Proponent: **Exxaro Reductants (Pty) Ltd**

Project: **Char Manufacturing Plant Expansion**

Report Name: **INTEGRATED WATER AND WASTE MANAGEMENT PLAN**
AMENDMENT - Volume 1 (Report)

Report Status: **DRAFT FOR PUBLIC REVIEW**

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PROJECT INFORMATION SHEET

PROJECT:

Char Manufacturing Plant Expansion

REPORT DETAILS

Report Name:	Integrated Water and Waste Management Plan Amendment (Draft)
Report Number:	S0342/IWWMP
Report Status:	Draft
Revision Number:	01
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EXECUTIVE SUMMARY

Introduction

Exxaro Reductants (Pty) Ltd (Exxaro Reductants) operate a Char Manufacturing Plant 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. Exxaro Reductants is proposing to expand this plant to increase the production capacity threefold. Grootegeluk Coal Mine is adjacent to the Matimba and Medupi Power Stations, two major clients of Grootegeluk Mine. The existing plant occupies an area of approximately 7.4 ha. Exxaro Reductants proposes to expand the Char Manufacturing Plant by increasing the number of retorts from 4 to a maximum of 12 and the plant area will increase to 13.4 ha. The majority of the infrastructure and stockpile areas associated with the retorts will also be expanded. The Char Manufacturing Plant expansion will be located adjacent to the existing Char Manufacturing Plant and will therefore also be in the Grootegeluk mining area.

The existing Char Manufacturing Plant has an authorisation under the MPRDA, an environmental authorisation(LEDET ref. 16/12/9-29), and a Water Use License (WUL) (License number: 27072505) (refer to Appendix 1). There is also an approved Integrated Water and Waste Management Plan (IWWMP) and a Supporting Technical Report for the WUL (Appendices 2 and 3). The proposed expansion of the Char Manufacturing Plant requires an amendment to the existing WUL. A WUL application for the amendment will be submitted to the Department of Water Affairs (DWA) and this IWWMP amendment will form part of the application. As there is already an existing, approved IWWMP and technical report for the existing Char Manufacturing Plant, this IWWMP Amendment Report will form an Appendix to the existing IWWMP and will thus focus specifically on the expansion of the Char Manufacturing Plant.

Synergistics Environmental Services (Pty) Ltd (Synergistics) has been appointed by Exxaro Reductants to undertake the WUL Amendment Application and compile an amendment to the existing, approved IWWMP to be submitted in support of this application.

This IWWMP Amendment has been compiled with the assistance of the Department of Water Affairs' (DWA) Draft Operational Guideline to assist in the Compilation of an Integrated Water and Waste Management Plan, dated September 2009.

Project Description

Char, a form of devolatilised coal, is used in the metals industry to reduce oxygen from ore to produce the basic metal. There is increased demand for 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 Char Manufacturing process 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.

Construction of the Char Manufacturing Plant Expansion is due to begin in June 2013 and the first retort should be completed by September 2015. Current production is 162 ktpa of char and will

ramp up from September 2015 progressively to March 2016 to a total of 486 ktpa when the Char Manufacturing Plant Expansion is complete.

Water Uses

Section 21 of the National Water Act (No 36 of 1998) (NWA) lists water uses that require licensing prior to commencement. Water uses at the current Char Manufacturing Plant, which are included in the existing WUL are:

21 (a) abstracting water from a water resource (Licence number: 27072505) (see Appendix 1)
21 (g) disposing of waste in a manner which may detrimentally impact on a water resource (also licence number: 27072505).
21 (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity, or for the safety of people (also licence number: 27072505).

A WUL Amendment application will be submitted to the Limpopo Department of Water Affairs for the following water uses at the plant:

21 (a) taking water from a water resource (taking stormwater runoff from the site only)
21 (b) storing water
21 (g) disposing of waste in a manner which may detrimentally impact on a water resource
21 (h) disposing of water which contains waste from, or which was heated in, any industrial or power generation process

There are no exemptions that have been granted for any of the section 21 water uses in terms of the NWA for the existing Char Manufacturing Plant. No exemptions from requirements of the NWA are requested for the Char Manufacturing Plant Expansion.

The following General Authorisations applicable to the Char Manufacturing Plant Expansion Project:

- A general authorisation is applicable for the section 21 (b) water use, for the Limpopo River catchment, for dams with a capacity of less than 10 000 m^3.

  The new raw water storage dam (440 m^3) falls within this section 21 (b) general authorisation.

The application forms for each of the above water uses and general authorisations will be submitted to DWA together with this report to form the WUL Amendment application.

Water Management

Two small water storage dams (and associated pipelines and pumps) will be required for the Char Manufacturing Plant Expansion Project. These include a new sediment settling pond and a raw water storage dam. The current pollution control dam (PCD) (which is part of the existing Char Manufacturing Plant) will be functioning at a higher rate of water recycling to facilitate the expansion. The PCD will not be expanded as part of the Char Manufacturing Plant Expansion Project.

Process effluent and storm water will be collected in the PCD which will be the primary source of process water, with make-up water being sourced from the Grootegeluk Mine process water system. A site water balance compiled for the existing and future use of the PCD indicated that there is sufficient capacity to prevent spillage of contaminated water for storm events up to at least the 1:50 year recurrence interval, for both the current and the expanded operation (Jones and Wagener, 2012).

Char Manufacturing Plant Expansion Project is located within a dirty water area within the Grootegeluk

Coal Mine, there are no clean areas surrounding or within the Char Manufacturing Plant (existing plant and expansion). A stormwater cut-off drain will be constructed around the plant to separate the plant's dirty water from the surrounding environment.

Waste Management

The tar, liquor and sludge which are considered to be hazardous waste from the various processes will not need to be disposed of to a landfill. The tar will be stored in tar storage tanks within the plant that will be bunded to prevent spillage. The tar will be sold to customers. Sludge which will be removed from the plant equipment during maintenance will be mixed with coal fines and transported to the Grootegeluk Mine to be included with the feed coal to Matimba Power Station. The liquor which will be produced from cooling the coal off-gas will be collected in tanks at the liquor destructors and will be destroyed by oxidation (burning) at high temperatures.

Non-process 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 will be collected in rubbish bins and disposal will be handled by the mine through a Service Level Agreement (SLA) between the Char Manufacturing Plant Expansion and the Grootegeluk Mine. All domestic, commercial, industrial waste, builders' rubble and other waste classified as General Waste (G) under the Minimum Requirements for Waste Disposal by Landfill (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.

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 of the Char Manufacturing Plant Expansion. From the sump, two pumps (one duty and one standby – already installed) pump the sewerage via the existing 100 mm diameter HDPE pipeline to the Grootegeluk Waste Water Treatment Works (WWTW).

Environmental Management and Monitoring

An Environmental Management Programme (EMP) has been compiled for the project. This programme will be implemented to ensure that environmental impacts are minimised as far as possible. Regular auditing will also be undertaken to ensure that the EMP is complied with.

A monitoring system has been set up to monitor potential groundwater and surface water impacts (quality and quantity), on both the Char Manufacturing Plant Expansion site and on the neighbouring Grootegeluk Mine. All identified surface water and groundwater monitoring points for the plant shall be monitored.

Conclusions and Key Findings

The Char Manufacturing Plant Expansion project may possibly result in impacts on water resources; however, with the implementation of the EMP and water and waste management measures, the potential impacts are reduced to low or very low levels. 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. It is also essential that the existing Grootegeluk Mine public forum includes the Char Manufacturing Plant Expansion Project, so that potentially affected

parties are able to regularly discuss and resolve waste and water-related issues they may be experiencing. There is no environmental or socio-economic reason why the water use license should not be granted for the Grootegeluk Char Manufacturing Plant Expansion Project.

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LIST OF TERMS, ACRONYMS AND ABBREVIATIONS

BEE	Black Economic Empowerment
BID	Background information document
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.
CMA	Catchment Management Agency
COC	Contaminant of Concern
DEA	Department of Environmental Affairs (National)
DMR	Department of Mineral Resources
DWA	Department of Water Affairs (previously Department of Water Affairs and Forestry)
EAP	Environmental Assessment Practitioner i.e. the professional person that has been responsible for carrying out the EIA.
EC	Electrical Conductivity
ECA	Environmental Conservation Act (Act 73 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMC	Ecological Management Categories
EMP (EMPr for DMR)	Environmental Management Programme
EMS	Environmental Management System
GDP	Gross Domestic Product
General waste	Waste that does not pose an immediate hazard or threat to health or to the environment, and includes-*(a)* domestic waste; *(b)* building and demolition waste; *(c)* business waste; and *(d)* inert waste.
GN	Government Notice as published in the Government Gazette
Hazardous waste	Waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.
HDPE	High-density polyethylene
IAPs	Interested and affected parties
IWWMP	Integrated Water and Waste Management Plan

IWULA	Integrated Water Use License Application
ktpa	kilo tonnes per annum
Liquor	When the coal in the Char Manufacturing Plant expansion 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.
LEDET	Limpopo Department of Economic Development, Environment and Tourism
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
mbgl	meters below ground level
MCWAP	Mokolo and Crocodile Water Augmentation Project
Mℓ	Mega Litres
MPRDA	Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MSDS	Material safety data sheet
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:WA	National Environmental Management Waste Act, 2008 (Act No. 59 of 2008)
NWA	National Water Act, 1998 (Act No.36 of 1998)
PCD	Pollution Control Dam
PESC	Present Ecological Status Category
Reserve	As defined in the National Water Act (No. 36 of 1998), reserve means the quantity and quality of water required - *(a)* to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act No. 108 of 1997), for people who are now or who will, in the reasonably near future, be – (i) relying upon; (ii) taking water from; or (iii) being supplied from, the relevant water resource; and *(b)* to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.
Retort	A retort is an airtight vessel in which substances are heated for a chemical reaction
RQOs	Resource Quality Objectives, defined as: Quantitative and verifiable statements about water quantity, water quality, habitat integrity and biotic integrity that specify the requirements (goals) needed to ensure a particular level of resource protection.
SANS	South African National Standard
SHE	Safety, Health and Environment
SLP	Social and Labour Plan
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 Expansion 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 as an equivalent to a commercially available substance, it is considered a by-product and thus does not fall within the definition of waste as stated in the NEMWA.
TDS	Total Dissolved Solids
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.
WCMR	Waste Classification and Management Regulations
WMA	Water Management Area
WML	Waste Management License
WUL	Water Use License

EXXARO REDUCTANTS (Pty) Ltd
CHAR MANUFACTURING PLANT EXPANSION PROJECT
Integrated Water and Waste Management Plan Amendment

1. INTRODUCTION

1.1 Project Background

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) 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 13.4 ha portion of land across an old coal stockpile area (also known as the old coal middling stockpile area). This site is adjacent to the existing Char Manufacturing Plant which has been operational since 2009 (refer to Figure 1.2). The existing 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 162 ktpa of char. The existing plant occupies an area of approximately 7.4 ha. The land leased by the existing 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 existing Char Manufacturing Plant by increasing the number of retorts from 4 to a maximum of 12, thereby increasing their production capacity threefold. When the expanded Char Manufacturing Plant reaches full capacity it will produce 486 ktpa of char. The majority of the infrastructure associated with the retorts will also be expanded within the current footprint of the existing Char Manufacturing Plant. The stockpile areas required for the coal and char product will expanded considerably.

The existing Char Manufacturing Plant has an authorisation under the Minerals and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA), an environmental authorisation under the Environmental Conservation Act (Act 73 of 1989) (ECA) (ref. 16/1/12-29), and a Water Use License (WUL) (License number: 27072505). There is also an approved Integrated Water and Waste Management Plan (IWWMP) and a Supporting Technical Report for the WUL. The proposed expansion of the Char Manufacturing Plant requires amendments to the existing WUL. An application for the amendment is being submitted to the Limpopo Department of Water Affairs (DWA).

Synergistics Environmental Services (Pty) Ltd (Synergistics) has been appointed by Exxaro Reductants to undertake the WUL Amendment Application and compile an amendment to the existing, approved IWWMP to be submitted in support of this application. The amendments to the existing IWWMP and supporting Technical Report, will thus focus specifically on the Char Manufacturing Plant Expansion Project.

This IWWMP Amendment has been compiled with the assistance of the Department of Water Affairs' (DWA) Draft Operational Guideline to assist in the Compilation of an Integrated Water and Waste

Management Plan, dated September 2009.

1.2 Project 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 in June 2013 and the first retort should be completed by September 2015. Current production is 162 ktpa of char and will ramp up from September 2015 progressively to March 2016 to a total of 486 ktpa when the Char Manufacturing Plant Expansion is complete.

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 expansion is 25 years.

1.3 Location of Project

The Char Manufacturing Plant Expansion will be located on the Farm Daarby 458 LQ, within the boundaries of the Grootegeluk Coal Mine. The regional locality is illustrated in Figure 1.1; the location of the Char Manufacturing Plant Expansion is shown in figures 1.1 and 1.2.

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.

