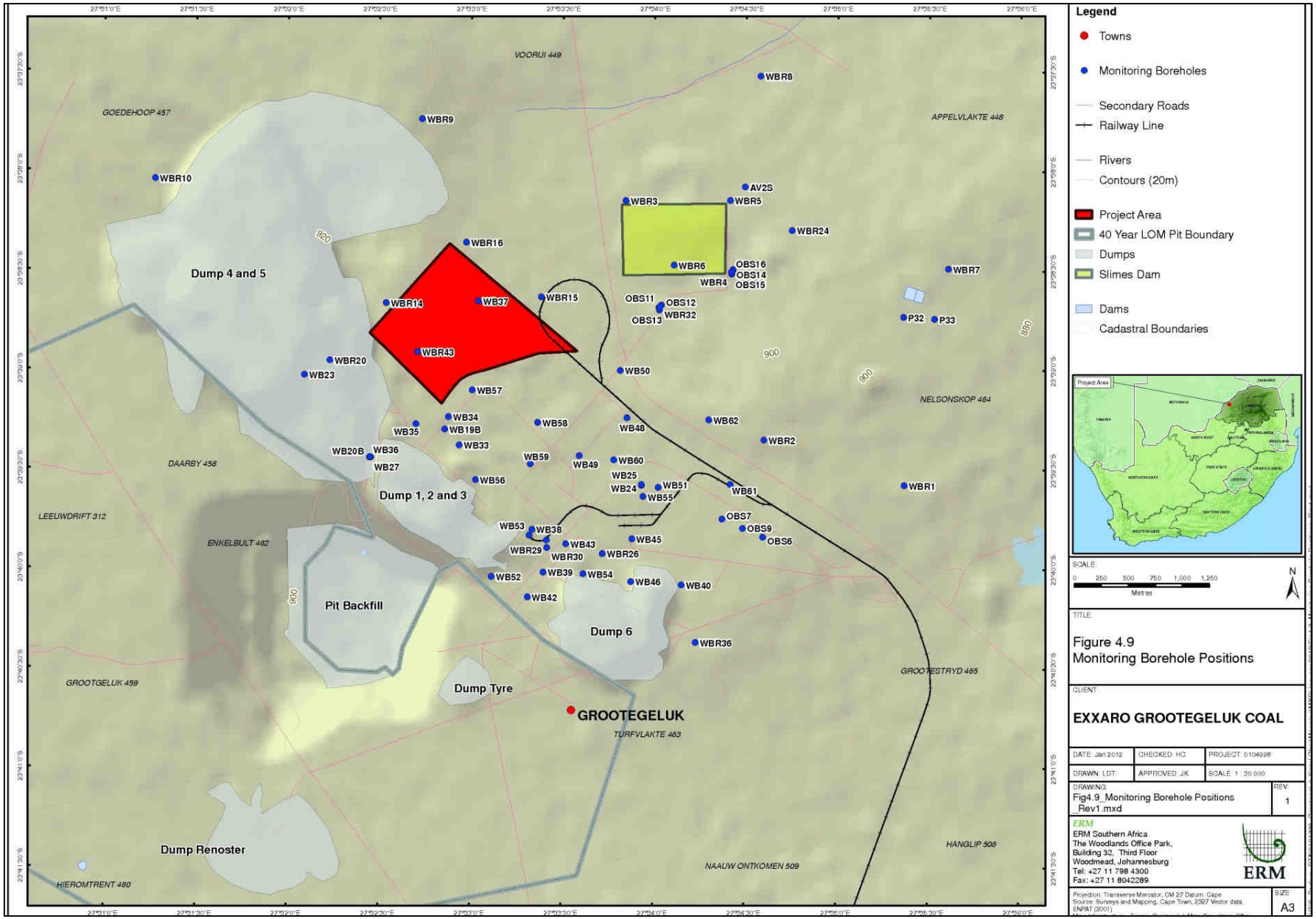


Figure 4.34: Monitoring Boreholes in the Greater Study Area (EMR, 2012).

Cations and Anions

The Total Dissolved Solids (TDS) values as measured in November 2008 exceed the SANS Drinking water standards in the majority of the samples taken (ERM, 2012). The observed TDS values are due to the presence of Ca, Mg, NO_3 and SO_4 in concentrations above recommended SANS Drinking water standards (ERM, 2012). A possible reason for this is leaching of these constituents from the waste rock dumps (Dump 1 – 6), the Kidney Discard stacker area, the Old Middling stockpile area and the current stockpile areas adjacent to the railway lines, to the shallow groundwater table present below these areas (ERM, 2012).

Table 4.13 lists the samples that exceed the SANS Drinking water standards in terms of cations and anions.

Table 4.13: Samples exceeding the SANS Drinking Water Standard (Anions and Cations)

Parameter	Samples exceeding SANS Standard Limit
Total dissolved solids (TDS)	WBR 8, WB 60, WBR 2, 3, 7, 9, 10, 15, 16, 26, 29, 30, 32, 36, 24, 43 WBR 4, 30,WB 29, 36, 48, 49, 58, 60
Sodium (Na)	P 32, WBR 8
Chloride (Cl)	WBR 3, 9, P 33, WBR 8, P 32
Nitrate (NO_3)	WBR 2, 10, 15, WB 19, 62, WBR 16, 36, WB 35, 58, P 32
Sulphate (SO_4)	WB 38, WBR 4, 29, 30, 43, WB 19B, 34, 35, 36, 39, 42, 45, 46, 48, 50, 54, 57, 58, 60

Metals

The concentration of metals such as Al, Cr, Co, Cu, F, Ni, V, and Zinc were all within the SANS drinking water guidelines. Conversely, concentrations of metals such as As, Sb, Cd, Pb, Mn and Se were elevated and exceeded the SANS drinking water guidelines in a large number of samples during the November 2008 sampling run (ERM, 2012).

Table 4.14 lists the samples that exceed the SANS Drinking water standards in terms of metals.

Table 4.14: Samples exceeding the SANS Drinking Water Standard (Metals)

Parameter	Samples exceeding SANS Standard Limit
Antimony (Sb)	WBR 8, WB 60, WBR 2, 3, 7, 9, 10, 15, 16, 26, 29, 30, 32, 36, 24, 43 WB 25,33, 34, 35, 36, 39, 40, 48, 58, 60, 61, 62, 19B
Arsenic (As)	WB 25, WBR 2, 4, 7, 8, 9, 10, 15, 16, 24, 26, 29, 30, 32, 36, 43 WB 19B, 33, 34, 35, 36, 39, 40, 48, 58, 90, 61, 62
Cadmium (Cd)	WBR 15, 43, WB 25, 48, WBR 2, 7, 9, 10, 16, 24, 26 WB 34, 35, 40
Iron (Fe)	WBR 9, 24
Lead (Pb)	WBR 2, 4, 26, 32, WBR 3, 7, 8, 9, 10, 15, 16, 24 WB 25, 34, 35, 62
Manganese (Mn)	WBR 3, 8, WB 25, WBR 4, 9, 24, 29, 30 WB 19B, 48
Selenium (Se)	WBR 2, 8, 9, 26, 32 WB 25, 35, 62

Current Investigation

Another sampling round was conducted in 2011 as part of the groundwater impact assessment for the Char Manufacturing Plant and is presented in Table 4.15 (ERM, 2012). Samples were taken from three boreholes, one up gradient (WBR15), one inside (WB58) and one down gradient of the Char Manufacturing Plant site (WBR43).

Table 4.15: 2011 Groundwater Quality Results (numbers in red indicate exceedence of the SANS 2011 Drinking Water Standard)

Parameter	SANS 241-1: 2011 Standard	WB58	WBR43	WBR15
pH	5 ≥ pH ≤ 9.7	6.1	6.6	6.7
EC (mS/m)	≤170	**330**	**220**	**220**
Antimony (mg/L)	≤ 0.02	-	-	
Arsenic (mg/L)	≤ 0.01	-	-	
Barium (mg/L)	NS	0.028	0.033	0.066
Cadmium (mg/L)	≤ 0.003	-	-	-
Chromium (mg/L)	≤ 0.05	0.008	-	-
Cobalt ((mg/L)	≤ 0.5	-	0.0014	0.0071
Copper (mg/L)	≤ 2	0.0053	0.009	0.0054
Lead (mg/L)	≤ 0.01	-	**0.036**	0.0049
Mercury (mg/L)	≤ 0.006	-	-	-
Nickel (mg/L)	≤ 0.07	-	0.0026	0.0186
Selenium (mg/L)	≤ 0.01	**0.012**	-	-
Uranium (mg/L)	≤ 0.015	-	-	-
Vanadium (mg/L)	≤ 0.2	0.097	0.02	-
Zinc (mg/L)	≤ 5	0.0076	0.047	0.04
Phenols (mg/L)	≤ 0.01	-	-	0.0006
2,3/3,5 –Dimethylphenol+ Ethylphenol (mg/L)	NS	-	0.00005	-
Phenanthrene (mg/L)	NS	-	0.00005	0.00003
2,4/2,5 Dichlorophenol (mg/ℓ)	NS	-	0.00003	-

The EC levels in the all the samples exceeded the SANS241-2011 standard limits for drinking water (SANS 241, 2011). Most metal concentrations are below the standard limits with the exception of lead (WBR43), selenium (WB58) and vanadium (WB58), which marginally exceed the standard limits.

A few organic compounds were detected namely phenols, chlorinated phenols and phenanthrene, a polycyclic aromatic hydrocarbon (PAH). However the concentrations of these compounds are at least two orders of magnitude below the SANS 241 standards. As the hydrocarbons were detected both up gradient and down gradient of the current Char Manufacturing Plant, the results indicate a regional impact to groundwater possibly related to current and historical stockpiling of coal in the area (ERM, 2012).

4.1.8 Noise

The proposed Char Manufacturing Plant expansion site will be located within the boundaries of Grootegeluk Coal Mine where the ambient noise level has already been impacted by the existing activities associated with the mining activity. Not only will blasting at Grootegeluk Mine have an impact on the noise level of the Char Manufacturing Plant expansion site and immediate surroundings, but also the use of heavy vehicles for coal and discard haulage, etc. The existing Char Manufacturing Plant will

also have an impact on the site of the proposed expansion adjacent to it.

4.2 Biological Environment

The footprint of the proposed Char Manufacturing Plant Expansion will be increased from approximately 8.1 ha to 54.6 ha. However, the proposed site has been previously disturbed by coal stockpiling undertaken for many years and the biological environment of the site is completely transformed. The possibility of species or habitats of significance being found at the site is therefore considered to be negligible.

4.2.1 Flora

4.2.1.1 Regional Vegetation

The proposed site is in the Savanna Biome and falls entirely within the Limpopo Sweet Bushveld vegetation type (Vcb 19), as described by Mucina and Rutherford (2006) (refer to Figure 4.35). This Bushveld type is widely distributed in the region and is characterised by a grassy ground layer and an upper layer of woody plants (Mucina and Rutherford, 2006). In disturbed areas thickets of *Acacia erubescens, Acacia mellifera* and *Dichrostachys cinerea* are almost impenetrable (NSS, 2010). Important plant species of the Limpopo Sweet Bushveld vegetation type are presented in Table 4.16.

Table 4.16: Important Plant Species in The Sweet Limpopo Bushveld.

Species Group	Important Taxa
Tall Trees	***Acacia robusta***(d)*,* ***Acacia burkei***
Small Trees	***Acacia erubescens***(d),***A. fleckii***(d), *A. nilotica* (d), *A. Senegal var rostrata* (d), *Albizia anthelmintica* (d)**,** ***Boscia albitrunca***(d)*,* ***Combretum apiculatum***(d),***Terminalia sericea***
Tall Shrubs	*Catophractes alexandri (d)**,*** ***Dichrostachys cinerea*** *(d), Phaeoptilum spinosum (d), Rhigozum obovatum (d),* ***Cadaba aphylla, Combretum hereroense****,* ***Commiphora pyracanthoides, Ehretia rigida subsp. rigida, Euclea undulate, Grewia flava, Gymnosporia senegalensis.***
Low Shrubs	*Acacia tenuispina* (d),***Commiphora africana****,* ***Felicia muricate****, Gossypium herbaceum subsp. africanum, Leucospaera bainesii.*
Gramminoids	***Digitaria erianthia subsp. erianthia***(d), *Enneapogon cenchroides* (d), *Eragrostis lehmanniana* (d),***Panicium coloratum***(d),***Schmidtia pappophoroides***(d)**,** ***Aristida congesta****, Cymbopogon nardus, Eragrostis pallens, E. rigidior, E. trichophora, Ischaemum afrum****,*** ***Panicum maximum****, Setaria verticillata, Stipagrostis uniplumis,* ***Urochloa mosambicensis****.*
Herbs	*Acanthosicyos naudinianus,* ***Commelina benghalensis****, Harpagophytum procumbens subsp. transvaalense, Hemizygia elliotii, Hermbstaedtia odorata, Indigofera daleoides.*
Succulent Herbs	*Kleinia fulgens, Plectranthus neochilus*

Source: Mucina & Rutherford (2006).
Key: (d)= dominant species; Species in bold indicate those identified in the study area

The conservation status of the Limpopo Sweet Bushveld is classified as Least Threatened. About 5% of the vegetation type has been transformed, mainly by cultivation. The area is good for game and cattle farming due to the high grazing capacity of sweet veld.

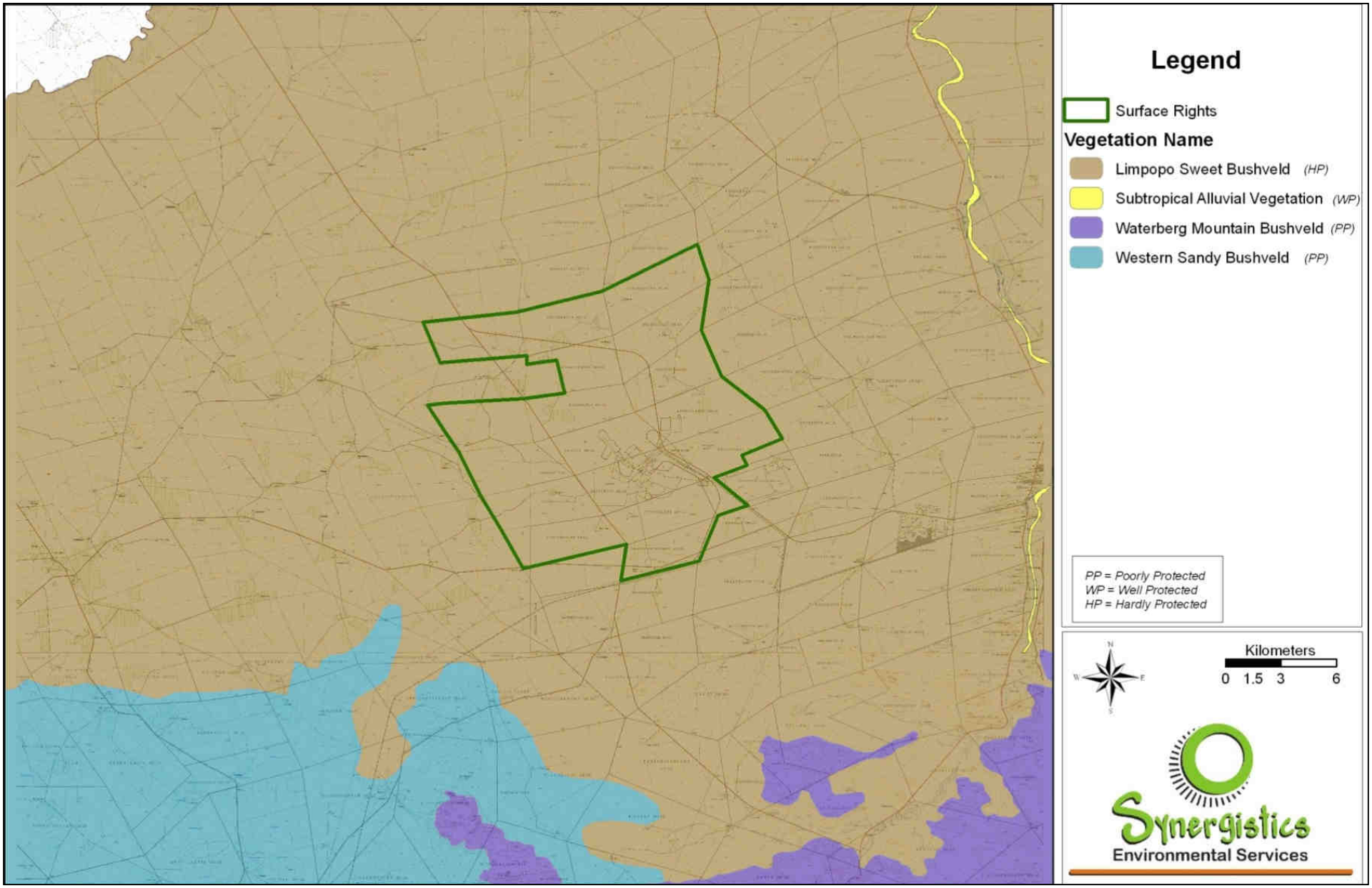
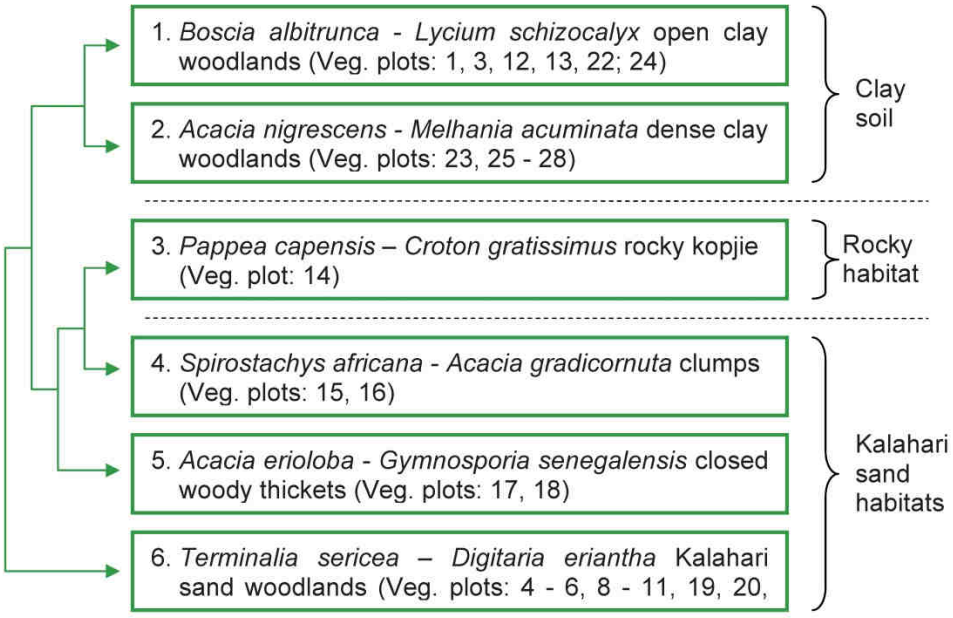


Figure 4.35: Boundaries of Regional Vegetation Types in the Study Area (AGIS, 2004)

4.2.1.2 Vegetation Units

Natural Scientific Services conducted a vegetation survey (NSS, 2010) of Grootegeluk Mine as part of an ecological impact assessment completed in 2010. Their results indicate that the greater Grootegeluk Mine study area is divided into six vegetation units, which include:



The vegetation varies from dense, short bushveld to open tree savannah (NSS, 2010). Variation in species composition is influenced by topography, soil depth and soil structure while the vegetation structure is determined by the fire and grazing regime (NSS, 2010).

Sclerocarya birrea (Marula tree) is the only species found in the greater Grootegeluk study area that is listed as protected under the Limpopo Environmental Management Act, 1998. SANBI lists five plant species with a Red Data status as occurring in vegetation units identified in the greater study area. However, only one species, *Acacia erioloba* (Camel thorn tree), was identified in the greater Grootegeluk study area with the other four unlikely to occur there (NSS, 2010).

The proposed Char expansion site falls entirely within the *Terminalia sericea – Digitaria eriantha* Kalahari sands woodlands vegetation unit which is the most widespread in the greater Grootegeluk study area (Figure 4.36) (NSS, 2010). *Terminalia sericea* is the dominant woody species occurring in this vegetation unit while the grass layer is strongly dominated by *Digitaria eriantha* (NSS, 2010).

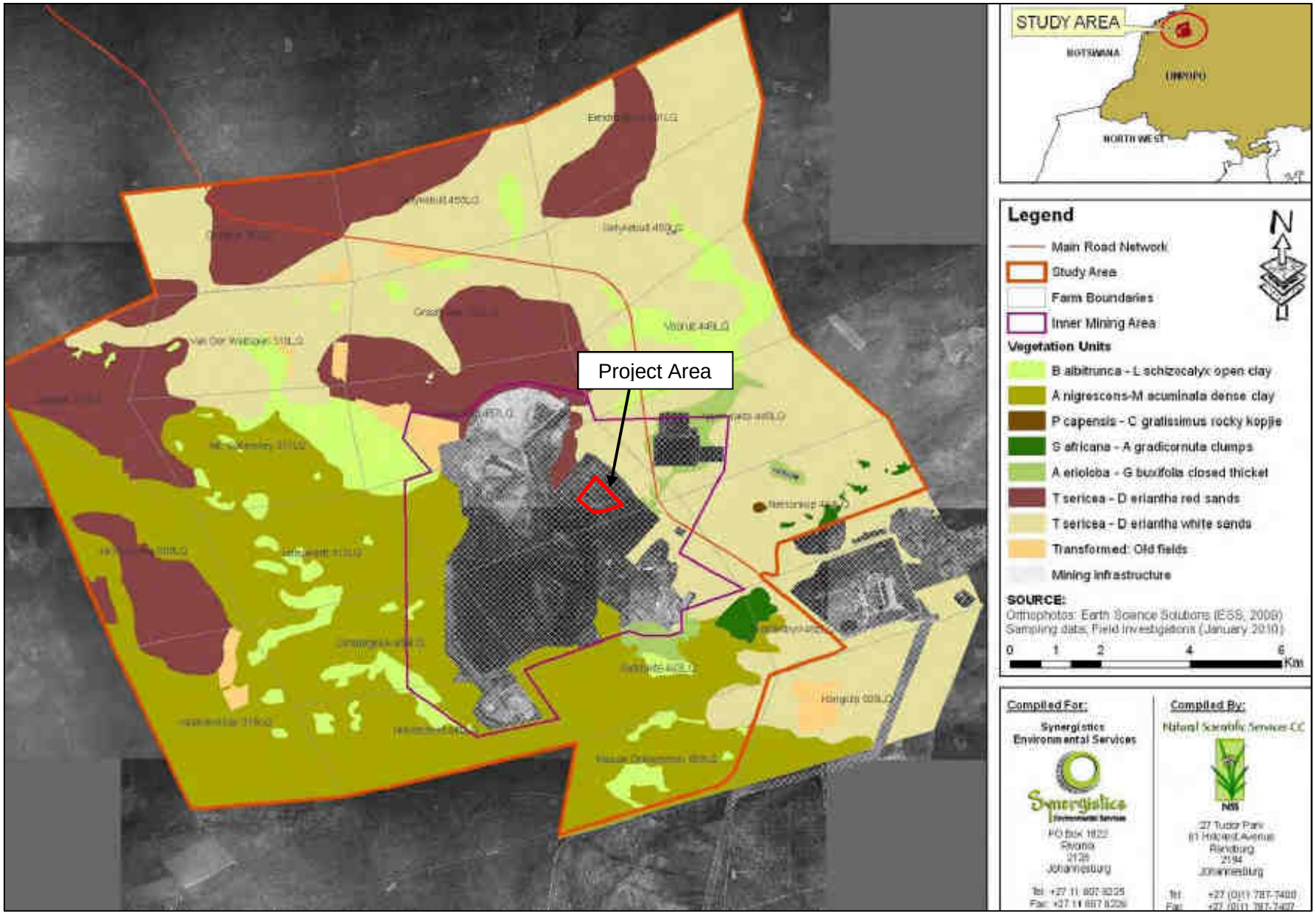


Figure 4.36: Boundaries of Vegetation Units in the greater Grootegeluk Mine Study Area (NSS, 2010)

4.2.2 Fauna

As already indicated, the proposed Char Manufacturing Plant Expansion site has been disturbed due to previous coal stockpiling activities. The site of the expansion of the Char Manufacturing Plant Expansion is still partially covered with a coal layer, which does not provide a suitable habitat for animal species. In addition, the location of the site adjacent to the existing Char Manufacturing Plant Expansion and close to other infrastructure, is also not suitable habitat for animals.

However, faunal surveys conducted by NSS in 2008 and 2010 confirmed that a large diversity of faunal species occur in the surrounding area. Numbers of faunal species identified during the in the greater Grootegeluk Study Area and surrounding areas is presented in Table 4.17.

Table 4.17: Numbers of faunal species (families for invertebrates) identified in the greater Grootegeluk Study Area (NSS, 2012).

Animal Group	Total for Study Area	Species Nearby (NSS, 2008)	Total Diversity
Mammals	43	6	49
Avifauna	94	65	159
Reptiles	18	10	28
Amphibians	10	3	13
Macro-invertebrates	41	7	48

4.2.2.1 Mammals

The study area supports a rich diversity of mammals. A large area of the greater Grootegeluk Study Area is managed as a nature reserve and has been stocked with a variety of large antelope and rhino species (NSS, 2010). The sex ratios and sizes of these populations are managed intensively to maintain a diversity of species and optimise the economic performance from the area (NSS, 2010). An impressive diversity of smaller mammals survives alongside the managed populations of larger mammals (NSS, 2010). These include carnivores, some of which thrive due to the significant conservation area with limited fragmentation by fences, roads and mining development (NSS, 2010).

A desktop study conducted by NSS (2010) identified 106 mammal species that can possibly be present in the region, of which 30 are Red Data species (Friedmann & Daly, 2004; NSS, 2010). The total mammal species identified represents a very large 63% of the provincial diversity of mammals (NSS, 2010). During their field survey, NSS (2010) identified 48 mammal species in the greater Grootegeluk study area, of which eight were red data species (Table 4.18). Sixteen of the 48 mammal species identified are considered to occur as managed or introduced populations.

Table 4.18: Red Data species identified in the Greater Study Area (NSS, 2012).

Species	Common Name	Red Data Status
Tatera leucogaster	Bushveld gerbil	data deficient species
Pipistrellus rusticus	Rusty pipistrelle	near threatened
Manis temminckii	Ground pangolin	vulnerable
Parahyaena brunnea	Brown hyaena	near threatened
Acinonyx jubatus	Cheetah	vulnerable
Diceros bicornis	Black rhinoceros (northeastern race)	vulnerable
Damaliscus lunatus	Tsessebe	endangered
Hippotragus niger	Sable	vulnerable

4.2.2.2 Birds

A potential of 394 bird species can possibly be present in the proposed areas of the development (Robert's,

2003 in Synergistics, 2006). Of the 394 birds recorded in the region, one is listed as endangered, namely the Saddle-billed Stork (*Ephippiorhynchus senegalensis*), 11 are listed as not threatened, 14 are listed as vulnerable species and 49 are listed as endemic species. A total of 27 Red Data species and 47 endemic species are listed by Robert's, 2003 in Synergistics, 2006 and can possibly be present at any given time.

During two field visits conducted by NSS in 2010, 94 bird species were identified (NSS, 2010). However, a combined list of birds including species from an adjacent area identified in a previous survey (NSS, 2008) has generated a list of 159 bird species for the greater study area. NSS confirmed the presence of three Red Data species in the greater study area, which include the White-backed Vulture (*Gyps africanus*) listed as vulnerable, the Kori Bustard (*Ardeotis kori*) also listed as vulnerable, and the Red-billed Oxpecker (*Buphagus erythrorhynchus*), listed as near threatened (Barnes, 2000; NSS, 2010).

4.2.2.3 Reptiles and Amphibians

The Limpopo Province supports at least 148 reptile species and 46 amphibian species with 11 being endemic to the province (SOER Limpopo, 2003). Potential species occurring in the greater study versus those identified during a survey conducted by NSS (2010) is listed in Table 4.19.

Table 4.19: Numbers of faunal species (families for invertebrates) identified in the greater Grootegeluk Study Area (NSS, 2012).