The Char Manufacturing Plant Expansion project site falls within quaternary catchment area A42J and the Limpopo Water Management Area.

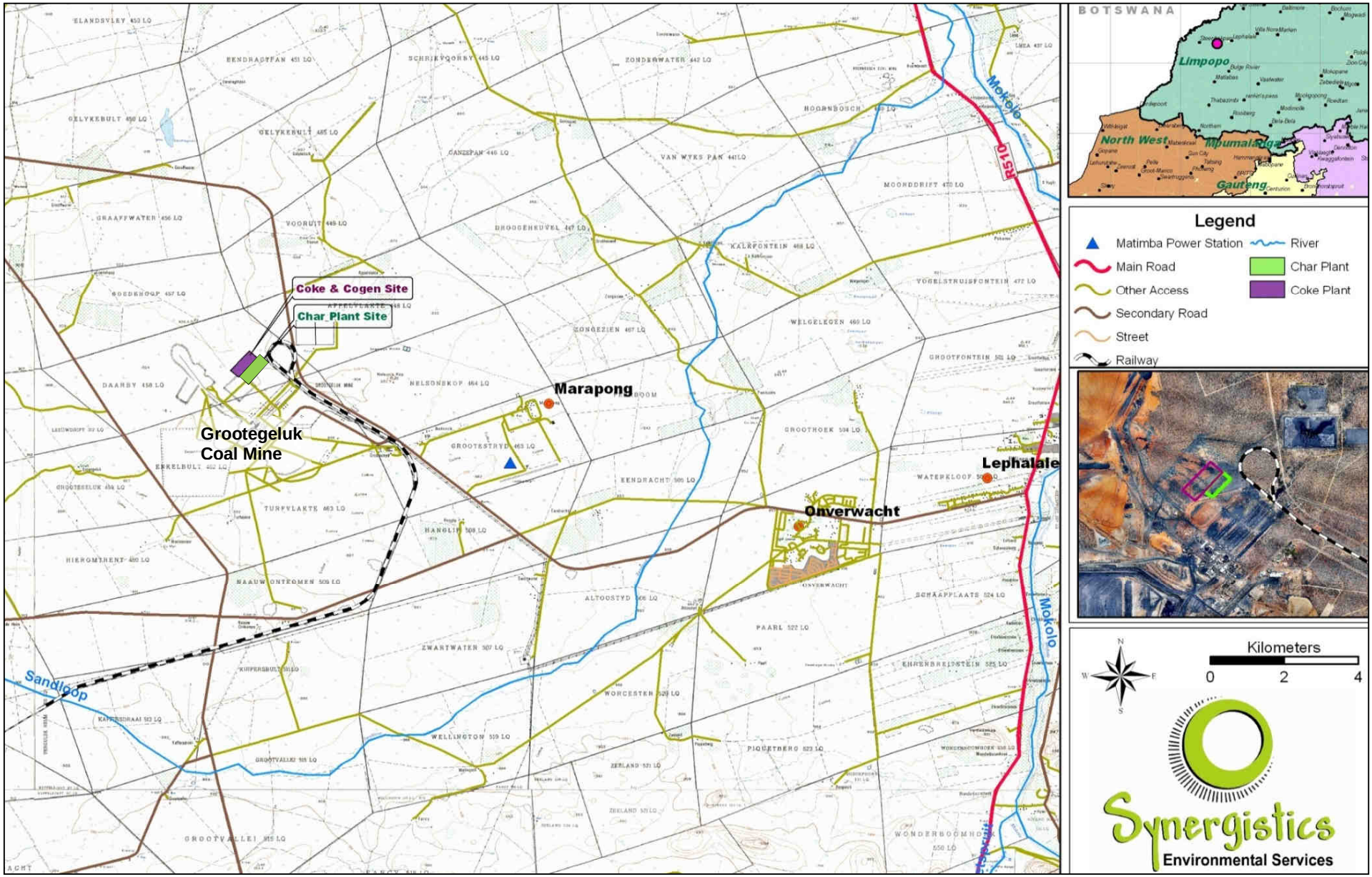


Figure 1.1: Regional location of the Char Manufacturing Plant Expansion, adjacent to the existing Char Manufacturing Plant at the Grootegeluk Mine.

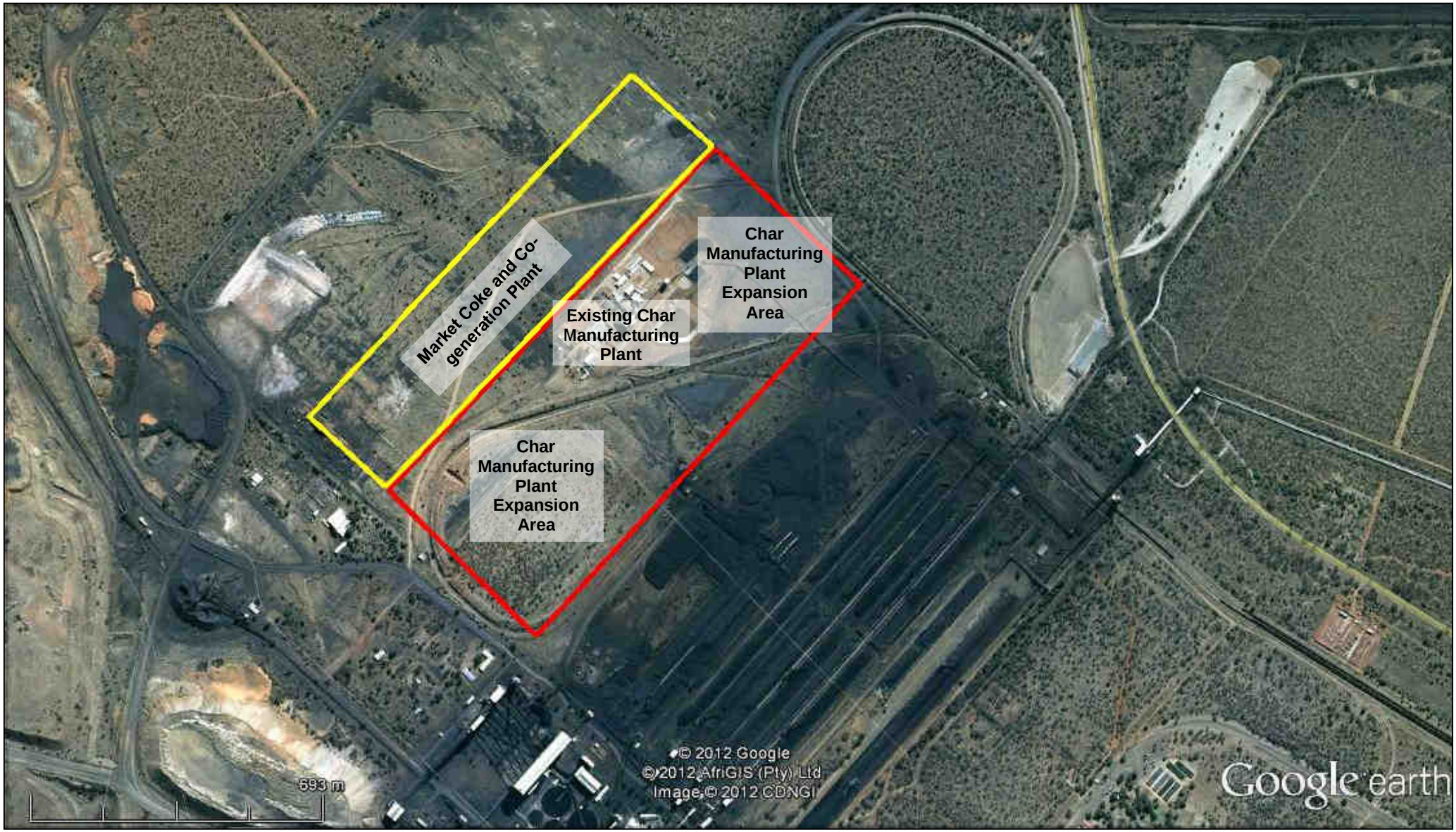


Figure 1.2: Char Manufacturing Plant Expansion area (within the red outline) within the Grootegeluk Mine (aerial view)

1.4 Property Description

The existing Char Manufacturing Plant (see Plate 1.1) 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.

Exxaro own a considerable area of land around the Grootegeluk Mine that is divided into a few sections under different forms of management. Ferroland, a subsidiary company of Exxaro, manages the bulk of the area as a nature reserve called the Manketti Reserve. Ferroland manage their land according to conservation principles and maintain breeding stocks of a variety of large wildlife species (Natural Scientific Services, 2011).

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.

The nearest stream is the Sandloop stream and the closest river is the Mokolo River approximately 20km east of the site (Jones & Wagener, 2012).

Plate 1.1: Photograph of the Existing Char Manufacturing Plant

1.5 Legal Assessment

1.5.1 Existing Lawful Uses

A WUL (Licence number: 27072505) is in place for the existing Char Manufacturing Plant (refer to Appendix 1). This licence includes section 21(a), 21(g) and 21(j) authorisations under the National

Water Act, 1998 (NWA) for the Grootegeluk Coal Mine and the Farm Daarby 458 on which the existing Char Manufacturing Plant are located. The existing licence also includes a section 21(g) authorisation for the Pollution Control Dam (PCD) at the existing Char Manufacturing Plant (page 12 of Appendix 1).

There is also an approved IWWMP and a Supporting Technical Report for the WUL (Appendices 2 and 3). The proposed expansion of the Char Manufacturing Plant requires an amendment to the existing WUL. A WUL application for the amendment will be submitted to the DWA and this IWWMP amendment will form part of the application. As there is already an existing, approved IWWMP and technical report for the existing Char Manufacturing Plant, this IWWMP Amendment Report will form an Appendix to the existing IWWMP.

There are no existing General Authorisations for the existing Char Manufacturing Plant, nor are there any existing General Authorisations on the site where the Char Manufacturing Plant Expansion is going to be constructed. The General Authorisations applicable to the Char Manufacturing Plant Expansion Project are discussed in section 1.5.4 below.

1.5.2 Summary of Water Uses

1.5.2.1 National Water Act (No. 36 of 1998)

For the Char Manufacturing Plant Expansion project, a WUL Amendment application is being submitted to the Limpopo DWA for their approval. The WUL Amendment application will be submitted in August 2012. Section 21 of the NWA lists water uses for which a WUL must be obtained. In terms of the NWA, the following water uses are applicable for the Char Manufacturing Plant Expansion:

- *Section 21 (a) 'taking water from a water resource'.* Since the existing Char Manufacturing Plant and the Char Manufacturing Plant Expansion are within a 'dirty water area' within the Grootegeluk mining area, all storm water runoff will be channelled into the PCD. This water will be reused in the Char Manufacturing process. As storm water runoff is considered to be a surface water resource, an application for a WUL Amendment is being made for a 21(a) use as this storm water will be taken for use by the existing Char Manufacturing Plant and the Char Manufacturing Plant Expansion.

- *Section 21 (b) 'storing water'.* A small raw water storage dam will be constructed to store water to ensure that the Char Manufacturing Plant Expansion 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'*. The existing PCD will be utilised as part of this Char Manufacturing Plant Expansion 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. Thus, as the throughput and usage of the existing PCD will increase, a section 21 (g) WUL amendment is being applied for. A section 21 (g) WUL Amendment application is also being applied for the new settling pond which temporarily collects storm water runoff, allowing sediment to settle out of the water, before the storm water is released into the PCD.

- Section 21 *(h) 'disposing of water which contains waste from, or which was heated in, any industrial or power generation process'.* The water which will collect in the existing PCD and which will pass through the new settling pond will contain waste from an industrial process (char manufacturing) and some of the water will also have been heated in a steam boiler as part of the char manufacturing process.

The application forms for each of these licenses are to be submitted to DWA together with this report.

1.5.3 Summary of Relevant Exemptions

1.5.3.1 National Water Act (No. 36 of 1998)

There are no exemptions that have been granted for any of the section 21 water uses in terms of the NWA for the existing Char Manufacturing Plant Expansion Project. No exemptions from requirements of the NWA are requested for the Char Manufacturing Plant Expansion.

1.5.3.2 Government Notice 704 (4 June 1999)

Government Notice (GN) 704, was published on 4 June 1999, in Government Gazette No. 20119, Vol. 408, in terms of Section 26 (1) (b), (g) and (i) of the NWA. The Regulations pertain to the use of water for mining and related activities and are aimed at the protection of water resources.

The Char Manufacturing Plant Expansion will be located within the mining area of the Grootegeluk Coal Mine and thus GN704 is applicable. There are no exemptions that have been granted for the existing Char Manufacturing Plant. No exemptions from GN704 are requested for the Char Manufacturing Plant Expansion.