Animal Group	Potential Species	Species Recorded	Percentage Representation
Snakes	33	9	27%
Agamas, chameleons & lizards	37	12	32%
Geckos	10	4	40%
Crocodile	1	0	0%
Terrapins and tortoises	5	3	60%
Frogs	23	13	57%
Total	109	41	38%

The greater study area was found to be particularly rich in reptile species, with 28 species or 33% of the potential diversity has been shown to be present in the area during three field surveys. One reptile species identified in the area, namely the Southern African python (*Python natalensis*), is listed as vulnerable in the IUCN list of threatened species (Friedmann & Daly, 2004; NSS, 2010)

In all, 13 amphibian species, representing a 57% of the potential amphibian fauna, was confirmed as being present in the greater study area. Two conservation important amphibian species – *Pyxiecephalus adspesus* (Giant bullfrog) and *P. edulis* (African bullfrog), have been reported to occur in the clay pans in the west and south regions of the greater study area (Peter Scott *pers. comm.* in NSS, 2010). The Giant Bullfrog is listed as near threatened while the African Bullfrog is listed as a species of least concern in the IUCN Red Data species list.

4.3 Land Capability and Land Use

4.3.1 Land capability

Land capability is determined by the combination of soil capability and climate factors. A land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. The majority of the land in the Grootegeluk Mining area(and hence the Char Manufacturing Plant expansion area) falls within land capability classes V and VI (see Figure 4.37). Land in these classes has very limited potential for use as arable landand is generally used as grazing landor wildlife habitat.

According to the IAPs, the area was cultivated in the past, but that this activity no longer takes place, mainly due to decreased rainfall. A vast area (approximately 16 000 ha) is managed as a game farm by Ferroland, a division of Exxaro Coal.

4.3.2 Land use

As illustrated in Figure 4.38 below, the entire Grootegeluk Mine area is classified as grazing land. These soils are thus generally capable of sustaining palatable plant species on a sustainable basis. In addition, there should be no rocks in the upper horizons of any of the soil groups. If present, these would limit the land capability to wilderness land.

Figure 4.39, shows land cover in the study area which provides some more details regarding land use, as the land subject to mining and quarrying is indicated. This map also shows the very small portion of land which is being cultivated in the region.

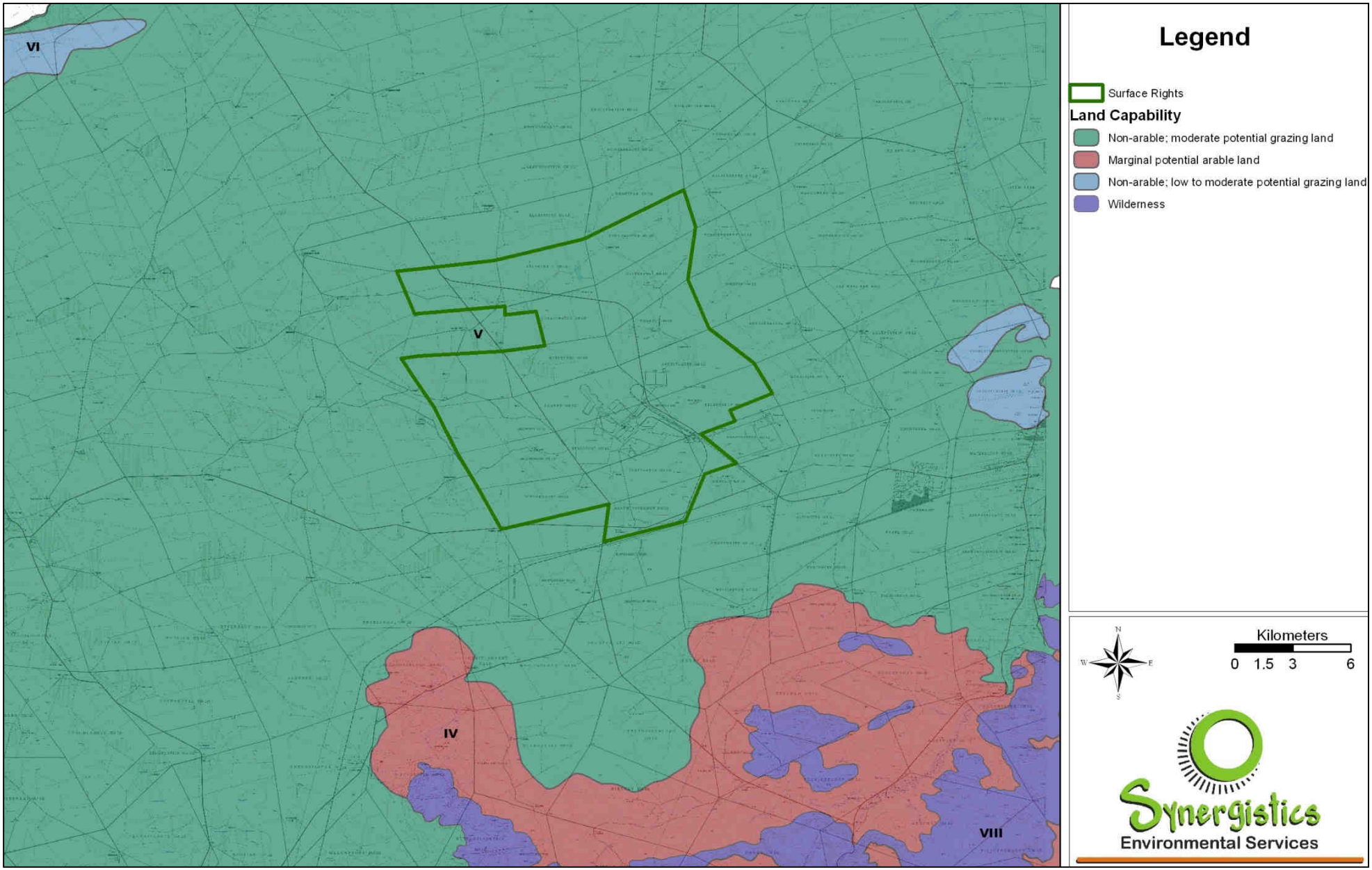

VI
V
IV
VIII
Legend
Surface Rights
Land Capability
Non-arable; moderate potential grazing land
Marginal potential arable land
Non-arable; low to moderate potential grazing land
Wilderness
N
W
E
S
Kilometers
0 1.5 3 6
Synergistics
Environmental Services

Figure 4.37: Land Capability in the Study Area

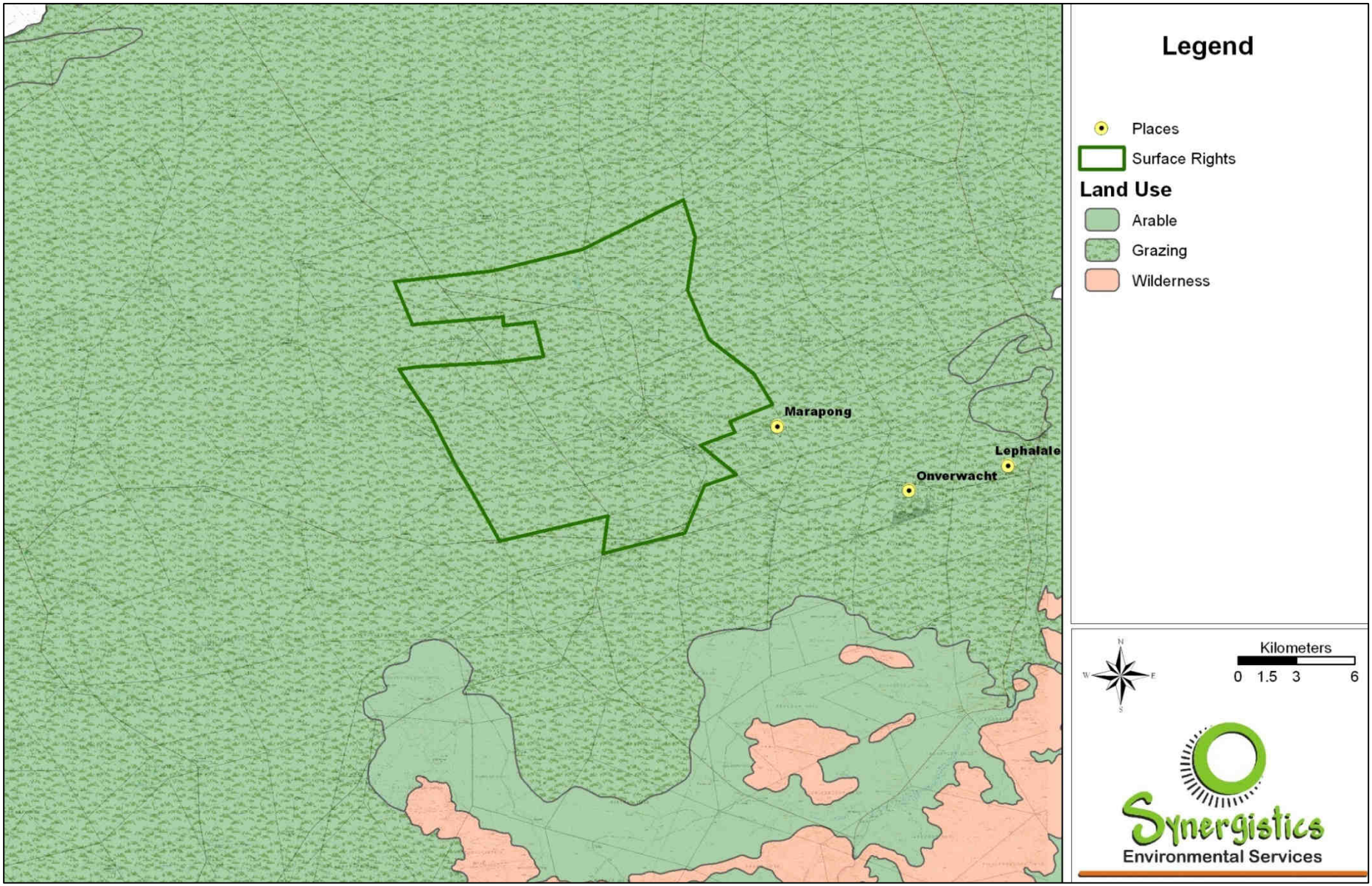


Figure 4.38: Land Use in the Study Area

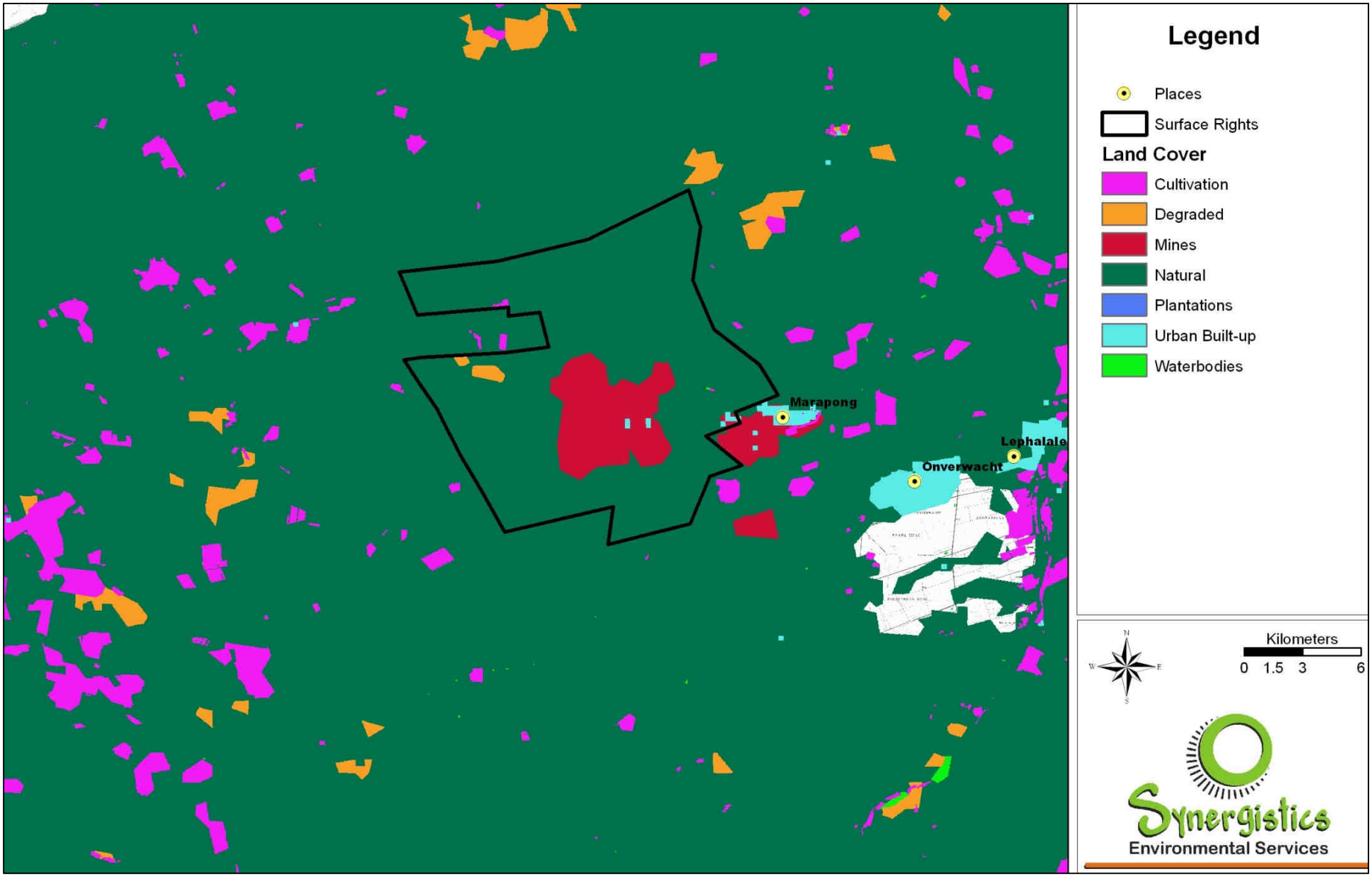


Figure 4.39: Land Cover Types in the Study Area (source Natural Scientific Services, 2010).

4.4 Land Tenure

The map below shows the farm names and locations of the farm boundaries. The Grootegeluk mining authorisation area is indicated with pink cross hatch. The proposed Char Manufacturing Plant expansion will take place on the farm Daarby 456LQ, entirely within the existing Grootegeluk mining area. Thus no other landowners will be directly affected by the development.

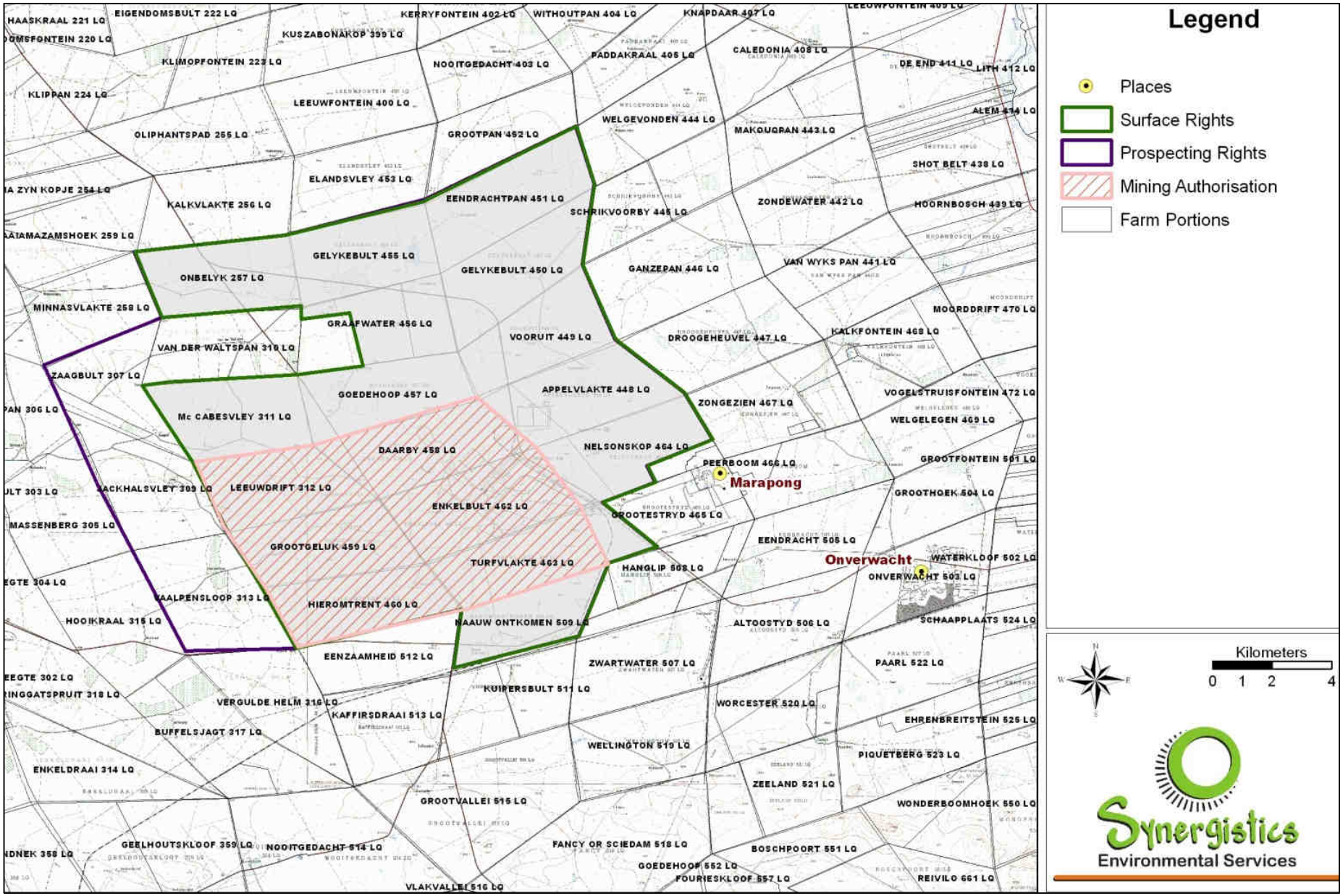


Figure 4.40: Farm Portions in the Study Area

4.5 Cultural and Heritage Resources

The footprint of the proposed Char Manufacturing Plant Expansion will be increased from approximately 8.1 ha to 54.6 ha. However, the proposed site has been previously disturbed by coal stockpiling undertaken for many years. The possibility of artefacts of cultural or heritage significance being located at the site is therefore considered to be negligible.

A phase one Heritage Impact Assessment was conducted for the entire mining rights area for the Exxaro Grootegeluk Mine, which includes the proposed site of the Char Manufacturing Plant Expansion (refer to Appendix 7). This report stated that due to the somewhat inhospitable environment, being hot and dry and with few sources of surface water, people did not settle in large numbers in the area in the past (National Cultural History Museum, 2005). As a result, only a few sites of cultural significance were identified in the study area (Figure 4.41). The results of this report indicate that the closest archaeological site to the proposed developments is on the farm Nelsonskop 3.16km away. This unique site is however considered to be of high archaeological significance, possibly religious significance and it has several engravings and artefacts (National Cultural History Museum, 2005).

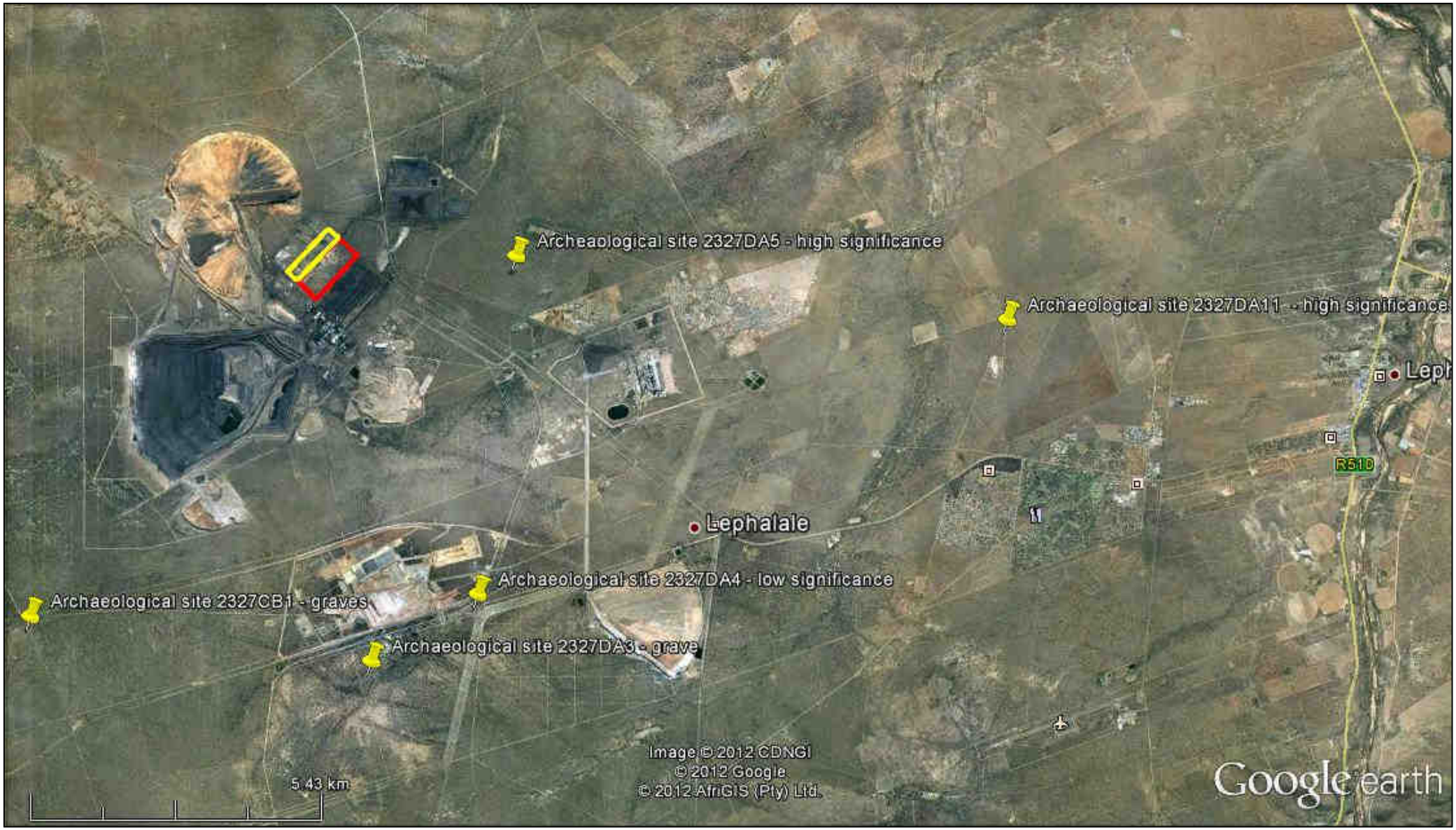


Figure 4.41: Archaeological sites in the vicinity of the Study Area

4.6 Traffic

The main access (M1) to Grootegeluk mine and the existing Char Manufacturing Plant is off Nelson Mandela Avenue (D2001) which links directly with Lephalale town (Figure 4.42). Access road M4 is currently used by employees. Presently, char is transported to Brits, eNtokozweni (previously Machadodorp) and Burgersfort. The main routes linking Lephalale to these destinations are the R510 (R511) to Brits, the R33 to eNtokozweni and the R518 to Burgersfort, as shown in Figure 4.43. Other roads currently used for product transport are the D1675, R517, R516 and R555.

As part of their Traffic Impact Assessment conducted in November 2011, WSP SA Civil and Structural Engineers (Pty) Ltd conducted a visual survey of roads used for transporting char products. The haul roads (D2001, R510, and R33) are all tarred and in good condition. A section of the D2001 between Grootegeluk mine and the residential areas along this road shows signs of failure (cracked surface, potholes and edge break). Potholes are also visible on the north-eastern approach of intersection M1. The road surface of the R510 is in a fairly good condition, however, at the time of the visual inspection, the road surface of the R33 was in a very poor condition due to significantly large potholes.

Electronic traffic counts, comprising 24-hour, classified (light and heavy) counts of vehicles in each direction, were carried out from Thursday 5 May 2011 to Wednesday 11 May 2011 at the intersections indicated in Figure 4.44. The seven-day average traffic volumes over 24 hours are summarised in Table 4.20 below.

Table 4.20: Seven-day Average Traffic Volumes (24 hours).

Station	Vehicles Classification	Counts (both directions)
E-1	Light	8607
	Heavy	1516
	All	10123
E-2	Light	6008
	Heavy	1848
	All	7856
E-3	Light	2329
	Heavy	587
	All	2916
E-4	Light	5101
	Heavy	557
	All	5658

Figure 4.42: Main Access Routes to Char Manufacturing Plant Site.

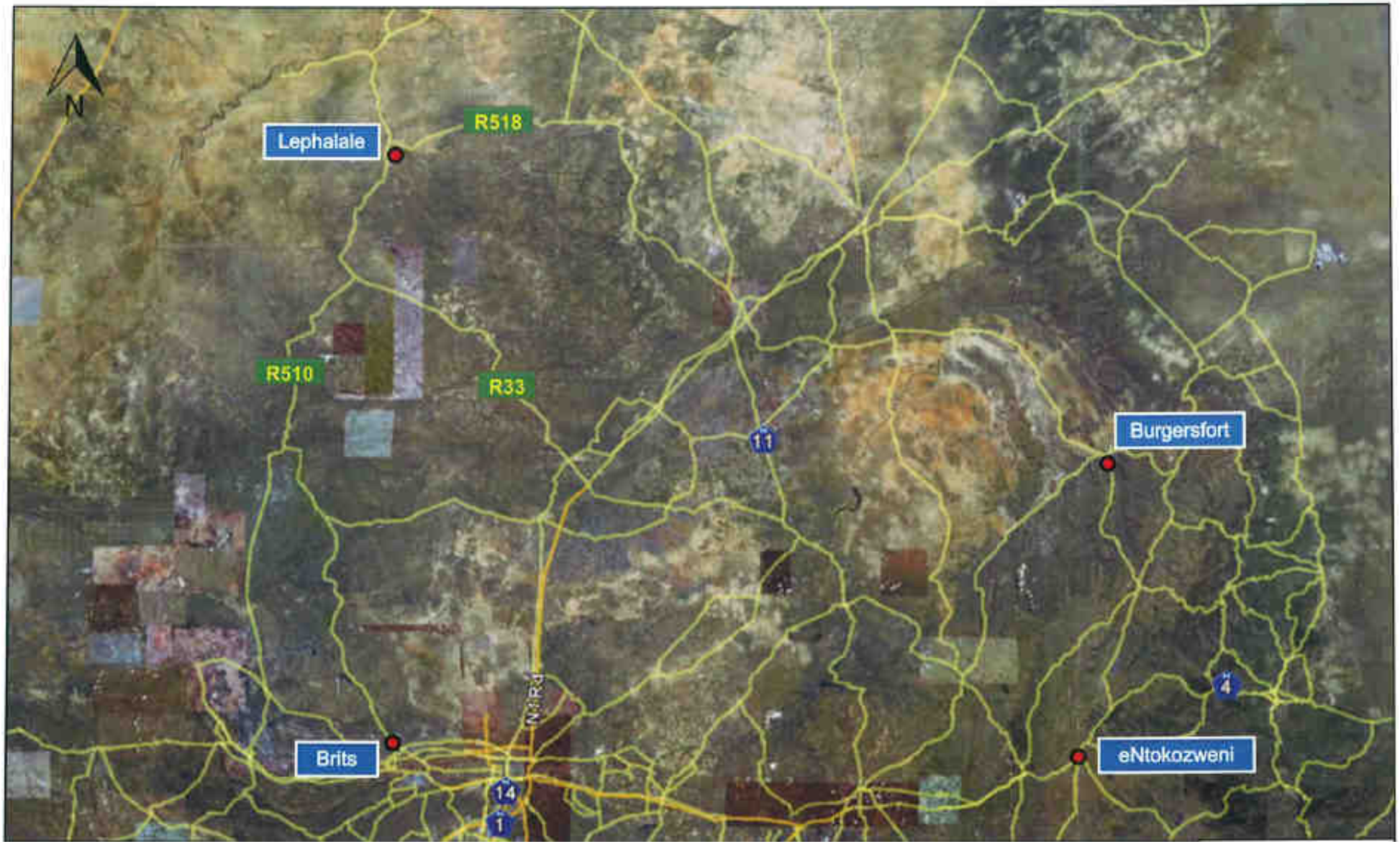


Figure 4.43: Char Destinations.

Figure 4.44: Electronic Survey Locations.