1.5.4 Summary of General Authorisations

In terms of GN 399 of 26 March 2004 “Revision of General Authorisations In Terms Of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998)”; GN 313 of 20 March 2009; GN 1199 of 18 December 2009; GN 837 of 23 September 2010 and GN 498 of 28 June 2012, the following is noted in terms of General Authorisations applicable to the Char Manufacturing Plant Expansion Project:

- A general authorisation cannot be obtained for the section 21(a) water use as the Limpopo River catchment is excluded and thus requires a license application.
- A general authorisation is applicable for the section 21 (b) water use, for the Limpopo River catchment, for dams with a capacity of less than 10 000 m^3.

  The new raw water storage dam (440 m^3) falls within this section 21 (b) general authorisation.
- A general authorisation cannot be obtained for the section 21(g) for the settling pond or the PCD as the water being stored is neither a domestic nor biodegradable wastewater which is required in order to apply for a general authorisation under 21(g). Thus a license application is required.
- A general authorisation cannot be obtained for the section 21(h) water use as the water being discharged in to the PCD meets the definition of “complex industrial wastewater” in GN 399 of 26 March 2004. Thus a WUL Amendment is required.

1.6 Section 27 Motivation

1.6.1 Section 27(1) (a): Existing lawful water uses

These have been described in Section 1.5.1 above.

1.6.2 Section 27(1) (b): The need to redress the results of past racial and gender discrimination

The Mining Charter (updated in 2010) in South Africa states that all mining development is aimed at redressing previous racial and gender discrimination. With the promulgation of the MPRDA, and the establishment of the subsequent Black Economic Empowerment (BEE) scorecard, the mining industry is geared towards sustainable development, providing opportunities to the previously disadvantaged. The proposed construction and production activities at the Char Manufacturing Plant Expansion are subject to compliance with the MPRDA legislation and the BEE scorecard, as they fall within a mining area. The Char Manufacturing Plant Expansion is expected to have the following positive socio-economic impacts:

- Stimulation of regional and local economy;
- Increased government income (through taxes);
- Increase in local employment level - an estimated additional 500 people will be employed during the construction phase and a total of 240 (108 permanent and 132 contractors) people during the operational phase of the Char Manufacturing Plant Expansion project. The current number of employees at the existing plant is 151 (85 permanent and 66 contractors). Thus, after expansion there will be an additional 89 employees.
- Increased standards of living for the nearby communities (as a result of higher incomes in the area); and
- Transfer of skills to unskilled workers.

The issuing of the water use license amendment is required before the Char Manufacturing Plant Expansion Project can go ahead. Thus there would be no positive socio-economic benefits without a water use license.

1.6.3 Section 27(1) (c): Efficient and beneficial use of water in the public interest

As public trustee of the water resources, the DWA must ensure that the water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all users. The Minister, through the department has to ensure that the water is allocated equitably and used beneficially in the public interest, while promoting environmental values.

The Char Manufacturing Plant Expansion Project is committed to sustainable water use and one of the key focus areas in the WUL Amendment application is to investigate and put into practice, water efficient devices or techniques for the re-use of water containing waste, in an endeavour to conserve water at all times. The use of the water will be in the public interest as it will result in the positive socio-economic impacts described in the section below.

1.6.4 Section 27(1) (d): The socio economic impact

1.6.4.1 Socio-economic impact of the water use or uses if authorised

The socio-economic impacts of the plant have been discussed in detail in section 4.6.4 of this report. Exxaro Reductants' existing Char Manufacturing Plant is included in the approved social and labour plan (SLP) for the Grootegeluk Coal Mine. The Char Manufacturing Plant Expansion project will be incorporated into the next updated version of the SLP. The Char Manufacturing Plant Expansion Project will directly assist in contributing positively to the existing socio-economic impacts of the area. The following positive impacts have been identified:

- Stimulation of economy - during the construction and operation phase of the expansion, due to increased financial spending from the plant, increased infrastructure investment and increased

spending from employees.

- It is expected that an additional 89 employment opportunities will be created. There will also be approximately 500 temporary jobs created during the construction phase. A large percentage of these employment opportunities will benefit the surrounding communities.
- Increased standards of living for the nearby communities (as a result of higher incomes in the area).
- Increased government income will allow for a positive economic impact for the country, during the construction and operation phase. Income will be derived from the increase in the tax base from royalties, company tax, PAYE, UIF, SDL, service council levies and rates.
- Skills development is a prerequisite for human resource development and the skills development initiatives during the construction and operation phase of the plant will have a lasting impact on the economy and beneficiaries.

1.6.4.2 Socio-economic impact of the failure to authorise the water use or uses

If the WUL Amendment is not authorised then there will be none of the above-mentioned positive socio-economic impacts. If there is no amendment to the current WUL the Char Manufacturing Plant Expansion Project will not be able to be implemented and thus jobs will not be created.

1.6.5 Section 27(1) (e): Any catchment management strategy applicable to the relevant water resource

The Char Manufacturing Plant Expansion is situated within quaternary catchment area A42J. The Water Management Area is number 1 – Limpopo, and the relevant Catchment Management Agency (CMA) is the Limpopo CMA. A finalised Catchment Management Strategy has not yet been completed for this CMA. However the following reports have been written by the Department of Water Affairs: Limpopo WMA: Water Resources Situation Assessment (2003) and Internal Strategic Perspective: Limpopo Water Management Area (2004). These reports provide the initial baseline data to be used by the CMA to develop its catchment management strategy, objectives, plans, guidelines and procedures for the protection, use, development, conservation, management and control of the water resources in the Limpopo.

Below in Table 1.1 and 1.2, are the management strategies for the Mokolo Key Area as outlined Part B of the Internal Strategic Perspective: Limpopo Water Management Area; (DWAF, 2004), which is be applicable to the A42J catchment as it is a part of the Mokolo catchment area.

Table 1.1. Water Balance and Reconciliation- Mokolo Key Area (Source: DWAF, 2004)

Situation assessment	The surface water resources of the Mokolo Key Area are substantial, while groundwater is also used. The large Mokolo Dam, together with numerous dams in the upper reaches of the Key Area, as well as run-of-river, all contribute to a large surface water resource estimated at 77 million m^3/a, after allowing for the Ecological Reserve. The current groundwater resource is estimated at 11 million m^3/a and this is used to supply irrigation and domestic rural use. The Mokolo Key Area is approximately in balance. Potential future requirements of Mokolo Key Area are: • Fast growing urban population in Lephalale and an explosion of informal settlements in and around the town of Vaalwater • Water required for emerging farmers in the catchment • Potential large scale methane gas field development around the coal reserves • Ecological Reserve requirements • Small-scale economic development for poverty eradication

	• Water to meet basic needs of the rural communities
Broad Management Objectives	To better understand current and potential future water requirements in the Mokolo Key Area.
Overall Strategic Approach	The overall strategy for the Mokolo Key Area is to maintain the catchment in at least its current state of balance. This can be achieved by not issuing any more water use licenses for irrigation. Other user sectors will need to source their additional water requirements from groundwater if possible, failing which the construction of farm dams is also as option. In the longer-term, if large new requirements materialise relating to development of the gas fields or the possible additional power station, additional surface water could be obtained from: • Transfers in from the Lower Crocodile, • Raising of the Mokolo Dam wall, • Trading with the irrigation sector.
Actions, Responsibility & Priority	• Assemble better estimates of current water use, especially the irrigation sector, • Obtain reliable rural and urban population figures for the catchments and the corresponding growth rates. The information will assist in determining the trends, • Obtain projected future water demands from Kumba Resources (now Exxaro Coal) and ESKOM, • Use the estimates to calculate accurate future water requirements, • Investigate groundwater as an additional option for meeting future water requirements, • Determine the needs of future coal/gas mining activities.

Table 1.2. Water Quality Management - Mokolo Key Area (Source: DWAF, 2004)

Situation assessment	Informal settlements have developed rapidly around Vaalwater (A42C) leading to increasing demands on the water supply and a serious potential for groundwater pollution. A similar situation is occurring at Alma, south of Vaalwater. Groundwater quality could be seriously impacted from the uncontrolled growth of informal settlements around the existing settlements. The quality of the water resource could also be affected by pollution from the Grootegeluk Coal Mine. Some of the water quality problems that could result from the coal mine are acid mine water, low PH, and a concentration of TDS. The extent of diffuse pollution from the mine and other industries in the area must be investigated and quantified. Adverse impacts from activities within these catchments outside of Vaalwater and small settlements are unlikely.
Broad Management Objectives	This strategy seeks to ensure that the extent of water resource pollution by Grootegeluk Colliery, agricultural activities, uncontrolled growth of informal settlements and other industries such as Matimba Power Station is understood and this understanding is applied in the development of strategies to improve the situation.
Overall Strategic Approach	Studies need to be initiated to understand the extent of potential pollution as a result of uncontrolled growth of informal settlements, mining activities in the Grootegeluk Mine, and agricultural activities. Water quality monitoring at selected key strategic points is required to understand the situation better and develop effective management strategies. These need to be developed and implemented in close co-operation with local Municipalities and the Grootegeluk Colliery.
Actions, Responsibility & Priority	Undertake a water quality situation assessment study to better understand pollution from Grootegeluk Coal Mine, agricultural activities upstream and downstream of the Mokolo Dam, and uncontrolled growth of informal settlements around Vaalwater.

1.6.6 Section 27(1) (f): The likely effect of the water use to be authorised on the water resource and on the water users

The effect of the water use on the resource will be that the resource will be utilised in a sustainable

manner. The Char Manufacturing Plant Expansion will not directly abstract any water from surface water or groundwater resources for their operations. Stormwater runoff from the plant site will be captured in the PCD and used in the process. Thus this captured stormwater will be the only surface water used.
The clean water (raw water and potable water) required for the Char Manufacturing Plant Expansion will be obtained from the Grootegeluk Coal Mine's existing raw water allocation from the Mokolo Dam. Dirty water required for the plant processes will be obtained from recycling dirty water from the existing Char Manufacturing Plant's PCD as well as using dirty water from other pollution control dams at the Grootegeluk Mine. Water will be recycled in the plant's processes as far as possible.

1.6.6.1 Quality of the ground and surface water

The potential to contaminate the water resource has also been considered and monitoring of ground water takes place to assess the changes in water quality. The results of the surface water and geohydrological studies (refer to Appendices 4 and 5) indicate that activities at the Char Manufacturing Plant Expansion are unlikely to change the quality of water in the underlying aquifer or in the surface water used by surrounding users.

1.6.6.2 Quantity of the ground water

As no groundwater will be abstracted for the Char Manufacturing Plant Expansion project, the water table will not be lowered. Groundwater modelling suggests that there could be potential water table rising in the vicinity of the project area due to artificial recharge through seepage from the modelled sources (i.e. possible seepage from the stockpiles). This rise in the water table is in the order of 0.05 m at the end of the life of the plant.

1.6.6.3 Quantity of surface water

Within the Char Manufacturing Plant Expansion site, 1522 m^3/month (average) of rainfall water, runoff and seepage is estimated to be obtained from the dirty water area at the plant. This water runs into the PCD where it gets reused in the process. The exact value obtained will be dependent on the amount of rainfall received in the area.

Thus the capture and use of stormwater and runoff will reduce the amount of surface water in the catchment by approximately 18 264 m^3/annum.

1.6.6.4 Water users

Surface water
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.

The Char Manufacturing Plant Expansion site is within a dirty water area at the Grootegeluk Mine and all storm water runoff is contained within the PCD, thus the contaminated water will not leave the site nor have an impact on water users.

In an emergency situation, if there were to be a spill within the site, only the Grootegeluk Mine area would be impacted as the Char Manufacturing Plant Expansion site is within the Grootegeluk mining area. There is also an additional Grootegeluk Mine PCD (called the Bosbok Dam) downstream of the Char Manufacturing Plant PCD. If the Char Manufacturing Plant PCD (for the existing plant and

expansion) were to overflow, this water would flow into the Bosbok Dam PCD downstream. Thus even in the unlikely event of an overflow, the dirty water would still not leave the Grootegeluk Mine site and would not impact other surface water users.

Ground water

The groundwater contribution to streams in Lower Mokolo catchment area (catchment A42J) is zero (DWAF, 2009). This implies that potential contaminants in the groundwater are highly unlikely to impact on the quality of streams in the area. Thus the surface water users in the surrounding area are unlikely to be affected.

1.6.7 Section 27(1) (g): The class and the resource quality objectives of the water resource

Chapter 3, Part 2 of the NWA states: *"Under Part 2 the Minister is required to use the classification system established in Part 1 to determine the class and resource quality objectives of all or part of water resources considered to be significant. The purpose of the resource quality objectives is to establish clear goals relating to the quality of the relevant water resources. In determining resource quality objectives a balance must be sought between the need to protect and sustain water resources on the one hand, and the need to develop and use them on the other. Provision is made for preliminary determinations of the class and resource quality objectives of water resources before the formal classification system is established. Once the class of a water resource and the resource quality objectives have been determined they are binding on all authorities and institutions when exercising any power or performing any duty under this Act."* Thus, the Minister of Water Affairs is required to classify the significant water resources and set resource quality objectives (RQOs).