4.7 Visual Impacts

The proposed site location for the Char Manufacturing Plant expansion is located adjacent to the existing Char Manufacturing Plant and in close proximity to surrounding infrastructure, such as the rail loops and internal mine roads. The site would be visible from the surrounding infrastructure within the Grootegeluk Mine area e.g. rail loops, slimes dams, dumps, plants, etc. It would not be visible from the nearest residential area (Maropong) which is 6km away. The site may however be visible from the nearest road, the D2001 (a tarred provincial road) which is approximately 850m from the site. The expanded Char Manufacturing Plant would also be visible from various points within the Grootgeluk Coal Mine area.

4.8 Sense of Place

The proposed site is located within the boundaries of the Grootgeluk Coal Mine and the land uses directly adjacent are related to mining activities. The construction of the Char Manufacturing Plant expansion would not change the sense of place in the nearby vicinity. The close proximity of the Matimba and Medupi Power Stations also results in the area having a somewhat industrial feel.

A vast area spanning 16 000 ha, surrounding and including the Grootgeluk Coal Mine is managed as a game farm(Clean Stream, 2005).Property in private ownership within a 5 km radius of the mine is mainly utilised for cattle and game farming and no cultivation of crops (dryland or irrigated) takes place (Clean Stream, 2005).

4.9 Social and Economic Environment

The Grootegeluk Mine is located in the Lephalale Local Municipality, which falls within the Waterberg District Municipality. The Char Manufacturing Plant falls within the Lephalale local municipality, which in 2007 had an estimated population of 80 142 (Lephalale Local Municipality, 2008). The local population resides in the towns of Lephalale, Marapong and Onverwacht, and on farms in the area.

4.9.1 Economic Drivers

Economically, Lephalale is one of the fastest growing centres in South Africa. The main economic drivers of the local municipal area include (Lephalale Local Municipality, 2008):

- the Grootegeluk Mine;
- the Matimba and Medupi power stations;
- agriculture;
- livestock farming;
- the D'Nyala Nature Reserve; and
- hunting and eco-tourism.

Most formally employed people in Lephalale local municipality work in the agriculture sector (39%) while most of the Gross Domestic Product (GDP) comes from mining (59%) (Environomics & NRM Consulting, 2010). The area also has extensive hunting and eco-tourism sectors, however these are very small in comparison. Table 4.21 below summarises the contribution of economic sectors in terms of GDP and employment for Lephalale local municipality.

Table 4.21: GDP contribution per sector of Lephalale, 2005 (NRM Consulting, 2010)

Sectors	GDP%	Sectoral Employment %
Agriculture	3.33	38.85

Mining	59.21	7.89
Manufacturing	4.08	6.75
Electricity	11.33	2.14
Construction	0.54	2.94
Wholesale	2.09	7.76
Transport	7.36	2.08
Finance	6.80	6.60
Community services	2.04	15.71
Government services	3.23	9.29
Total	100	100

4.9.2 Economic Potential

The Lephalale Local Municipality is seen as an area with high economic growth potential, due mainly to the positive outlook for mining and electricity generation around Lephalale (Lephalale Local Municipality, 2012). The Waterberg Coal Field in Lephalale is the biggest coal field in South Arica in terms of *in situ* reserves, and with the Grootegeluk Mine planning to expand its coal mining operations, mining is likely to play an ever more important role in the area's future economic development. In terms of power generation, a second power station (Medupi) is currently being constructed at a cost of R26 billion near Lephalale, with a third one being considered due to the large coal reserves in the area. The area is also seen as having considerable agricultural potential (Lephalale Local Municipality, 2012).

Other major projects anticipated for the Lephalale Local Municipality area include:

- a projected Sasol Plant;
- upgrading of the Matimba Power Station;
- further exploration of the other mineral rich areas; and
- the proposed privatisation of the D'Nyala and the Mokolo Dam Nature Reserve - in order to utilise the reserves more economically and to be able to provide better services to tourists.

4.9.3 Population and Social Environment

The local population has increased considerably since the early 1980s due largely to the strong economic growth of the area in that time. The population of the then Ellisras (now Lephalale) stood at 500, however with development of the Grootegeluk Mine and Matimba and Medupi Power Stations, the population in Lephalale (including Marapong and its Extensions) grew to some 18000 to 19000 people (Lephalale Local Municipality, 2012).

With this increase in population, significant development of social infrastructure has occurred. A number of schools (primary and secondary), recreational facilities (golf course, tennis court, soccer, athletics, and rugby sports field) as well as a hospital have been established (Environomics & NRM Consulting, 2010). There is also a high demand for housing in the local area. It is estimated that within the next 5 years, 5000 additional residential units have to be built in Lephalale and Marapong to ensure that the demand for housing is met. However, the municipality have indicated that they do not have the land available for further expansion.

Table 4.22 presents the population of Lephalale Local Municipality, divided by age and gender for 2001 and 2007. According to census figures, a 20% decline in population has occurred from 2001 to 2007. However, this decline is due mainly to a shift in municipal boundaries, which has resulted in a smaller population for the Lephalale local municipality (Environomics & NRM Consulting, 2010). A high proportion (55%) of individuals in the population is younger than 25 years of age. This is typical for South Africa and indicates a high birth rate in the area.

Table 4.22: Lephalale Local Municipality Population – Age and gender (NRM Consulting, 2010)

	2001			2007		
Age	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
0-4	5490	5345	10835	4535	4688	9223
5-9	5638	5520	11153	4809	4726	9535
10-14	5679	5644	11323	4512	4747	9259
15-19	5302	6527	10729	4138	4717	8855
20-24	4631	4881	9512	3873	3461	7334
25-29	4106	4390	8496	3222	2797	6073
30-34	3445	3518	6963	3529	2764	6293
35-39	3099	3403	6502	2260	1963	4223
40-44	2579	2495	5074	1795	2474	4369
45-49	1918	2245	4163	1639	1424	3063
50-54	1461	1637	3098	1298	1722	3020
55-59	1012	1052	2064	1135	1149	2286
60-64	923	1090	2013	665	1303	1968
65-69	568	930	1468	388	1251	1639
70-74	495	650	1145	384	907	1291
75-79	266	365	631	272	487	759
80-84	220	316	536	84	365	449
85+	150	216	366	217	340	557
Sub-total	**46982**	**49124**	**96106**	**38857**	**41285**	**80142**

The table below presents the annual household income for the Lephalale local municipality. The most striking feature is the exceptionally high unemployment figure, with 31% of households earning no formal income. Despite the high unemployment figures, approximately 80% of households live in formal dwellings, while roughly equal proportions of the remainder live either in traditional or informal dwellings (Lephalale Local Municipality, 2008).

INCOME LEVEL	**HOUSEHOLD**	
	NUMBER	**PERCENTAGE**
None	15 381	31,3%
R0-R2400	2 537	5,1%
R2401-R6000	3 604	7,3%
R6001-R12 000	4 060	8,2%
R12 001-R18 000	5 396	10,9%
R18 001-R30 000	4 534	9,2%
R30 001-R42 000	3 385	6,8%
R42 001-R54 000	2 253	4,5%
R54 001-R72 000	1 809	5,2%
R72 001-R96 000	1 554	3,6%
R96 001-R132 000	1 314	2,6%
R132 001-R192 000	1 169	2,3%
R192 001-R360 000	1 088	2,2%
R361 000+	1 064	2,1%
TOTAL	**49 148**	**100%**

Source: Global insight 2007

5. Results of Consultation with Interested and Affected Parties

A detailed public participation report is included in Appendix 1. This report provides further details of the public participation process that was followed for the EIA process. Table 5.1 and Table 5.2 below provide the issues raised by IAPs for the project and the project response to the comments.

Table 5.1: Authorities Comments and Issues of Concern

No.	Authority	Authority Comments
1.	LEDET	An in depth Air Quality Study taking into consideration suitable abatement technology should be undertaken.
2.		Proof, which will take into consideration the amendments of the Integrated Water Use Licence Application (IWULA), submitted to the Department of Water Affairs (DWA), must be provided.
3.		Proof that an EMP in accordance with the MPRDA, submitted to the DMR for approval, must be provided,
4.		Proof that a Waste Management Licence application in accordance to NEMWA has been submitted to the Department of Environmental Affairs (DEA) must be provided.
5.		Proof of the Atmospheric Emission Licence in accordance with NEMAQA must be provided.
6.		Proof confirming that South African Heritage Resource Agency (SAHRA) was consulted must be provided.
7.		The surface water studies undertaken by Jones and Wagener Engineers must be incorporated in the EIR.
8.		Feasible methods for managing the existing waste sludge produced at the Char Manufacturing Plant must be adequately addressed.
9.	LEDET	The existing waste management plan must be incorporated in the EIR and the EMP.
10.		Designs of the plant must take into consideration for the minimisation of SO_2 and CO_2 and the possible impacts of acid rain must be addressed in the EIR.
11.		Alternatives for lining of the waste water dams must be identified and addressed and the best option recommended.
12.		The groundwater specialist must recommend suitable measures to mitigate potential groundwater pollution from the stockpiles.
13.		The water specialist study must recommend feasible measures of recycling of water in order to address water and salt balance.
14.		The existing IWWM, as well as the Environmental Management Framework by Waterberg Local Municipality must be incorporated in the EIR.
15.		The EIR must indicate the adequacy of the capacity of the pollution control dam to accommodate the proposed project.
16.		Provide proof of where additional water will be obtained as the DWA has indicated that the existing allocation, which is inadequate to support the expansion, is the maximum the Char operation can be provided.
17.		Proof of agreements that are in place regarding, for example the provision of water and electricity, must be provided.
18.		From a site visit, it was noted that the stockpiling area was not adequately managed. Provide comment on management measures and improvements which will be put in place to rectify this issue.
19.		General waste management must be reported on. This includes issues such as the availability of bins, the disposal of contaminated Personal Protective Equipment (PPE).
20.	LEDET	Discuss how vegetation will be managed following the upgrade of the pollution control dam, i.e. how much will be removed and whether cleared areas will be revegetated after construction.

No.	Authority	Authority Comments
21.		No energy alternatives were considered during the scoping phase. This must be evaluated in the EIR.
22.		The management of extra sludge (hazardous waste) produced at the Char Manufacturing Plant must be elaborated on in the EIR.
23.		Ensure the exact size of the expansion is noted in the documentation as no deviations after issuing of the Record of Decision (ROD) can be accepted.
24.		Address cumulative impacts.
25.		Clearly show all the links with Grootegeluk and other role players in the area with regards to movement of coal, waste, product, electricity, etc.
26.		As the Char Manufacturing Plant is already running, and this project is an expansion, there should be an existing management plan that needs be reflected in the documentation.
27.		From the documentation it is not clear that this is a highly disturbed area.
28.		Ensure that the documentation highlight if the project will improve some of the disturbed areas.
29.		The area where the expansion is to take place, what needs to be cleared (vegetation?), be clear on the current state (baseline).
30.	DMR	Although this is an expansion, alternatives should be listed in the report.
31.		Specialist studies with regard to water, heritage and others must be done.
32.		All issues and concerns raised by IAPs need to be addressed.
33.		The closure objectives must be described.

Table 5.2: IAP Issues and Concerns, with Responses and References to Report Sections where Issues and Concerns are addressed

No.	IAP Issues	Response to IAP Issues / Reference to Report Section where IAP Issues are Addressed	Reference
1.	When will the construction of the expansion project begin?	Guillaume de Swart – Exxaro (GS) answered that construction is scheduled to begin in the third quarter of 2011.	Stakeholder at the meeting (11 August 2010)
2.	Will the pollution control dam remain the same size? Is the capacity adequate for the expansion project?	GS answered that the pollution control dam is currently sized for 8 retorts and the size will therefore be sufficient for an additional 4 retorts. Vivienne Vorster – Synergistics (VV) added that the surface water specialist study, undertaken by Jones and Wagner Engineers will verify whether the size is sufficient.	Stakeholder at the meeting (11 August 2010)
3.	Will any additional water be required for the expansion project?	GS said that potable water requirements will remain roughly the same, as employment numbers will only increase slightly. Raw water required for use in the boilers will also remain as per the original water balance since the boiler system will not be expanded for this project.	Stakeholder at the meeting (11 August 2010)
4.	A statement was made by Filomaine Swanepoel - IAP (FS) that the water service agreement between Char Manufacturing Plant and Grootegeluk Mine will need to be amended, should water use increase.	GS answered that the agreement will be looked into and any changes required will be done accordingly. Charles Linstrom - Exxaro (CL) added that the water balance will be updated as part of the surface water specialist study.	Filomaine Swanepoel of the Grootegeluk Mine (11 August 2010)

No.	IAP Issues	Response to IAP Issues / Reference to Report Section where IAP Issues are Addressed	Reference
5.	Will the existing Atmospheric Pollution Prevention Act (APPA) Permit be amended?	VV answered that an Atmospheric Emissions License (in terms of the new National Environmental Management Air Quality Act No. 39 of 2004) will be undertaken to amend the existing APPA permit.	Stakeholder at the meeting (11 August 2010)
6.	There have been complaints about odours from the Char Manufacturing Plant at Grootegeluk Mine. There are also rumours amongst employees that the phenol levels are harmful to people's health and affect the mine personnel. What air quality monitoring is being undertaken at Char Manufacturing Plant?	Edwin Mogoane - Char Manufacturing Plant (EM) answered that air quality monitoring is undertaken bi-annually and assessed according to the conditions within the APPA permit.	Stakeholder at the meeting (11 August 2010) Refer to Appendix xx for the Hazardous Chemical Substances Survey which examines the health hazards at the Char Manufacturing Plant.
7.	What is being done about the waste 'sludge' which is currently being stored?	GS answered that coal fines that accumulate in the cyclones and tar precipitators of the recycle gas system are removed on a scheduled basis to avoid negative impacts on the process. The coal fines mixed with tar are removed as a sludge and stored in 210ℓ drums. These drums were initially sent to Holfontein, but this alternative was stopped due to excessive cost. Testing, with positive results, has been obtained by mixing the sludge with char fines to a dry consistency suitable for blending with Power Station coal. Sludge production volumes +- 0.04% of coal used.	Stakeholder at the meeting (11 August 2010)
8.	The Grootegeluk Water Use License (WUL) states that the pollution control dam needs to be monitored for phenols. The mine is worried that this is not being done and it is a bad reflection on them.	EM answered that monitoring is being done at boreholes up and downstream from the pollution control dam. There have been no phenols detected in these monitoring boreholes.	Stakeholder at the meeting (11 August 2010)
9.	Tendani Mufamadi of the Grootegeluk Mine (TM): Are you going to extend the capacity of the pollution control dam?	GS: Yes we are. Charles Linstrom of Exxaro (CL): It is currently under investigation by Jones and Wagener (surface water specialists). We will update the public on the results of the specialists' studies.	Tendani Mufamadi of the Grootegeluk Mine (17 March 2011)
10.	Elijah Mabogo (EM): How long will construction of the plant take?	Lomeus Konradie of Exxaro (LK): We use special materials, and thus it can take two years, up to the end of 2014.	Elijah Mabogo (17 March 2011)
11.	TM: Will you need a permit for emissions and electricity generation form the Department of Energy?	SH: We are applying for an Atmospheric Emissions License. With regard to the Department of Energy, I don't think a permit is needed, but we will confirm it.	Tendani Mufamadi of the Grootegeluk Mine (17 March 2011)
12.	TM: With regard to water use licenses required, a Section 21 A license is missing. Are you making provision for it?	CL: No, section 21 A applies to the Mokolo and Crocodile Water Augmentation Project (MCWAP). We already have an allocation from MCWAP for the Grootegeluk Mine. We will use the allocated water for the Char, Coke and Co-gen Plants as well.	Tendani Mufamadi of the Grootegeluk Mine (17 March 2011)
13.	Concerned about environmental impacts. Expansion of residential market could positively impact property development.	Section 6 of this report. Socio-economic impacts will be covered in more detail in the EIA report.	Susan Pretorius (4 March 2011)

No.	IAP Issues	Response to IAP Issues / Reference to Report Section where IAP Issues are Addressed	Reference
14.	The planned residential and industrial developments in the Steenbokpan area are ignorant of the air quality studies which usually show that air flows from the east to the west. The expansion of the char plant will add to the existing pollution of the mine and other nearby industrial developments.		Susan Pretorius (10 August 2011)

6. Assessment of Environmental Impacts

Please refer to the EMP (Volume 3) for more detail regarding the mitigation measures which will be implemented to address the impacts.

6.1 Planning and Design

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
PROTECTION OF SOILS AND GROUNDWATER RESOURCES												
Loss of utilisable soils and contamination of groundwater.	Failure to include measures for the protection of soils and water resources in design.	3	2	5	3.3	1	2.2	0.8	1.7	High	Very Low	(1.) Planning should provide for impervious surfaces, bunding and dirty water management areas. (2.) Planning should allow for facilities for the management of general and hazardous waste. (3.) Waste management procedure to be developed including the management of builders' rubble and recyclable wastes. (4.) Agreements to be sought for the use of waste disposal sites and sewage treatment facilities which may be required. (5.) Exxaro Reductants procurement contract to make provision for compliance with EMP. (6.) Planning to include provision for the development of topsoil stockpiles.
PROTECTION OF SURFACE WATER RESOURCES												
Contamination of surface water.	Failure to include measures for the protection of surface water resources in design.	3	2	5	3.3	1	2.2	0.8	1.7	High	Very Low	(1.) The storm water management measures must be designed by a suitably qualified person and in accordance with the requirements of Regulation GN 704, dated June 1999, under the National Water Act, 1998 (Act 36 of 1998).
AIR QUALITY												
Decrease in air quality	Failure to consider the management of dust emissions in planning	3	3	4	3.3	2	2.7	0.8	2.1	Medium	Low	(1.) Methods for the management of dust at coal and char product handling areas and on gravel roads must be planned for during this phase. (2) The Char Manufacturing Plant process will be designed to comply with known existing atmospheric emission levels in South Africa.
	Failure to include design measures to ensure emissions that meet air quality standards	3	3	4	3.3	3	3.2	0.8	2.5	Medium	Low	1.) Design must ensure that all emissions meet the emissions limits set in the NEMAQA and the proposed Waterberg Priority area.
LAND USE												
Inadequate rehabilitation.	Failure to plan and have financial provision for rehabilitation.	2	1	5	2.7	1	1.8	1	1.8	Medium	Low	(1.) Financial provision to be made for the rehabilitation of Char Manufacturing Plant Expansion site.
TRAFFIC												
Decrease in traffic safety	Failure to consider road upgrading and maintenance issues during planning.	3	3	4	3.3	3	3.2	0.8	2.5	Medium	Low	(1) Negotiations must be undertaken with the Grootegeluk Coal Mine and other stakeholders with regard to the surfacing of problem areas on the Char product transport route (D2001 and R33) as well as the regular maintenance of the roads.
ENVIRONMENTAL AWARENESS AND TRAINING												
Persons working at the plant are not aware of potential environmental and occupational health issues at the Char Manufacturing Plant Expansion site.	Failure to plan for environmental and occupational health awareness and training.	2	2	4	2.7	1	1.8	1	1.8	Medium	Low	(1.) Environmental and occupational health induction training material must be ready prior to construction period for use in environmental induction training.

6.2 Construction Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
GROUNDWATER												
Decrease in groundwater availability	Abstraction of water for construction	2	3	4	3	2	2.5	0.4	1.1	Medium	Low	(1.) Water abstraction is to comply with water use licensing requirements. (2) All groundwater monitoring points for the plant shall be monitored on a quarterly basis. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43. Both groundwater level and groundwater quality are to be measured.
Decrease in groundwater quality	Chemical pollutants from construction activities reaching groundwater	3	3	4	3.3	2	2.7	0.6	1.6	Medium	Low	(1.) Pollution control measures for the protection of soils to be put in place. (2) Sampling is to be conducted by a suitably qualified and competent person using appropriate sampling techniques. The samples will be analysed at an accredited, independent laboratory for chemical and physical constituents normally associated with the presence of coal and carbonaceous material, as well as those which are specific to Char Manufacturing Plant operations.
	Existing pollutants on site reaching groundwater	3	3	4	3.3	2	2.7	0.8	2.16	Medium	Low	(1) The remaining coal layer/carbonaceous material will be removed from the Char Manufacturing Plant Expansion site and either returned to the Grootegeluk beneficiation plants or will be disposed of on the Grootegeluk discard dumps where there is no risk of combustion. The coal/carbonaceous material will not be stockpiled on the surrounding area. (2)The removal of the upper soil layer to a depth of 60cm where contamination has been identified (refer to the report by Golder, 2011 – Appendix xx of the EIA). The contaminated soil must be disposed of at a Hazardous Waste Disposal Facility.
SURFACE WATER												
Decrease in surface water quality	Sedimentation of surface water run-off. Release of dirty water into environment.	3	3	4	3.3	2	2.7	0.8	2.16	Medium	Low	(1.) Sediment originating from construction activities is to be prevented from contaminating storm water. (2.) Dirty water run-off is to be contained and not allowed to enter into the surrounding environment. (3) All identified surface water quality monitoring points for the plant shall be monitored on a quarterly bases. Sampling points include the Pollution Control Dam (PCD) – South (GES01) , PCD – North (GES02) and the Bosbok Dam. (4) Ground and surface water monitoring results must be kept on site and made available to the Plant Manager and the Environmental Manager on a monthly basis. Potential negative impacts should be identified and addressed as soon as possible. (5) Appropriate storm water control measures will be provided for the site, which will comply with the GN704 Regulations on the Use of Water for Mining and Related activities. (6) A storm water cut-off drain according to the Regulations (see 2.24) specifications will be constructed around the site. (7) No construction of any water management facilities will be undertaken with any material (such as coal residue or other carbonaceous material) that may cause pollution of water resources.
SOIL												
Loss of utilisable soils	Failure to strip and conserve topsoil	4	3	5	4.0	1	2.5	0.6	1.5	High	Very Low	(1.) Where not contaminated, the upper 70 cm of soils of the construction footprint (i.e. any area to be disturbed by construction activities) must be removed and stored as topsoil . (2) To minimise poterntial soil erosion, appropriate storm water control measures will be provided for the site, which will comply with the GN704 Regulations on the Use of Water for Mining and Related activities. (3) Topsoil stockpiles must be protected through seeding as soon as possible, or within 30 days after the formation of the stockpile. (4) Topsoil stockpiles must be benched and sloped to 1: 6. (5.) Once the construction activity has been completed, the remaining disturbed area which will not be used must be topsoiled, sloped and re-vegetated as soon as possible using suitable grass species. This re-vegetation will assist in reducing the potential for soil erosion. (6) The topsoil will be analysed to determine imbalances prior to the replacement of soil. Inorganic fertilisers will be used to supplement the soils before seeding of the area takes place.

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
	Compaction of soils during construction activities	2	2	4	2.7	1	1.9	0.6	1.1	High	Very Low	(1.) Before any construction activity takes place, the proposed Char Manufacturing Plant Expansion site will be pegged out and fenced. All construction activities will take place within this area to limit the extent of impacts. (2.) No off-road driving allowed. (3.) All roads and compacted areas used during construction (which are not required for operation) are to be ripped and the establishment of vegetation promoted.
Contamination of soils by chemical spills.	Spillage of hydrocarbons and other hazardous chemicals, failure to contain dirty water run-off.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) If vehicles or machinery will be serviced or maintained on site , this must be done on an impervious surfaces (hard-standing, trip trays etc.) (2) All vehicles must be checked for leaks before commencing work on site. All equipment that leaks fluid must be repaired immediately or removed from site when necessary. (3) Drip trays must be placed beneath parked vehicles which drip oil. (4) All spills of chemicals or hydrocarbons (oil, grease , diesel, petrol, etc.) will be cleaned with the use of suitable absorbent materials such as drizit or oclansorb. (5) All soils that have become contaminated with oils, fuels and lubricants must be removed and managed as hazardous waste. Bioremediation of contaminated soils shall take place should such a facility be available on site. (6) Within the plant area, self-contained bunded areas will be provided for the collection of spillage where the following substances are stored: • Hazardous waste storage facilities (e.g. liquor); • Flammable and combustible liquid; • Electrical transformers containing oil and/or PCBs and • Locations where spills are common, including trasfer points, workshops, and where hazardous substances are transferred and used on a regular basis. (7) The self-contained bunded areas will be lined with an impermeable material to limit seepage into the ground water environment. (8) For flammable liquids, bunded areas should have 110% of the capacity of the total storage volume for the flammable liquid. For other potentially dangerous/hazardous materials, the capacity of the bund should: • Equal 100% of the largest drum/tank/container; PLUS • 35% of the maximum intended stoage capacity ; PLUS • Additional capacity for firewater. (9) Material Safety Data (MSD) sheets for all chemicals must be displayed in close proximity to the area of storage. (10) Chemical spills are to be regarded as an environmental incident and reported through the incident reporting system. (11) Hazardous chemicals (such as those used for cleaning) must not be released into the environment or sewage treatment system. These materials must be contained and disposed of as hazardous waste. (12) All fuel tanks used in construction must be aboveground and bunded in accordance with the requirements for flammable liquids. (13) Hydrocarbon handling areas must be supplied with stormwater diversion measures. (14)The integrity of the bund for hydrocarbon storage is to be monitored regularly to ensure that no seepage escapes it.
Contamination of soils by wastes.	Spillage of sewage and incorrect management and disposal of waste.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) All waste will be classified and disposed of accordingly. No illegal dumping or disposal will take place - general waste must be disposed of at a permitted landfill site and hazardous waste must be disposed of at a permitted hazardous waste site. (2) All hazardous waste must be handled on impervious surfaces. (3) Chemical toilets will be provided for construction personnel during the construction phase if the sewage system is found to be insufficient for the number of people on site during construction.

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
BIODIVERSITY (Flora)												
Species diversity loss of vegetation	Unnecessary destruction of vegetation. Establishment or spread of alien species. Introduction of problem species during construction rehabilitation.	2	3	4	3.0	1	2.0	0.8	1.6	Medium	Low	(1) Unnecessary disturbance of vegetation not to be allowed - vegetation clearance must be restricted to footprint areas required for the development of the Plant. (2) All contractors/employees will be informed that no fires will be permitted on site or adjacent to the site. (3) All contractors/employees will be informed that the collection of plant material or the picking of plants on site or the surrounds is prohibited. (4) Dust suppression will be practiced in order to prevent air-borne deposition on the surrounding natural vegetation. (5) Source populations of alien plants, if present, must be removed during construction phase. (6.) Seed mix used for construction rehabilitation is to include only species indigenous to the area.
	Site is not suitably rehabilitated.	2	2	5	3.0	1	2.0	0.8	1.6	Medium	Low	(1) The revegetated areas will not be grazed before the climax species are well established. If necessary, the revegetated areas will be fenced in order to avoid grazing. (2) Vegetation growth on rehabilitated areas must be monitored until the following rainy season to ensure re-growth and sustainable growth. (3) All infrastructure including foundations and concrete surfaces that will not be used during operation of the Char Manufacturing Plant Expansion must be removed from site after construction.
BIODIVERSITY (Fauna)												
Killing of fauna	Vehicle collisions. Poaching.	3	2	3	2.7	1	1.8	0.6	1.1	Medium	Low	(1.) Education of staff on safe driving and protection of animals (2.) All contractors/employees will be informed that no poaching/trapping of animals will be allowed.
NOISE												
Increase in ambient noise levels	Transportation of construction workers and materials on nearby roads.	1	3	2	2.0	3	2.5	0.8	2.0	Low	Medium	No mitigation practicable.
	Construction activities at the Char Manufacturing Plant Expansion Project.	1	3	2	2.0	1	1.5	0.8	1.2	Medium	Very Low	(1.) Where possible, working hours are to be limited to day time to minimise night time noise levels. (2) All machinery to be used during the construction phase should be properly muffled and maintained so as to reduce noise generation to a minimum. (3) Working procedures should be structured so as to avoid the unnecessary generation of noise. (4) Standards pertaining to noise must be stipulated and monitoring for management purposes should be carried out at regular intervals. Where the standards have been exceeded, appropriate action should be taken to rectify the situation.
AIR QUALITY												
Decrease in air quality	Entrainment of dust resulting from site clearance and movement of machinery on site.	2	2	2	2.0	2	2.0	0.8	1.6	Medium	Low	(1) Appropriate measures are to be taken to minimise the generation of dust as a result of work, operations or activities. Such measures must include regular and effective wetting or chemical dust suppression of gravel access roads and working areas. (2) During windy conditions, dust generation should be minimised and dust suppression activities intensified. (3) The use of water sprays for dust suppression should be included in potential mitigating measures, especially during the dry season. (4) Dust suppression should be done with water hoses in inaccessible areas where vehicular traffic is impossible. (5) Abstracted ground water could be used for dust suppression purposes since groundwater quality only marginally exceeds SANS 241: 2011 standards.
	Entrainment of dust as a result of construction vehicles.	1	2	2	1.7	3	2.3	0.8	1.9	Medium	Low	(1.) Dust suppression to be implemented along main construction roads during construction phase where necessary.
TRAFFIC												
Decrease in road safety during construction.	Dust from heavy vehicles using the access roads to the Char	2	2	2	2	3	2.5	0.8	2	Medium	Low	(1.) Implementation of dust control measures.