1.6.7.1 Water Resource Classification

The resource classification involved the assessment of the following ecological aspects:

- The presence of rare or endangered species,
- Habitat diversity,
- The importance of a river reach in providing connectivity between different sections of the river, and
- The sensitivity of the reach to environmental changes.

The water resource, A42J catchment (where the Mokolo Key area is situated) has been classified by the DWA as an ecological management Class C – Good Management Class and Good Water Resource Class (DWAF, 2004). DWAF (2006), states that the present ecological state of the Mokolo River Catchment (A42) lies predominantly in a Fair to Good Ecological Class.

The DWAF 2004 '*Integrated water resource management: Guidelines for groundwater management in the areas, South Africa'* Report illustrates the relationship between the six distinct ecological management categories (EMC) and the management and water resource classes. These categories are also used to describe the present ecological status category (PESC). The table below (Table 1.3) captures the information relevant for EMC/PESC Class C (DWAF, 2004**b**).

Table 1.3. Illustration of the relationship between EMC/PESC and water resource class (Source-DWAF, 2004**b**)

MANAGEMENT CLASS	EMC/PESC	WATER RESOURCE CLASS
Excellent	A – (Un-modified/ natural)	Natural
Good		**Good**

	B- (Largely natural)	
Fair	**C - (Moderately modified)**	**Fair**
	D- (Largely Modified)	
	E- (Seriously modified)	Poor
	(Critically modified)	

DWAF (2006) added that while the Mokolo Catchment is currently in a Fair to Good state, increasing water demands within the catchment are likely to cause a downward trend in the overall status of the system.

1.6.7.2 Water Resource Quality Objectives

Table 1.4. Reserve and Resource Quality Objectives Strategy - General Strategy Applicable to Whole WMA (Source- DWAF, 2004)

Situation assessment	None of the river systems in the Limpopo WMA have been classified nor have the resource quality objectives been determined. The methodology for classifying the river systems is in the process of being developed nationally. Rapid Reserve determinations have been done for some of the rivers based on the license applications, but none have yet seen either intermediate or comprehensive determinations. A need for the Reserve in the river systems of the Limpopo WMA are discussed below: Mokolo River: The Mokolo River system is perennial. The flow regime in the lower reaches downstream of the Mokolo Dam has been modified by releases from the dam. Irrigators also abstract water downstream of the Mokolo Dam. To ensure that there is a balance between the irrigators requirements and ecological environment, Reserve determination for the river reach downstream of the dam should be conducted at an Intermediate level. The Ecological requirements of the Mokolo Key Area have not been determined in any detail, but the NWRS estimates the impact of the Reserve on the currently available yield at 17 million m^3/a. This can theoretically be supplied from currently available water although this would require a re-allocation from the Mokolo Dam and/or the curtailment to irrigation upstream of the dam.
Broad Management Objectives	This strategy seeks to ensure that all the river systems, their tributaries and reaches in the Limpopo WMA are classified according to Chapter 3 (sections 12-15) of the NWA and that the class and resource quality objectives have been determined for all or part of the river systems that have been considered significant. In addition this strategy seeks to prioritise the various main river systems in the Limpopo WMA in terms of Reserve determination.
Overall Strategic Approach	DWAF will do everything possible to set a stage for River Classification, determinations of the Resource Quality Objectives and Reserves. Once the river systems, reaches and tributaries have been classified and Resource Quality Objectives determined, the Department will determine the human & ecological Reserves in catchments where there is pressure to do so.
Actions, Responsibility & Priority	Prioritize the river systems with regard to Reserve determination. The following rivers should receive priority:- *Mokolo, Mogalakwena, Nzhelele and Nwanedi*. • Assemble the data that would assist in the classification of the river systems. Typically this would include aquatic ecosystems in each river reach, socioeconomic activities etc. • Once appropriate data has been assembled, classify the river systems, reaches and tributaries. • Once the methodology for classifying the river systems has been established, this should be applied to all systems. • Develop management guidelines and procedures for each river system • Liaise with all stakeholders to ensure that the concept of Reserve is well understood.

1.6.8 Section 27(1) (h): Investments already made and to be made by water user in respect of the water use in question

Exxaro Reductants Pty Ltd is the developer of the Char Manufacturing Plant Expansion Project. The expansion to the Char Manufacturing Plant will be at a total cost of about R900 million. At this point in the project, approximately R12.5 million has been spent.

1.6.9 Section 27(1) (i): The strategic importance of the water use that has been authorised

The water use is required because the current and proposed activities at the Char Manufacturing Plant Expansion Project will contribute positively towards the economic development of the site, area and region.

1.6.10 Section 27(1) (j): The quality of water in the water resource which may be required for the Reserve and for meeting international obligations

1.6.10.1 Groundwater

The groundwater quality in the area has been described in detail in section 3.4.2 of this report. The groundwater quality results from the site have been compared to the South African National Standards (SANS) 241 specifications of 2011 for drinking water.

Boreholes within and near the site were sampled for water quality. The pH in the majority of the borehole water samples near the site were slightly acidic an average value of pH 6.5. The Groundwater report ERM 2012, includes a list of boreholes sampled and their individual water quality results. Some of the boreholes showed elevated levels of electrical conductivity, lead and selenium.

1.6.10.2 Surface Water

The surface water quality in the PCD and the Bosbok Dam have been determined and described in detail in section 3.3 of this report. The surface water quality results from the site have been compared to the (SANS) 241 specifications of 2011 for drinking water.

The PCD water was found to exceed the drinking water standards for sulphate, magnesium, Total Dissolved Solids and Total Petroleum Hydrocarbons. The Bosbok Dam water (which is re-used by Grootegeluk in their coal processing plant) has high conductivity, but no traces of Petroleum Hydrocarbons (indicating that there is no overflow from the existing Char Manufacturing Plant PCD reporting to this dam).

1.6.11 Section 27(1) (k): The probable duration for any undertaking that a water use has been authorised

The water use requirements will apply for the life of the plant to ensure availability of water for the processes required, as well as to ensure safe production conditions for the Char Manufacturing Plant Expansion Project and its employees. The life of the plant is currently estimated to be approximately 25 years, but may vary depending on the economic conditions and other external factors. Construction of the Char Manufacturing Plant Expansion is due to begin August 2013 and the first retort should be completed by September 2015 and should be operational by March 2016.

2. PROJECT DESCRIPTION

2.1 Purpose of the Document

The purpose of this report is to present the results of the investigations regarding water and waste issues for the Char Manufacturing Plant Expansion Project, in order to inform the Limpopo DWA and registered interested and affected parties (IAPs) of the issues and impacts of the project on the quality and quantity of water resources in the area. The report also presents the management and mitigation measures identified for the project.

2.2 Objectives of the Project

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 an increased demand for production of char within this market, which the Char Manufacturing Plant Expansion aims to address. 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.

In addition, Exxaro would like to invest more in char production opportunities due to the high profit margins on this product.

2.3 Physical Project Description

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°C. 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.

2.3.1 Extent of Operation

The expanded Char Manufacturing Plant will occupy a footprint area of approximately 13.4 ha. The site is rectangular with an approximately 475 m base width and 1120 m length. The proposed plant layout is given in Figure 2.1 and 2.2 below.

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 2.1: 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)

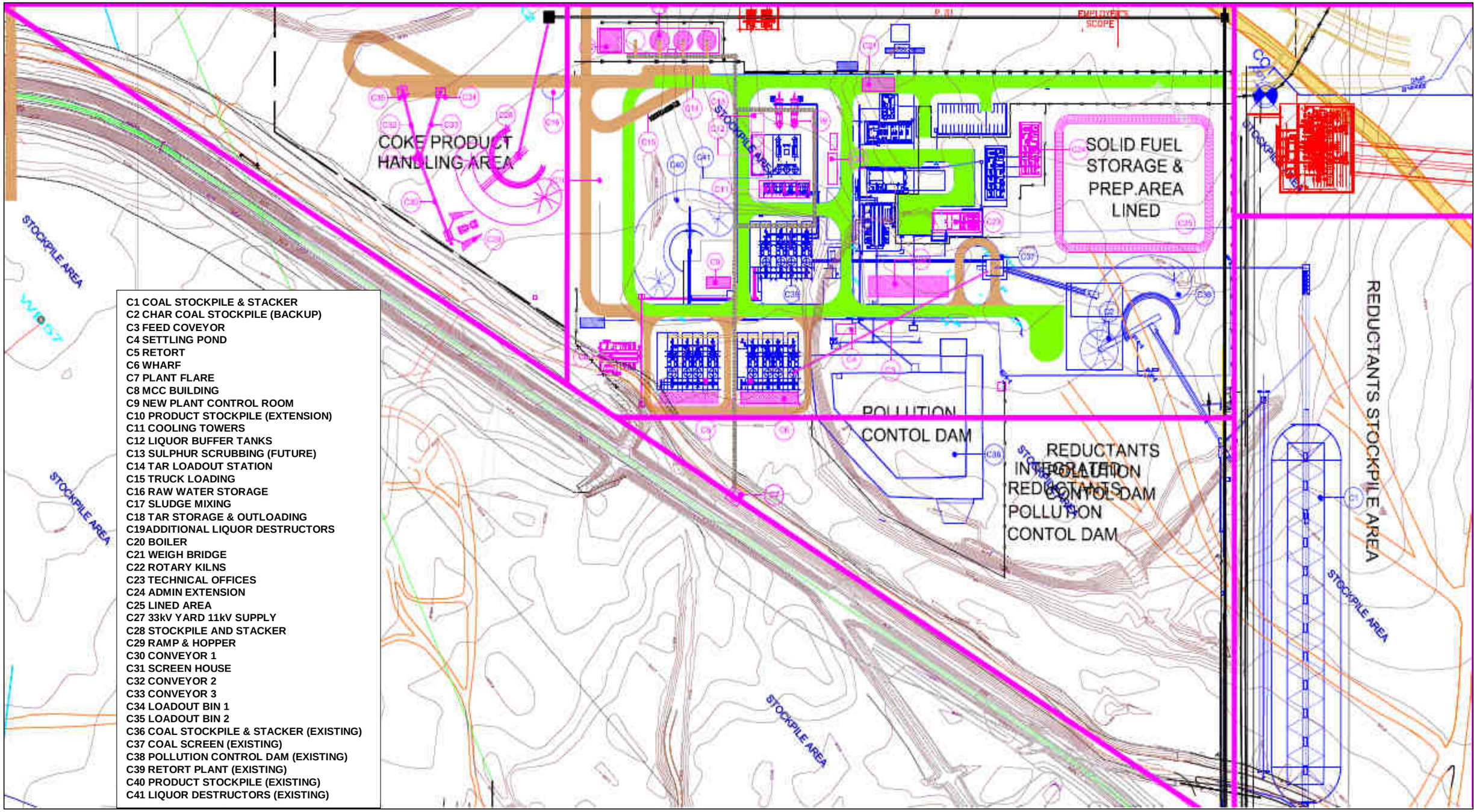


Figure 2.2: Smaller scale layout of Char Manufacturing Plant Expansion showing plant and stockpile areas

2.3.2 Char Process

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.

A simplified process flow diagram of the process is given in Figure 2.3 with a more detailed process flow diagram in Figure 2.4 and Figure 2.5.

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.