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
	Manufacturing Plant Expansion site.											
	Compromised pavement surface on access roads.	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) Negotiations must be undertaken with the Grootegeluk Coal Mine, Department of Transport and other stakeholders with regard to the surfacing of problem areas on the Char product transport route (D2001 and R33) as well as the regular maintenance of the roads.
SOCIO-ECONOMICS												
Employment of people from local communities	Employment of construction workers	3	1	2	2.0	3	2.5	1	2.5	High	Moderate	(1.) Employment policy to give preference to employment of local people.
Safety and security for surrounding landowners	Influx of people to the construction area in search of employment	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1.) Employment and procurement policies to be in place and clearly communicated to public e.g. through community leaders. (2.) Under no circumstances is recruitment to take place at the gate. (3.) Access control to be in place at the project.
CULTURAL HERITAGE												
Disturbance of heritage sites	Site clearance and excavations for the development of Char Manufacturing Plant Expansion infrastructure.	2	1	5	2.7	1	1.8	0.4	0.7	Medium	Very Low	(1.) If any archaeological remains are exposed during the construction phase, construction at that site must be immediately suspended and the South African Heritage Resources Agency (SAHRA) and the Limpopo Department of Economic Development, Environment and Tourism must be informed.
ENVIRONMENTAL AWARENESS AND TRAINING												
Persons working at the plant are not aware of potential environmental and occupational health issues at the Char Manufacturing Plant Expansion site.	Failure to implement environmental and occupational health awareness and training.	2	2	2	2	1	1.5	1	1.5	Medium	Low	(1.) Environmental induction training is to be undertaken by all persons undertaking work at the Plant (to be incorporated into normal induction training) including permanent workers, contractors and consultants. As part of the induction all workers on site must be made aware of the conditions of the EMP. (2) A copy of the EMP and all environmental authorisations must be kept at the main site office. (3) A copy of the EMP must be given to each contractor on site. (4) Each contractor must keep a copy of the EMP at their office and this copy must be made available to staff. (5) It will be ensured that operators of specialist equipment are properly trained by auditing the training certificates before any job commences. (6) Employees must wear the correct PPE at all times.
PUBLIC RELATIONS												
Disturbance of sense of place.	Noise and dust emissions from construction work and increased road traffic.	3	1	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) The general public forum which is conducted by the Grootegeluk Mine, must also allow members of the community to raise their issues of concern regarding the Char Manufacturing Plant Expansion project. (2) Communication between the contractors, Grootegeluk Coal Mine and the various interested and affected parties will be established and maintained. (3) A complaints register for the development will be kept at the construction camp. (4) The complaints register will record the following: Date when complaint/concern was received; Name of person to whom the complaint/concern was reported; Nature of the complaint/concern reported; The way in which the complaint/concern was addressed (date to be included). (5) Any complaints regarding the said development will be brought to the attention of the Environmental Manager within 24 hours after receiving the complaint. The complaints must be investigated and remedied where possible. (6) The complaints register will be kept up to date for inspection by members of the Limpopo Department of Economic Development, Environment and Tourism.
ENVIRONMENTAL COMPLIANCE												
All environmental impacts mentioned above resulting from not implementing mitigation measures.	Non-compliance with the mitigation measures and EMP could result in negative environmental impacts during construction.	4	3	3	3.3	2	2.7	0.4	1.1	Medium	Low	(1) An environmental compliance officer will be appointed, in writing, to monitor all environmental aspects relating to the construction phase. (2) The responsible person will monitor and audit the construction activities on a weekly basis and ensure compliance with this EMP and the Envrionmental Authorisation. (3) A register of environmental monitoring and auditing results will be available for inspection at the construction camp. These results should also be forwarded to the Environmental Manager of the Char Manufacturing Plant on a regular basis. (4) Records relating to the compliance and non-compliance with the conditions of the Authorization and Record of Decision will be kept in good order. Such records must be made available to the

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												Limpopo Department of Economic Development, Environment and Tourism within seven (7) working days of the date of the written request by the Department for such records.

6.3 Operation Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
SURFACE WATER												
Contamination of stormwater	Contamination of surface water run-off. Release of dirty water into environment.	4	3	4	3.7	2	2.9	0.8	2.3	Medium	Low	(1.) Sediment originating from operation activities is to be prevented from contaminating storm water. (2.) Dirty water run-off is to be contained and not allowed to enter into the surrounding environment. (3) All identified surface water quality monitoring points for the plant shall be monitored on a quarterly bases. Sampling points include the Pollution Control Dam (PCD) – South (GES01) , PCD – North (GES02) and the Bosbok Dam. (4) Ground and surface water monitoring results must be kept on site and made available to the Plant Manager and the Environmental Manager on a monthly basis. Potential negative impacts should be identified and addressed as soon as possible. (5) Appropriate storm water control measures will be maintained on the site, which will comply with the GN704 Regulations on the Use of Water for Mining and Related activities. (6) A storm water cut-off drain according to the Regulations (see 2.24) specifications will be maintained around the site. (7)The storm water control measures will be inspected on a weekly basis for signs of erosion or blockages during the first rainy season. Thereafter, inspections should occur on a monthly basis during the rainy and dry seasons. Any blockages or erosion should be repaired within 24 hours of discovery. (8) Accumulated contaminated water will be stored and treated in a liquor destructor, of which the exhaust has to be designed to comply with known existing atmospheric emission levels. (9) A water balance will have to be set up for the plant in order to accurately record the water usage and to monitor the potential impact on the overall Grootegeluk Coal Mine water system.
GROUNDWATER												
Decrease in groundwater availability	Abstraction of water for operation	2	3	4	3	2	2.5	0.4	1.1	Medium	Low	(1) Water abstraction is to comply with water use licensing requirements. (2) All groundwater monitoring points for the plant shall be monitored on a quarterly basis. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43. Both groundwater level and groundwater quality are to be measured.
Decrease in groundwater quality	Chemical pollutants from operation activities reaching groundwater	4	3	4	3.7	2	2.9	0.8	2.3	Medium	Low	(1) Pollution control measures for the protection of soils to be put in place. (2) Sampling is to be conducted by a suitably qualified and competent person using appropriate sampling techniques. The samples will be analysed at an accredited, independent laboratory for chemical and physical constituents normally associated with the presence of coal and carbonaceous material, as well as those which are specific to Char Manufacturing Plant operations.
SOILS												
Loss of utilisable soils	Failure to conserve topsoil.	4	3	5	4.0	1	2.5	0.6	1.5	Medium	Very Low	(1) To minimise potential soil erosion, appropriate storm water control measures will be provided for the site, which will comply with the GN704 Regulations on the Use of Water for Mining and

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												Related activities. (2) Topsoil stockpiles must remain protected through seeding as soon as possible, or within 30 days after the formation of the stockpile. (3) Topsoil stockpiles must remain benched and sloped to 1: 6. (4) The topsoil will be analysed to determine imbalances prior to the replacement of soil. Inorganic fertilisers will be used to supplement the soils before seeding of the area takes place.
	Compaction of soils during operation activities	2	2	4	2.7	1	1.9	0.6	1.1	Medium	Very Low	(1.) No off-road driving allowed.
Contamination of soils by chemical spills.	Spillage of hydrocarbons and other hazardous chemicals, failure to contain dirty water run-off.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) If vehicles or machinery are serviced or maintained on site , this must be done on an impervious surfaces (hard-standing, trip trays etc.) (2) All vehicles must be checked for leaks before commencing work on site. All equipment that leaks fluid must be repaired immediately or removed from site when necessary. (3) Drip trays must be placed beneath parked vehicles which drip oil. (4) All spills of chemicals or hydrocarbons (oil, grease , diesel, petrol, etc.) will be cleaned with the use of suitable absorbent materials such as drizit or oclansorb. (5) All soils that have become contaminated with oils, fuels and lubricants must be removed and managed as hazardous waste. Bioremediation of contaminated soils shall take place should such a facility be available on site. (6) Material Safety Data (MSD) sheets for all chemicals must be displayed in close proximity to the area of storage. (7) Chemical spills are to be regarded as an environmental incident and reported through the incident reporting system. (8) Hazardous chemicals (such as those used for cleaning) must not be released into the environment or sewage treatment system. These materials must be contained and disposed of as hazardous waste. (9)The integrity of the bund for hydrocarbon storage is to be monitored regularly to ensure that no seepage escapes it.
Contamination of soils by wastes.	Spillage of sewage and incorrect management and disposal of waste.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) All waste will be classified and disposed of accordingly. No illegal dumping or disposal will take place - general waste must be disposed of at a permitted landfill site and hazardous waste must be disposed of at a permitted hazardous waste site. (2) All hazardous waste must be handled on impervious surfaces.
BIODIVERSITY (FAUNA)												
Killing of fauna	Vehicle collisions. Poaching.	3	2	4	3	1	2	0.6	1.2	Medium	Low	(1.) Education of staff on safe driving and protection of animals (2.) All contractors/employees will be informed that no poaching/trapping of animals will be allowed.
BIODIVERSITY (FLORA)												
Species diversity loss of vegetation	Establishment or spread of alien species.	2	3	4	3.0	1	2.0	0.8	1.6	Medium	Low	1) Site will be inspected annually for populations of alien plants. If present, these must be removed.
AIR QUALITY												
Decrease in air quality	Entrainment of dust resulting from movement of machinery on site.	2	2	2	2.0	2	2.0	0.8	1.6	Medium	Low	(1) Appropriate measures are to be taken to minimise the generation of dust as a result of work, operations or activities. Such measures must include regular and effective wetting or chemical dust suppression of gravel access roads and working areas. (2) During windy conditions, dust generation should be minimised and dust suppression activities intensified. (3) The use of water sprays for dust suppression should be included in potential mitigating measures, especially during the dry season. (4) Dust suppression should be done with water hoses in inaccessible areas where vehicular traffic is impossible. (5) Abstracted ground water could be used for dust suppression purposes since groundwater quality only marginally exceeds SANS 241: 2011 standards.
	Entrainment of dust as a result of operation vehicles.	1	2	2	1.7	3	2.3	0.8	1.9	Medium	Low	(1) Dust suppression to be implemented along main haul roads during operation phase. (2) Trucks should not be overloaded to prevent spillages of coal feedstock or products

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
	Release of gaseous emissions from the product and feedstock handling at the Char Manufacturing Plant Expansion.	3	5	2	3.3	3	3.2	1	3.2	Medium	Moderate	(1) Water sprays will be used where possible to limit coal dust generation. (2) Coal would be introduced from the coal bunkers into the retort vessels in a controlled manner to maintain a constant level in the retort. The feed rate would be controlled by a set of knife gate valves that operate in sequence passing the coal through a feed lock chamber to prevent the escape of gas into the atmosphere or entry of air into the retort.
	Release of gaseous emissions from the product charring process at the Char Manufacturing Plant Expansion.	4	5	3	4	3	3.5	1	3.5	Medium	Moderate	(1) The Char Manufacturing plant will be operated in accordance with the National Environmental Management: Air Quality Act, 2004 any applicable regulations made under this act and the Atmospheric Emissions Licence (AEL) when issued. (3) An air quality monitoring system specific to the plant will be put in place as required in terms of the legislation. The instantaneous peak, the 1-hour and 24-hour average as well as the monthly average will be obtained and the results compared to the limits in the AEL. (4) An ambient air quality monitoring programme must be set up in consultation with Grootegeluk Coal Mine and Matimba Power Station. (5) Air quality monitoring results must be made available to the Char Manufacturing Plant manager and the Environmental Manager of Grootegeluk Coal Mine on a monthly basis. Potential negative impacts should be identified and addressed as soon as possible. (6) An air quality monitoring report will be forwarded to the province until such time that an air quality officer for the local municipality is appointed in terms of the National Environmental Management: Air Quality Act, 2004. A copy thereof will also be forwarded to the National Department of Environmental Affairs and Tourism. (7) An operator awareness and training programme based on safety procedures would be developed and implemented in order to ensure safe operation and maintenance of the plant.
NOISE												
Increase in ambient noise levels	Transportation of operational workers and products on nearby roads.	1	3	2	2.0	2	2	0.8	1.6	Low	Low	No mitigation practicable.
	Construction activities at the Char Manufacturing Plant Expansion Project.	1	3	2	2.0	1	1.5	0.8	1.2	Medium	Very Low	(1.) Where possible, scheduled maintenance is to be limited to day time to minimise night time noise levels. (2) All machinery to be used should be properly muffled and maintained so as to reduce noise generation to a minimum. (3) Working procedures should be structured so as to avoid the unnecessary generation of noise. (4) Standards pertaining to noise must be stipulated and monitoring for management purposes should be carried out at regular intervals. Where the standards have been exceeded, appropriate action should be taken to rectify the situation.
TRAFFIC												
Decrease in road safety during operation.	Dust from heavy vehicles using the access roads to the Char Manufacturing Plant Expansion site.	2	2	2	2	2	2	0.8	1.6	Medium	Low	(1) Implementation of dust control measures.
	Compromised pavement surface on access roads.	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) Negotiations must be undertaken with the Grootegeluk Mine and other stakeholders with regard to the surfacing of problem areas on the Char product transport route (D2001 and R33) as well as the regular maintenance of the roads.
SOCIO-ECONOMICS												
Employment of people from local communities	Employment of operation workers	3	1	2	2.0	3	2.5	1	2.5	High	Moderate	(1.) Employment policy to give preference to employment of local people.
Safety and security for surrounding landowners	Influx of people to the operation area in search of employment	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1.) Employment and procurement policies to be in place and clearly communicated to public e.g. through community leaders. (2.) Under no circumstances is recruitment to take place at the gate. (3.) Access control to be in place at the project.
OCCUPATIONAL HEALTH AND SAFETY												
Safety of workers at the Char Manufacturing Plant Expansion.	Failure to wear adequate PPE.	3	3	4	3.3	1	2.2	0.4	0.9	Medium	Very low	(1) The Employees and contractors will adhere (at all times) to the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the Mine Health and Safety Act,