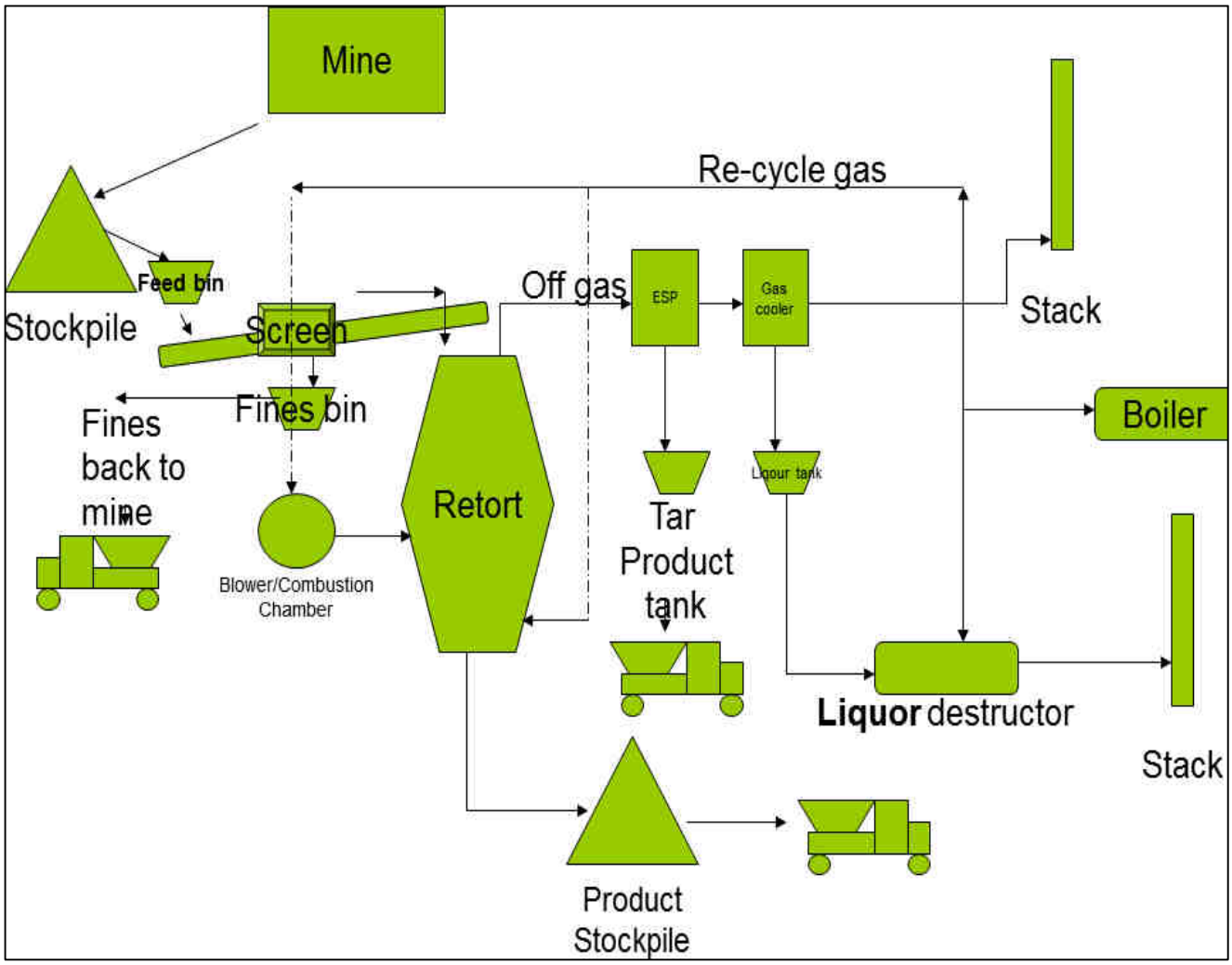


Figure 2.3: Simplified process flow diagram of the Char Manufacturing process

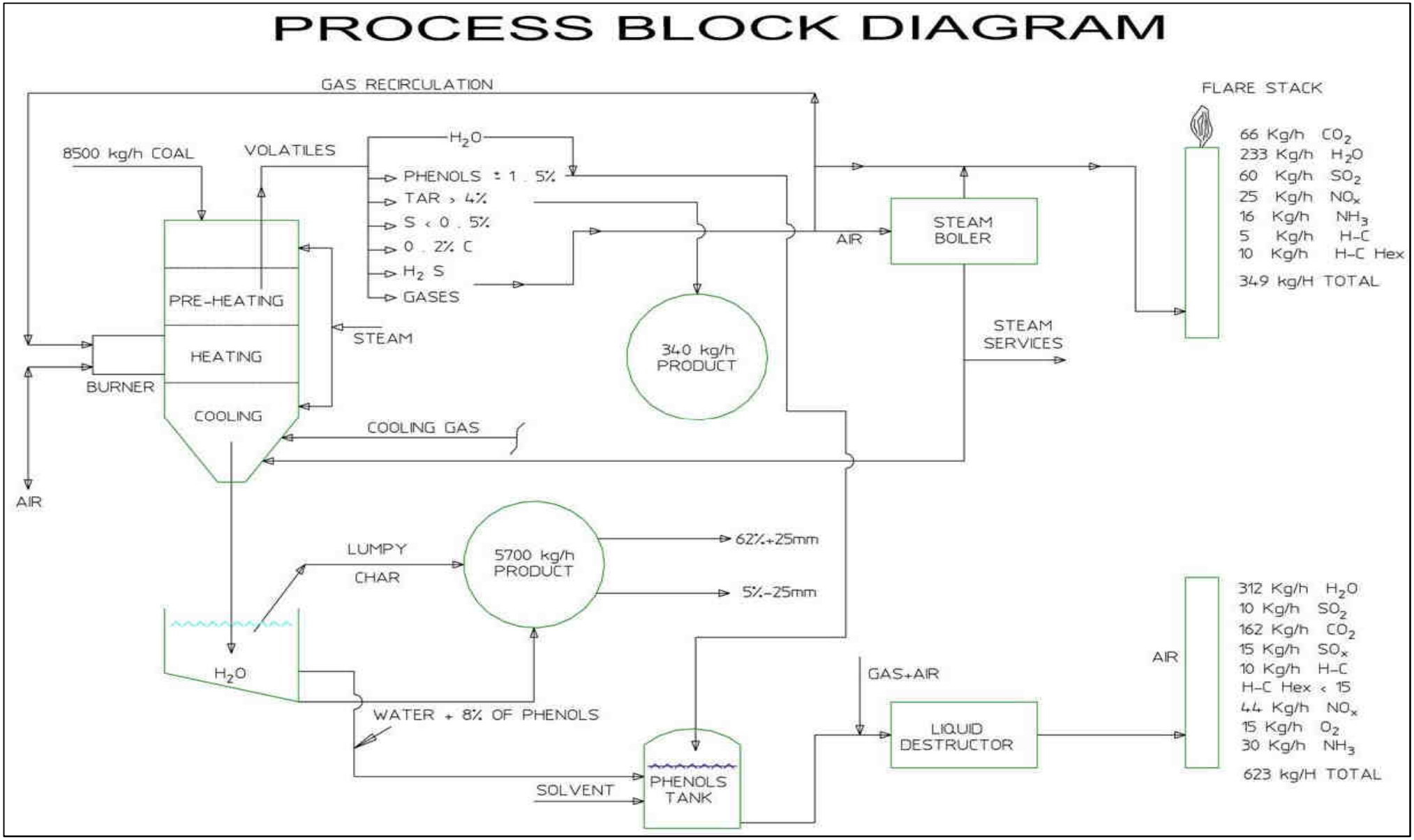
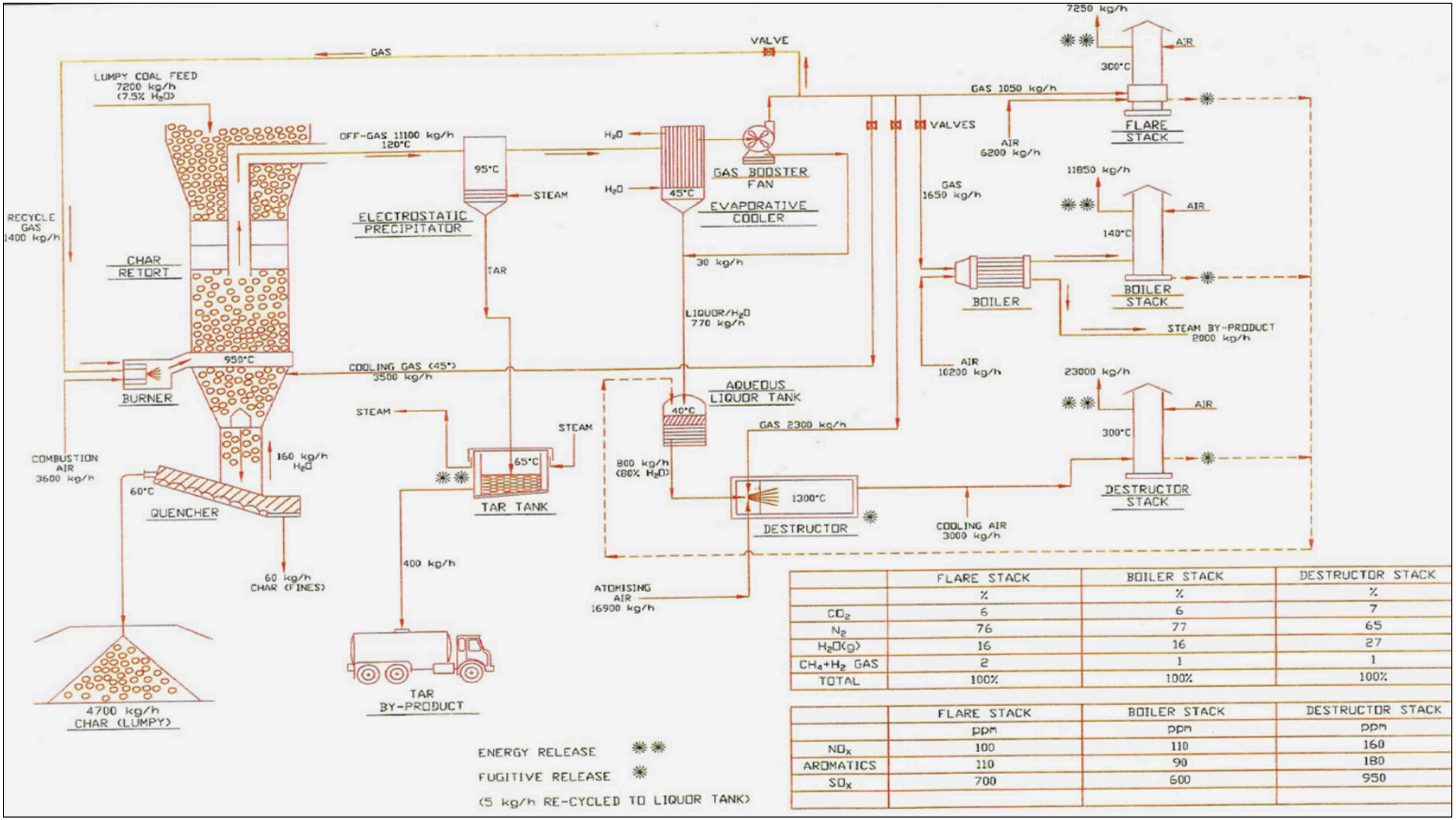


Figure 2.4: Process flow block diagram of Char Manufacturing Plant (per Retort) (existing plant and expansion)



	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 2.5: Process flow diagram of Char Manufacturing Process (per Retort) showing inputs and outputs (for existing plant and expansion)

2.3.2.1 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 will be transported to the Char Manufacturing Plant Expansion via an overland conveyor system and is stockpiled at the Char Manufacturing Plant Expansion site by means of a stacker onto the coal stockpile (kidney shaped) (Plate 2.6). 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 sourced from different benches.

Plate 2.6: The coal from the mine is transported to the Char Manufacturing Plant Expansion 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 2.7). The coal is then washed and sized using a vibrating screen (Plate 2.8). 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**.** The screened coal is transported via conveyor belt to the retort feed bins located above the retorts Plate 2.9.

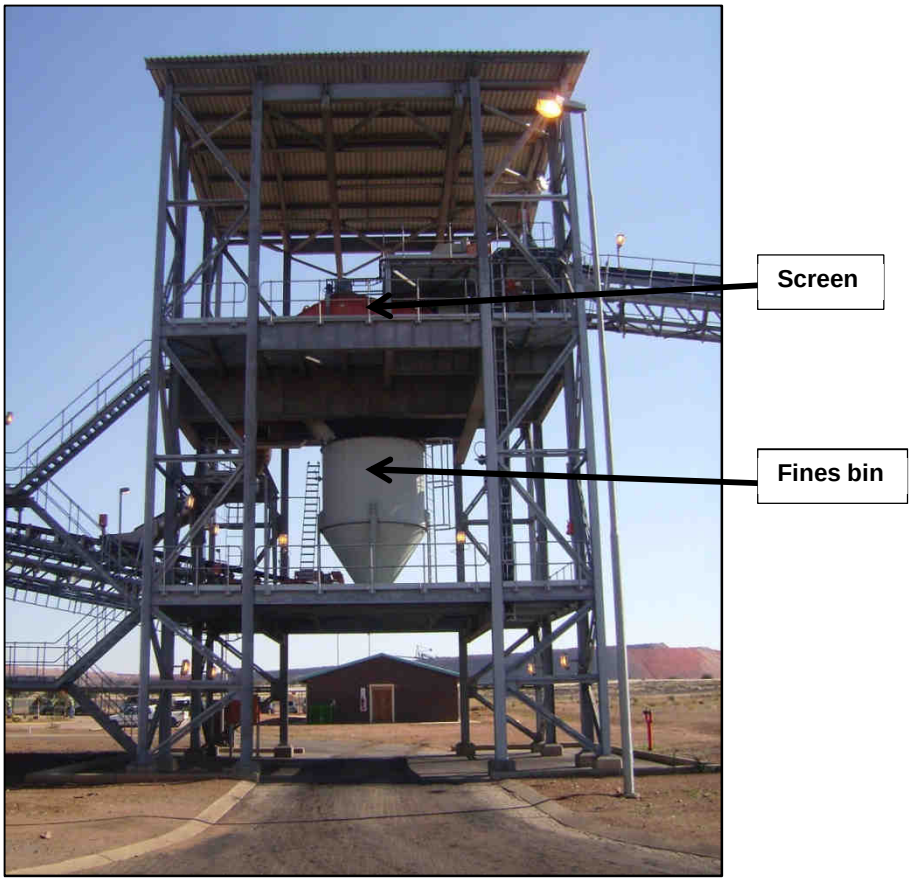


Plate 2.7: The coal screening house with conveyor belts bringing coal in and taking screened coal to the retorts.

Plate 2.8: The vibrating screen – coal is passed over this screen to remove the unwanted fines less than 15 mm in size.

Plate 2.9: The screened coal is transported via conveyor belt to the retort feed bins located above the retorts.

2.3.2.2 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 2.10) 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 2.11).

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

Plate 2.10: Retort feed bins above the retorts.

Plate 2.11: The retort in which the coal is heated.

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 (Refer to Plate 2.12).

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) (refer to Plate 2.13 and Plate 2.14).

Plate 2.12: Quenched char leaving the retort.

Plate 2.13: The product stacker stacking the char onto the product stockpile area.

Plate 2.14: Char is stockpiled and separated (screened) into char fines and lumpy char.

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

2.3.2.3 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 2.15). 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 (Plate 2.16) from where it is collected by customers/contractors by pumping it into to road tankers. It is primarily used in the manufacture of creosote. The tar is currently sold and 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.

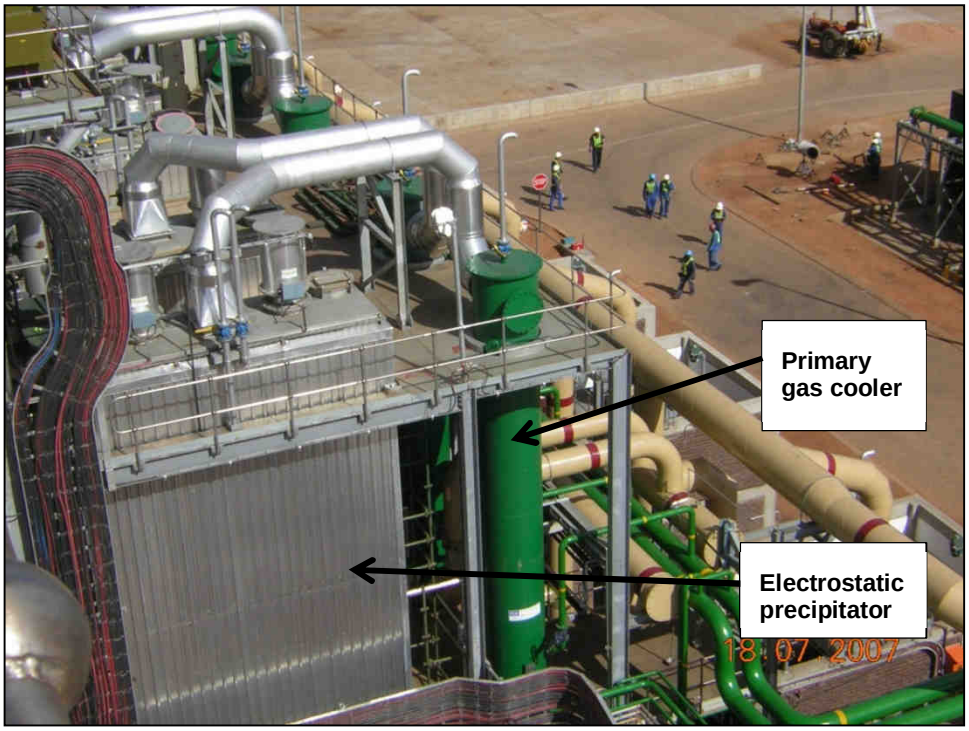


Plate 2.15: Photo showing the electrostatic precipitator which separates the tar from the volatile gas mixture and the primary gas cooler which cools the remaining gas to 40°C.

Plate 2.16: Tar storage tanks.

2.3.2.4 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 40oC (Plate 2.18). 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 2.17).

Plate 2.18: The cyclonic separator.

Plate 2.19: 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 2.20) 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 2.20: 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 2.21). 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 2.21: Flare stacks.

2.3.2.5 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 2.22). 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 2.22: Sludge mixing area (currently using part of the product storage area)

2.3.3 Project Life Description

The plant has a proposed life of 25 years. 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.

2.3.4 Infrastructure Requirements

The infrastructure requirements for the site of the proposed Char Manufacturing Plant Expansion (also showing the existing Char Manufacturing Plant and the proposed coke and co-generation plant) are illustrated in Figure 2.23. From this illustration it can be seen that some of the infrastructure required for the plant expansion (existing and to be expanded) 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 (PCD) and silt trap.

Two smaller scale layouts of the Char Manufacturing Plant Expansion area are provided in Figure 2.23 and Figure 2.24. 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 sludge (coal fines and tar mixture) handling area;
- Construct a sludge storage and reclamation facility;
- Increase the size of the coal feed stockpile with automated coal loading;
- Construct an additional 100 m^3 silt pond;
- Construct a 440 m^3 raw water storage dam;
- 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

2.3.4.1 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: 13.4 ha (including existing plant and with stockpile extensions)

Enlarged Char Stockpile: 9300 m^2

The water and waste related infrastructure requirements are described in further detail in Sections 6.2 and 6.3 of this report.

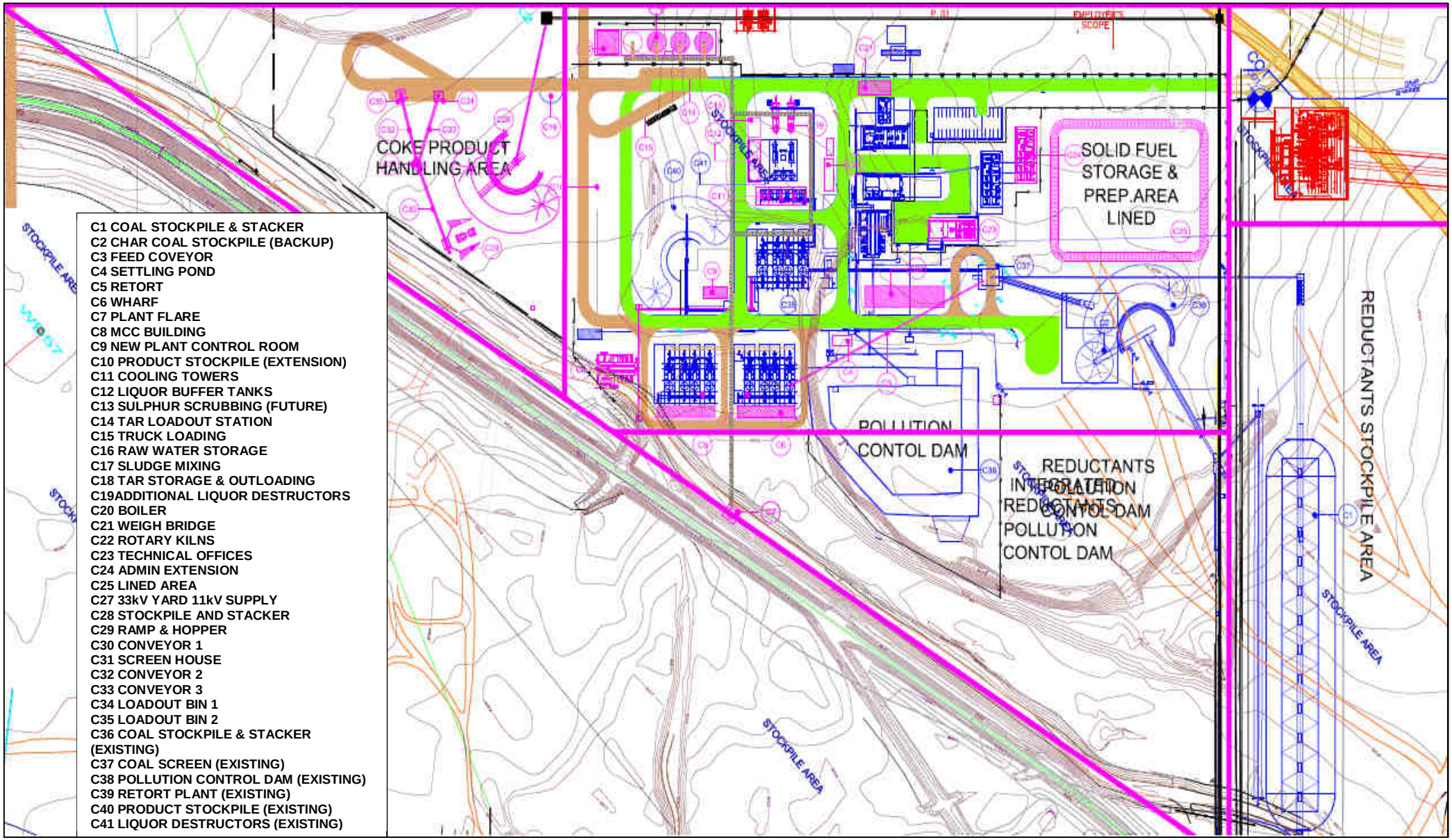


Figure 2.23: Smaller scale layout of Char Manufacturing Plant Expansion showing plant and stockpile areas

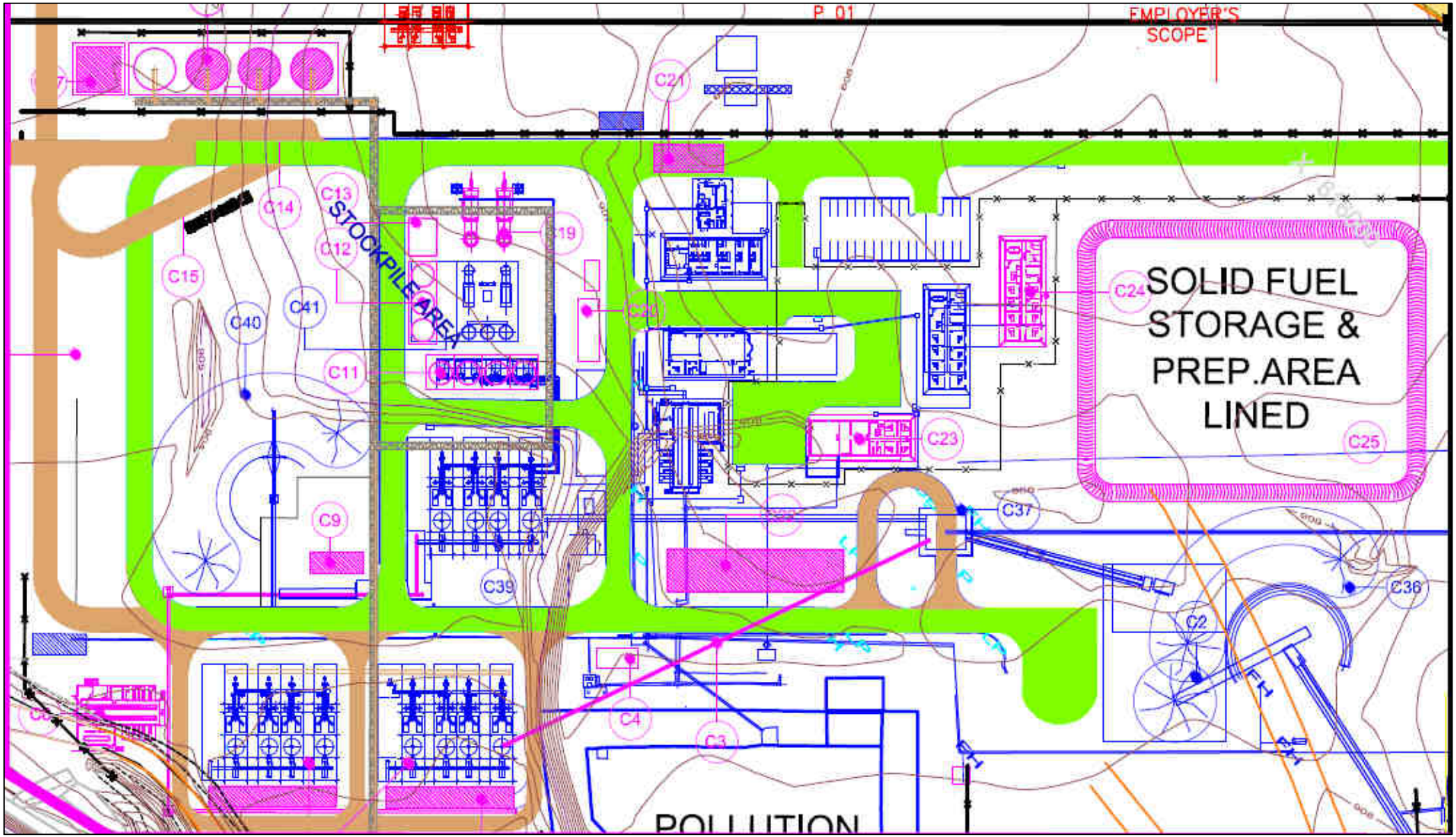


Figure 2.24: Smaller scale layout of Char Manufacturing Plant Expansion showing plant only (see figure above for legend)

2.4 Residue and Emissions

2.4.1 Waste Stream Identification

The following solid waste streams have been identified for the Char Manufacturing Plant Expansion Project: sediment from the PCD, sediment from the silt trap and new silt pond, sludge (a mixture of sludge which collects in the plant machinery and char fines - which is sold as a by-product), general waste (construction rubble and domestic), and hazardous waste (workshop waste).