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												1996 (Act 29 of 1996). (2) The contractors must ensure that the necessary protective gear is worn at all times.
ENVIRONMENTAL AWARENESS AND TRAINING												
Persons working at the plant are not aware of potential environmental and occupational health issues at the Char Manufacturing Plant Expansion site.	Failure to implement environmental and occupational health awareness and training.	2	2	4	4	1	2.5	0.4	1	Medium	Low	(1.) Environmental induction training is to be undertaken by all persons undertaking work at the Plant (to be incorporated into normal induction training) including permanent workers, contractors and consultants. As part of the induction all workers on site must be made aware of the conditions of the EMP. (2) An environmental awareness programme to be implemented for plant work force addressing pertinent topics as required. (3) A copy of the EMP and all environmental authorisations must be kept at the main site office. (4) A copy of the EMP must be given to each contractor on site. (5) Each contractor must keep a copy of the EMP at their office and this copy must be made available to staff. (6) It will be ensured that operators of specialist equipment are properly trained by auditing the training certificates before any job commences. (7) Employees must wear the correct PPE at all times.
PUBLIC RELATIONS												
Disturbance of sense of place.	Noise and dust emissions from operations and increased road traffic.	3	1	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) The general public forum which is conducted by the Grootegeluk Mine, must also allow members of the community to raise their issues of concern regarding the Char Manufacturing Plant Expansion project. (2) Communication between the contractors, Grootegeluk Coal Mine and the various interested and affected parties will be established and maintained. (3) A complaints register for the development will be kept at the Char Manufacturing Plant site. (4) The complaints register will record the following: Date when complaint/concern was received; Name of person to whom the complaint/concern was reported; Nature of the complaint/concern reported; The way in which the complaint/concern was addressed (date to be included). (5) Any complaints regarding the said development will be brought to the attention of the Environmental Manager within 24 hours after receiving the complaint. The complaints must be investigated and remedied where possible. (6) The complaints register will be kept up to date for inspection by members of the Limpopo Department of Economic Development, Environment and Tourism.
EMP IMPLEMENTATION AND MONITORING												
All environmental impacts mentioned above resulting from not implementing mitigation measures.	Non-compliance with the mitigation measures and EMP could result in negative environmental impacts during construction.	4	3	3	3.3	2	2.7	0.4	1.1	Medium	Low	(1) Monthly internal audits of EMP compliance. (2) Annual external audit of EMP compliance . (3) Submission of external annual report to environmental authorities

6.4 Decommissioning Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
NOISE												

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
Increase in noise levels	Demolition of Char Manufacturing Plant infrastructure	1	3	2	2.0	2	2.0	0.4	0.8	Low	Very Low	(1.) Where possible, demolition activities are to be limited to daytime to minimise night noise impacts.
AIR QUALITY												
Decrease in ambient air quality	Demolition of structures and movement of machinery on site	1	3	3	2.3	2	2.2	0.6	1.3	Low	Low	(1.) Dust mitigation measures to be implemented as in Construction Phase.
SOCIO-ECONOMIC												
Loss of jobs	Scaling down of operation activities	3	1	5	3.0	3	3.0	0.8	2.4	Low	Medium	(1) Implement measures identified in the Social and Labour Plan for promoting portable skills for employees
SOILS												
Contamination of soils	Pollution due to mishandling of hydrocarbons and other hazardous substances.	2	1	2	1.7	1	1.3	0.6	0.8	High	Very Low	(1) Spill prevention measures to be implemented during decommissioning phase as in operation phase. (2) All soils that have become contaminated with oils, fuels and lubricants must be removed and managed as hazardous waste. Bioremediation of contaminated soils shall take place should such a facility be available on site.
LAND CAPABILITIES												
Reduction in land capability	Unsuccessful rehabilitation	4	1	5	3.3	2	2.7	0.6	1.6	High	Low	(1) All disturbed areas must be topsoiled, sloped and re-vegetated as soon as possible using suitable grass species. This re-vegetation will assist in reducing the potential for soil erosion. (2) The topsoil will be analysed to determine imbalances prior to the replacement of soil. Inorganic fertilisers will be used to supplement the soils before seeding of the area takes place. (3) Appropriate soil conservation measures will be provided in order to prevent soil erosion and loss of topsoil.

6.5 Post Closure Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
SOCIO-ECONOMIC												
Loss of jobs	Final closure of the Char Manufacturing Plant Expansion	3	1	5	3.0	3	3.0	0.8	2.4	Low	Medium	(1) Implement measures identified in the Social and Labour Plan for promoting portable skills for employees
GROUNDWATER												
Groundwater contamination	Contamination of groundwater by possible contamination sources.	1	5	5	3.7	1	2.3	0.4	0.9	High	Very Low	(1) The groundwater monitoring programme should be continued for the period stipulated by the relevant authorities
LAND CAPABILITIES												
Reduction in land capability	Unsuccessful rehabilitation	4	1	5	3.3	2	2.7	0.6	1.6	High	Low	(1) Exxaro Reductants is to monitor success of rehabilitation for at least 3 years after closure. Should rehabilitation not prove successful, a rehabilitation specialist is to be included in the rehabilitation process.

7. Discussion

A detailed description of the Char Manufacturing Plant operation impacts on surface water is given in Appendix 4. There are no major surface water features in the plant area and run-off from the area is unlikely to reach surrounding catchments. Due to the limited gradient, surface water falling on site is likely to seep into the surface or evaporate.

Of concern is the risk of run-off from construction and plant areas becoming contaminated and this water being allowed to enter into the natural environment. Pollution control measures to contain hydrocarbons and other potential contaminants during the construction period is thus essential. Geochemical analysis of pollution sources show that there is a risk of contamination from waste sources at the Char Manufacturing Plant Expansion site. Such water should be managed and prevented from entering the neighbouring environment. Provision has been made for the management of dirty water from the plant and maintenance areas and this water will be contained in the pollution control dam and prevented from entering into the surrounding environment.

7.1 Groundwater

A detailed description of the Char Manufacturing Plant operation impacts on groundwater is given in Appendix 5.

7.1.1 Change in Groundwater Levels

The use of water for the Char Manufacturing Plant Expansion project is likely to have little effect on the groundwater levels in the nearby vicinity.

7.1.2 Change in Groundwater Quality

The groundwater quality at the site is currently slightly polluted due to the historic use of the site. If the storm water, product stockpiles and waste management measures are implemented, then there is likely to be little additional effect on groundwater quality. The contaminated soil will also need to be removed and appropriately remedied. On-going quarterly monitoring of borehole water quality on site will continue.

7.2 Soils and Land Capability

The clearance of soils is required for the development of the Char Manufacturing Plant Expansion infrastructure. Soils are regarded as a valuable resource as they are essential for rehabilitation. Soil clearance could result in loss of soils should such soils not be stripped and stockpiled correctly. The upper 700 mm of soil at the site is considered utilisable and requires conservation.

Conservation of soils requires correct stockpiling and treatment during construction and operation. The soil should also be protected from pollution as a result of spillage of hydrocarbons, raw sewage, chemicals, etc. The storage and handling of these substances will have to be managed to ensure minimum contamination of soils.

The impact on soils is considered to be low as any impacts that occur will be limited to the Char Manufacturing Plant Expansion site. Mitigation measures such as separate stockpiling, limiting the height of such stockpiles and erosion control measures will keep the impacts at a low level.

7.3 Ecology

A full description of the flora and fauna is provided in the specialist biological report Appendix 6. The project will have little effect on flora and fauna as the site is already highly disturbed as a result of current and future uses. The impact is low and no mitigation is required.

7.4 Air Quality

The operation of the Char Manufacturing Plant Expansion project will result in the emissions of various gases and particulate matter (dust) that will impact on air quality. These emissions will be as a result of the stack emissions from the charring process, material handling, dust from vehicles travelling on haul roads, dust from vehicles on the public roads and wind erosion of stockpile areas. An air quality study was undertaken to establish the project's impacts on air quality see Appendix 3. The study focused on gases and particulates considering impacts on human health and dust nuisance.

The impacts of the emissions of the gases studied were predicted to be below the limits for ambient air quality. The proposed Char Manufacturing Plant Expansion will not add significantly to existing pollution levels in the area.

Cumulatively the existing char plant contributes marginally to existing background concentrations of SO_2, NOx and PM10 over a small area and in close proximity to the plant. No exceedance of the SO_2 and NO_2 National Ambient Air Quality Standards (NAAQS) is predicted for long or short term periods.

Elevated background PM10 concentration is predicted in the study area with predicted PM10 cumulative concentrations in exceedance of the NAAQS mainly due to mining operations at the Grootegeluk mine.

SO_2 emissions from future char plant operations result in ambient SO_2 concentrations which are in compliance with the NAAQS. NOx emissions from future char plant operations result in ambient concentrations below the long and short term NAAQS. Incrementally, PM10 emissions result in concentrations that are in compliance with the NAAQS. CO emissions from future operations result in ambient concentrations below the short term NAAQS.

Existing char plant operations do not contribute significantly to background concentrations. Existing emissions from the char plant are in compliance with the NAAQS. Future expansion will result in increased ground level concentration, but not in exceedance of the NAAQS for any of the pollutants included.

The contribution of char plant emissions (from existing and future operations) is expected to add marginally to current sulphur and nitrogen deposition rates from current background sources. Based on the fact that average predicted incremental sulphur and nitrogen deposition rates (from char plant emissions only) are lower compared to measured and predicted sulphur and nitrogen deposition levels over the Highveld area it was concluded that the acidification potential impact related to char plant emissions will be low. The potential for acidification impact from existing background sources exists and could be assessed by a monitoring campaign.

7.5 Noise

Noise impacts are likely to be minor as the Char Manufacturing Plant Expansion project will take place within an existing mining area and adjacent to an existing industrial plant. The closest possible sensitive noise receptors are over 4km away and it is likely that the main noise effect is from the D2001 road adjacent to the Grootegeluk Mine.

Thus the additional noise from the expanded plant will have little noticeable effect.

7.6 Traffic

The traffic assessment is included in Appendix 10. Current traffic levels on public roads in the area are relatively high due the large amount of construction activities in the area, these include the Eskom Medupi power station and the Grootegeluk Expansion Project. Key safety issues relate to the surface road condition, the presence of slow moving traffic and dust.

The conclusions of the traffic impact study were as follows:

- Peak hour traffic operating conditions near the Grootegeluk Mine and haul routes will not be significantly affected by the expansion of the Char Plant.
- The surfacing of the haul route will need to be replaced (or at least treated) at the problem areas identified.
- Appropriate intersection and heavy vehicle warning signs on the approaches to the mine accesses should be erected in accordance with the South African Road Traffic Signs manual.

Taking the above into account, the impacts associated with the proposed project can be managed and accommodated within acceptable limits. Further investigation should be undertaken to determine the pavement capacity of the haul routes and the maintenance required.

7.7 Socio-Economic Impacts

Major social impacts are unlikely due to the fact that the area is already undergoing a considerable amount of development. Additional housing, infrastructure and social services are being developed in the Lephalale area to cater for the increased demand from the growing population.

Some additional jobs will be created by the project which could result in an influx of additional people into the area. However, since Exxaro Reductants plans to implement appropriate recruitment practices including preferences to local labour during the construction and operational phases, it is expected that such impacts will be curtailed.

The direct Char Manufacturing Plant Expansion project operation impacts such as air quality, noise, and groundwater impacts will be limited to the site, or possibly immediate neighbours. There are no sensitive receptors which have been identified nearby.

However, as most of the potential impacts have been simulated through models, it is important that the suggested monitoring is undertaken to verify the impacts. In addition to monitoring, it is recommended that the existing Grootegeluk Mine forum includes the Char Manufacturing Plant Expansion project for open communication and discussion of grievances that affected parties may have once project implementation commences.

The development of the Char Manufacturing Plant Expansion will also result in the following positive socio-economic impacts:

- Employment opportunities for local people;
- Providing and additional tax base; and
- Overall contribution to South Africa's economy.

7.8 Heritage Resources

No archaeological or paleontological resources were observed on site (see Appendix 7). The impact to these resources is therefore considered to be very low. However, there is possibility of unearthing these resources during construction and this will need to be managed in accordance with the EMP.

8. Financial Provision

8.1 Method of Financial Provision

Exxaro Reductants (Pty) Ltd will contribute to a trust fund for their financial provision.

8.2 Quantum of Financial Provision

The operation of the plant has a life of approximately 25 years. Provision has been made for premature closure (Year 1) for rehabilitation and dismantling of infrastructure. Provision has also been made for the life of the plant.

The details of the closure costing calculations are provided in the EMP, Volume 3.

9. Conclusions and Key Findings

This report forms part of the EIA phase of the Char Manufacturing Plant Expansion Project environmental assessment. It outlines the results of the public participation and authority consultation process undertaken in August 2010 and March 2011, explains the results of the specialist studies undertaken, assesses the environmental and socio-economic impacts and outlines mitigation measures.

As most of the assessment was undertaken using modelling exercises, it is vital that suggested monitoring is undertaken to ensure better understanding of the environmental impacts.

The EAP considers that the environmental process followed meets the requirements of the legislation to ensure that the regulatory authorities receive sufficient information to enable them to make an informed decision.

The mitigation measures which are presented in the EMP which accompanies this report are considered to be sufficient to mitigate the impacts to environmentally acceptable levels. There are no impacts which have a high significance after mitigation. There have been no fatal flaws identified during the EIA phase and the EAP therefore considers that the project should proceed to the final EIA phase.

10. Consultant Declaration

Synergistics Environmental Services is an independent environmental consultancy that was established in South Africa in 2004. Matthew Hemming is the project director responsible for this report. He has over 6 years' experience in the field of environmental consulting, particularly in the mining, waste and infrastructure development sectors.

The undersigned herewith declare that this EIA report represents an objective and complete draft EIA-level assessment of the environmental impacts associated with the proposed Char Manufacturing Plant Expansion. Issues and impacts were defined through professional judgement and consultation with interested and affected parties and authorities.

The drat EIA for this project is deemed to comply with relevant legislation, best practices and principles of integrated environmental management.

Matthew Hemming
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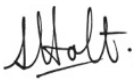
Director
Synergistics Environmental Services (Pty) Ltd
Date: May 2012



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Appendices