The following effluents / liquid wastes have been identified for the Char Manufacturing Plant Expansion Project: tar (which is sold as a by-product), liquor (which is incinerated), dirty storm water and process water contained in the PCD and sewage (which flows to an existing wastewater treatment works). The dirty storm water and process plant effluent will be managed using the PCD and recycled into the char manufacturing process at the plant site. The various waste streams are described in more detail in section 6.2 of this report.

Please note that a Waste Management License (WML) application has been submitted to the Department of Environmental Affairs (DEA) for certain waste generated as a result of this project (tar, liquor and sludge). A copy of the WML application has been included in Appendix 8.

2.4.2 Waste Stream Characterisation

A waste stream analysis specialist study was conducted in order to understand the nature of the wastes produced and to classify them (refer to Appendix 6). Certain wastes, which will be produced during the Char Manufacturing Plant Expansion Project, are classified as general waste according to the definition in the National Environmental Management Waste Act (Act 59 of 2008) (NEMWA). General wastes will include builders' rubble, office waste, canteen waste, scrap metal and possibly some workshop waste. The char manufacturing process itself will also produce general wastes including: sediment from the PCD, sediment from the silt trap and settling pond, dirty storm water and process water contained in the PCD.

Hazardous waste will also be produced at the plant site, which will include: used oils, rags contaminated with hydrocarbons, containers of hydrocarbons and solvents, soil contaminated with hydrocarbons and sewage. The char manufacturing process itself will also produce hazardous wastes including: sludge (which is sold as a by-product), tar (which is sold as a by-product), and liquor (which is incinerated).

When the waste stream analysis specialist study was conducted (refer to Appendix 6) and at the time of writing this report, the Department of Environmental Affairs (DEA) was in the process of revising the waste classification system for South Africa (Golder Associates, 2011). Draft Waste Classification and Management Regulations (WCMR) had been finalised and circulated. The WCMR are to be included in regulations in terms of the NEMWA with associated Schedules and/or Norms and Standards in terms of the NEMWA as appropriate or required. These regulations will replace the *"Minimum Requirements for Handling, Classification and Disposal of Hazardous Waste"* (DWAF, 1998). The draft regulations also include a draft national standard for Leach Test and Screening Values for Risk Profiling of Waste. However, until implementation of the WCMR and 18 months thereafter, the Minimum Requirements will still be applicable. Therefore, the various waste streams from the Char Manufacturing Plant Expansion were classified and characterised in terms of both the Minimum Requirements and the WCMR (Golder Associates, 2011).

The level of risk associated with each type of waste stream was identified according to five different

levels:

- Type 0: Very High Risk - Considered very high risk waste with a very high potential for contaminant release (must be disposed of at a hazardous waste facility);
- Type 1: High Risk - Considered high risk waste with high potential for contaminant release (must be disposed of at a hazardous waste facility);
- Type 2: Moderate Risk - Considered moderate risk waste with some potential for contaminant release (can be disposed of at a general waste landfill)
- Type 3: Low Risk - Low risk waste with low potential for contaminant release (can be disposed of at a general waste landfill); and
- Type 4: Very low risk or Inert Waste - Very low risk waste that does not impact negatively on the environment because of its very low pollutant content and because the toxicity of its leachate is insignificant (can be disposed of at a general waste landfill).

Each waste stream was sampled and analysed and was categorised under one of the above-mentioned risk categories. Table 2.1 shows a summary of the risk profiles of the different waste streams based on the different analytical results. The Char Fines, PCD Silt and PCD water have a type 3 (low risk) risk profile while the tar, mix (mixture of PCD sediment, fine coal and sludge which builds up in the machinery) and liquor have a type 0 (very high risk) risk profile (Golder Associates, 2011).

Table 2.1. Summary of risk profiles of waste streams according to different analytical results

Waste stream	Total inorganic COCs	Water soluble inorganic COCs	Organic COCs
Char fines	Type 3: Low Risk	Type 3: Low Risk	Type 3: Low Risk
Mix	Type 3: Low Risk	Type 4: Very Low Risk	Type 0: Very High Risk
PCD Silt	Type 3: Low Risk	Type 3: Low Risk	Type 3: Low Risk
Tar	Type 3: Low Risk	Type 4: Very Low Risk	Type 0: Very High Risk
Liquor	Not applicable	Type 3: Low Risk	Type 0: Very High Risk
PCD Water	Not applicable	Type 3: Low Risk	Type 4: Very Low Risk

2.4.3 Waste Management

The detailed description of the management of the waste has been included in Chapter 6 of this report. Both hazardous and general waste will be produced. Non-process general and hazardous waste disposal will tie in with the current practices and facilities of Grootegeluk Mine.

2.4.3.1 General Waste Management

General 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 general waste on the site:

- Construction waste from the construction of the Char Manufacturing Plant Expansion,
- Site offices,
- Canteen and ablutions,
- Workshops,
- Char Manufacturing Plant Expansion stormwater system.

General 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 will be collected in rubbish bins and disposal will be handled by the mine through a Service Level Agreement between the Char

Manufacturing Plant Expansion and the Grootegeluk Mine. All domestic, commercial, industrial waste, builders' rubble and other waste classified as General Waste under the South African Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998) will be removed from the site by an appropriately licensed waste removal contractor and disposed of at a licensed general waste facility.

Stormwater runoff will enter the PCD and this water will then be recycled in the char manufacturing process. The contaminated water will not be allowed to enter the environment. The silt which collects in the silt trap, settling pond and PCD will be periodically removed and disposed of as general waste.

2.4.3.2 Hazardous Waste Management

Solid Waste

The non-process waste classified as hazardous, including grease, oils, acids, fluorescent tubes, medical waste etc. will also be handled by the Grootegeluk Mine through their existing systems which will involve disposing of the waste at a licensed hazardous waste site.

Sludge

The process hazardous waste sludge removed from the Char Manufacturing Plant Expansion equipment will be transferred to a mixing station where it will be mixed with char product fines to form a dry consistency. The sludge/char fines mix will then be transferred to the nearby Eskom Matimba Power Station as part of the coal feed for power generation.

Liquid Waste

Tar generated during the char production process will be collected in a tar tank near the bottom of each retort. The tar is sold as a by-product of the process. When customers come to collect the tar at the loading facility it will be transferred to the customers tar tanks for transport. 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.

Sewerage

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.

2.4.4 Waste Recovery and Reduction

As discussed above, the tar generated at the plant will be sold to customers, thus this will not require disposal. The liquor produced by the cooling of some of the waste gas will be incinerated as the method of disposal, thus negating the need to dispose of it to land.

Waste gas is produced from the heating of the coal to produce char. The waste gas which still remains after the tar and liquor has been removed will be recycled in the plant and primarily burnt as a fuel gas to heat the retorts. Some of the gas will also be used to fuel a boiler which 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 gas which still remains will be flared and will exit the plant through the flare stack (refer to plate

2.20).

Effluent from the Char Manufacturing Plant Expansion process will be initially disposed of via a silt trap to the Char Manufacturing Plant PCD (for the existing plant and expansion). From here, it will be pumped back to the plant for reuse in the process. Additionally, all the dirty storm water runoff that is directed to the PCD will be also re-used in the process.

The sludge will also be re-used as it will be transferred to a mixing station where it will be mixed with char product fines to form a dry consistency. The sludge/char fines mix will then be transferred to the nearby Eskom Matimba Power Station as part of the coal feed for power generation.

Recycling of some of the solid general waste will also take place. Wastes will be separated into colour coded bins and recyclable waste will be recycled through the existing Grootegeluk Mine waste disposal system. Scrap metal will also be sold to a scrap metal recycling company.

2.4.4.1 Possible future waste reduction

Currently the remaining emitted gas from the flare stack of the existing 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. PRESENT ECOLOGICAL STATUS

3.1 Climate

3.1.1 Regional Climate

3.1.1.1 Mean rainfall

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 3.1.

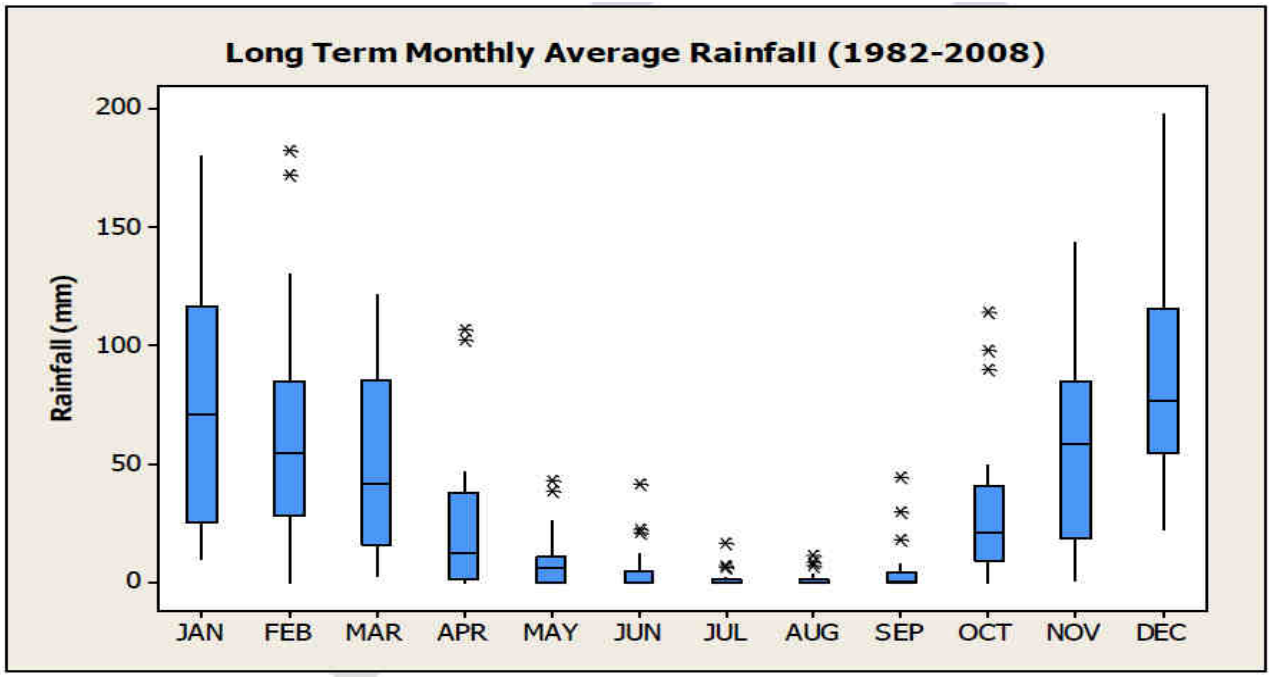


Figure 3.1: Monthly average rainfall for Lephalale (Airshed, 2011).

3.1.1.2 Maximum Rainfall

Table 3.2 below shows that the highest annual rainfall experienced in the last 30 years was 762.3mm in 1999/2000. The maximum monthly rainfall in the last 30 years was 237.5 mm in February 2000.

Calculations were completed to determine possible flood levels which may be experienced on the site with a 1 in 50 year return interval. These calculations showed that the maximum amount of rain which could fall in 24 hours is 98.7mm and in 7 days is 177.7mm (Jones and Wagener, 2012, Appendix 5).

Table 3.1: Rainfall Data from 1980-2012 (Grootfontein and Grootegeluk weather station) Source: South African Weather Services (2012)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	YEAR
1980/81	0.0	0.0	13.0	42.0	178.0	56.0	124.0	83.0	67.0	37.0	0.0	3.0	**603.0**
1981/82	0.0	12.0	7.0	13.0	56.0	31.0	96.0	98.0	30.0	15.0	2.0	0.0	**360.0**
1982/83	3.0	0.0	3.0	80.0	74.0	30.0	50.0	20.0	70.0	2.0	10.0	3.0	**345.0**
1983/84	7.0	8.0	0.0	12.0	69.0	67.0	53.0	37.0	85.0	15.0	2.0	17.0	**372.0**
1984/85	5.0	0.0	3.0	25.0	34.0	70.0	138.0	87.0	47.0	37.0	27.0	2.0	**475.0**
1985/86	1.0	0.0	10.0	35.0	2.0	84.0	6.0	37.0	5.0	82.0	0.0	0.0	**262.0**
1986/87	0.0	0.0	3.0	85.0	64.0	90.0	80.0	23.0	32.0	15.0	0.0	0.0	**392.0**
1987/88	0.0	0.0	23.0	30.0	21.0	111.0	38.0	167.0	123.0	25.0	0.0	1.0	**539.0**
1988/89	1.0	0.0	11.5	92.5	8.7	36.7	112.8	113.0	26.8	38.0	2.5	10.3	**453.8**
1989/90	0.0	4.5	0.0	10.0	104.0	112.3	36.4	68.3	80.3	35.0	0.9	0.0	**451.7**
1990/91	0.0	0.0	0.0	32.5	18.3	55.2	152.9	94.5	93.1	3.0	3.0	2.0	**454.5**
1991/92	0.0	0.0	0.0	16.6	39.7	195.5	19.3	34.0	18.3	15.0	0.0	0.0	**338.4**
1992/93	0.0	0.0	0.0	124.7	33.1	110.7	42.0	23.2	22.8	41.0	0.8	0.0	**398.3**
1993/94	5.5	3.7	0.5	55.5	71.1	167.5	76.6	108.5	37.0	6.0	0.0	0.0	**531.9**
1994/95	0.0	0.0	0.0	3.5	45.3	63.2	187.0	63.0	78.6	19.8	26.3	0.0	**486.7**
1995/96	0.0	0.0	0.0	25.0	75.0	164.1	79.1	165.9	31.0	0.0	24.5	0.0	**564.6**
1996/97	4.5	1.5	0.0	35.0	118.8	82.2	165.5	53.0	86.5	6.5	39.0	0.0	**592.5**
1997/98	0.0	0.0	8.0	9.5	74.8	25.7	39.0	45.5	46.5	32.5	0.0	0.0	**281.5**
1998/99	0.0	0.0	0.0	25.7	66.7	219.7	73.5	29.5	17.6	5.1	23.5	0.0	**461.3**
1999/2000	0.0	0.0	1.0	16.0	60.7	61.0	104.5	237.5	137.0	108.1	23.0	13.5	**762.3**
2000/01	0.0	0.0	0.0	38.8	27.0	34.0	35.2	92.0	54.8	24.5	8.0	21.0	**335.3**
2001/02	0.0	0.0	0.3	27.0	148.0	72.8	31.6	38.0	5.0	140.5	0.0	44.0	**507.2**
2002/03	0.0	0.2	1.5	42.0	0.0	86.4	83.0	37.5	5.0	0.0	0.0	39.0	**294.6**
2003/04	0.0	0.0	1.5	15.3	27.6	29.5	191.5	128.7	152.0	57.5	0.0	0.0	**603.6**
2004/05	0.0	0.0	0.0	10.3	41.5	186.1	45.0	13.1	48.0	33.5	0.0	0.0	**377.5**
2005/06	0.0	0.0	0.0	0.0	78.5	33.8	221.7	56.8	89.0	10.5	9.0	0.0	**499.3**
2006/07	0.0	0.8	5.0	0.0	37.5	108.0	11.0	25.5	32.0	33.7	0.0	0.0	**253.5**
2007/08	0.0	0.0	50.5	53.3	63.0	161.8	139.0	6.5	41.5	14.9	6.5	0.0	**537.0**
2008/09	3.0	0.0	0.0	25.5	132.0	88.0	158.9	51.8	64.5	0.0	26.0	26.5	**576.2**
2009/10	0.0	0.0	1.5	44.0	70.0	52.7	58.5	38.5	29.0	99.5	56.0	0.0	**449.7**
2010/11	0.0	0.0	0.0	0.0	77.7	63.0	152.0	5.0	19.5	17.2	14.0	3.0	**351.4**
2011/12	0.1	2.5	0.0	55.0	50.0	131.2	40.5	15.0	0.7	0.0	0.0	0.0	**295.0**

3.1.1.3 Evaporation

Evaporation in the area is high, with the annual evaporation being approximately 2 281 mm (refer to Table 3.2 in which the average monthly evaporation data for the Limpopo Province is summarised).

Table 3.2: 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

3.1.1.4 Temperatures

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 3.2 and Figure 3.3 respectively. A visual representation of average temperatures throughout the day and year is provided in Figure 3.4, which depicts data recorded at the SAWS station at Lephalale in 2006.

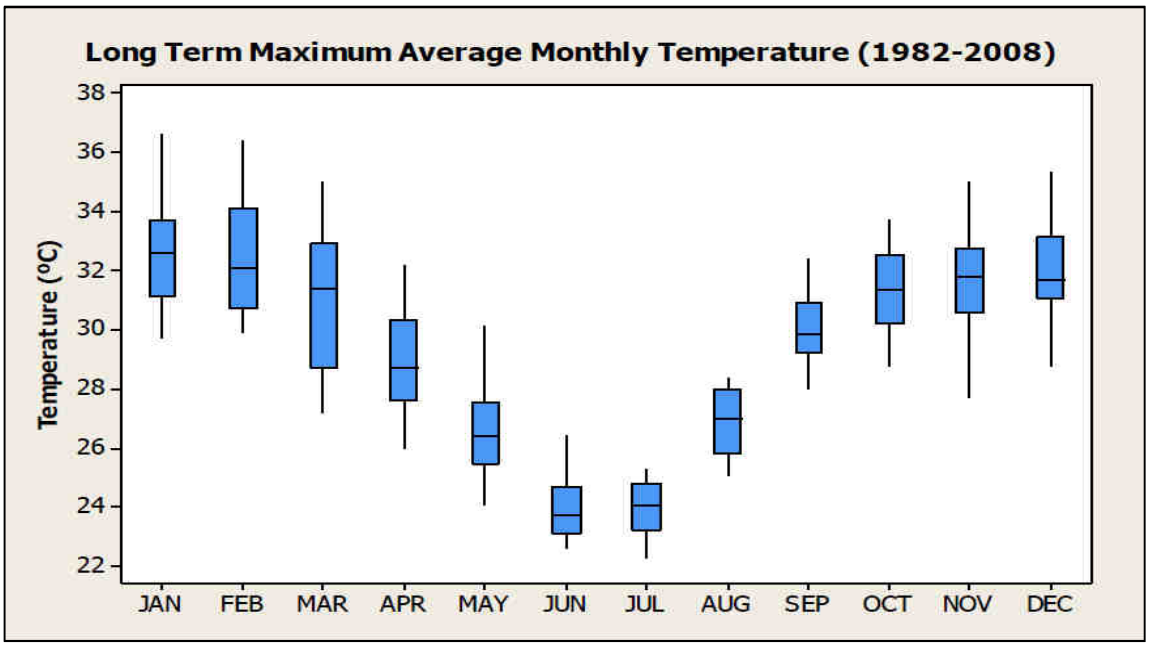


Figure 3.2. Long-term average maximum temperature for Lephalale (1982 – 2008) (Airshed, 2011).

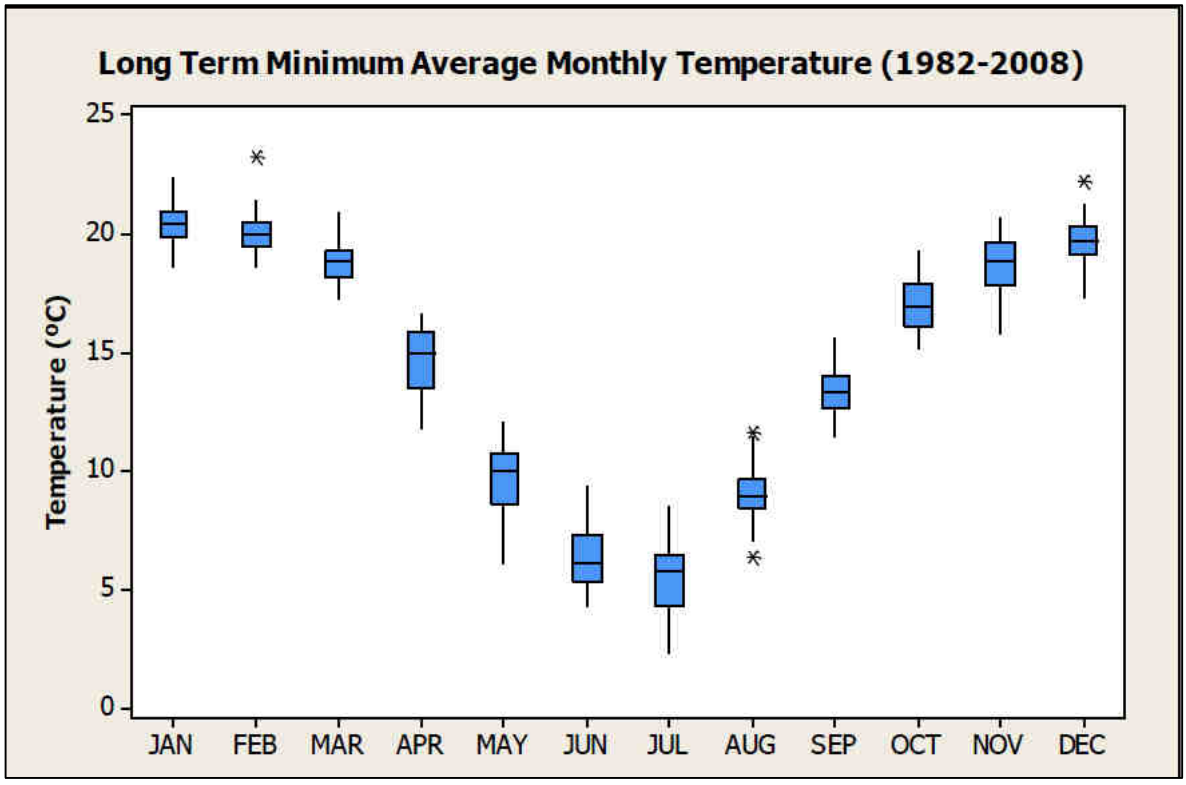


Figure 3.3: Long-term average minimum temperature for Lephalale (1982 – 2008) (Airshed, 2011).

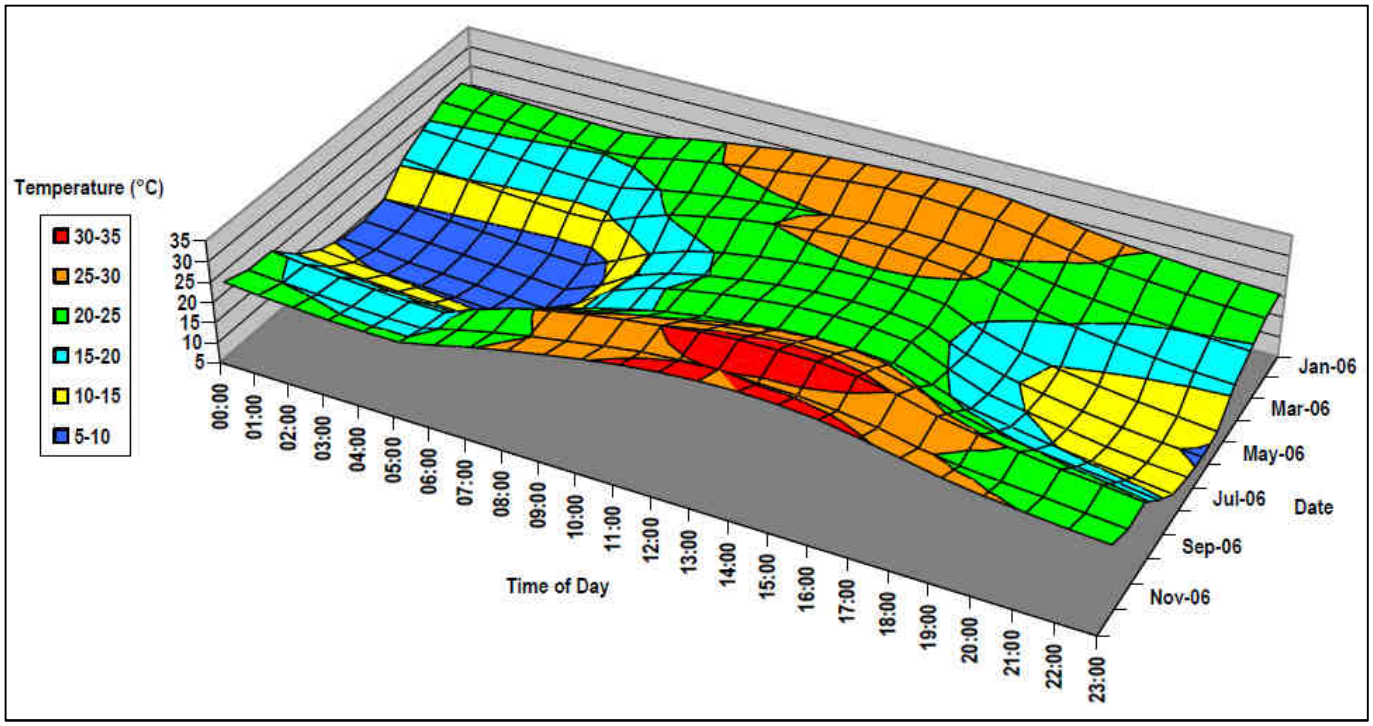


Figure 3.4: Monthly daily temperature profile of Lephalale in 2006 (Airshed, 2011).

3.1.1.5 Wind

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) (Airshed, 2011). An annual average wind rose for the area is depicted in Figure 3.5 and seasonal average wind roses in Figure 3.6.

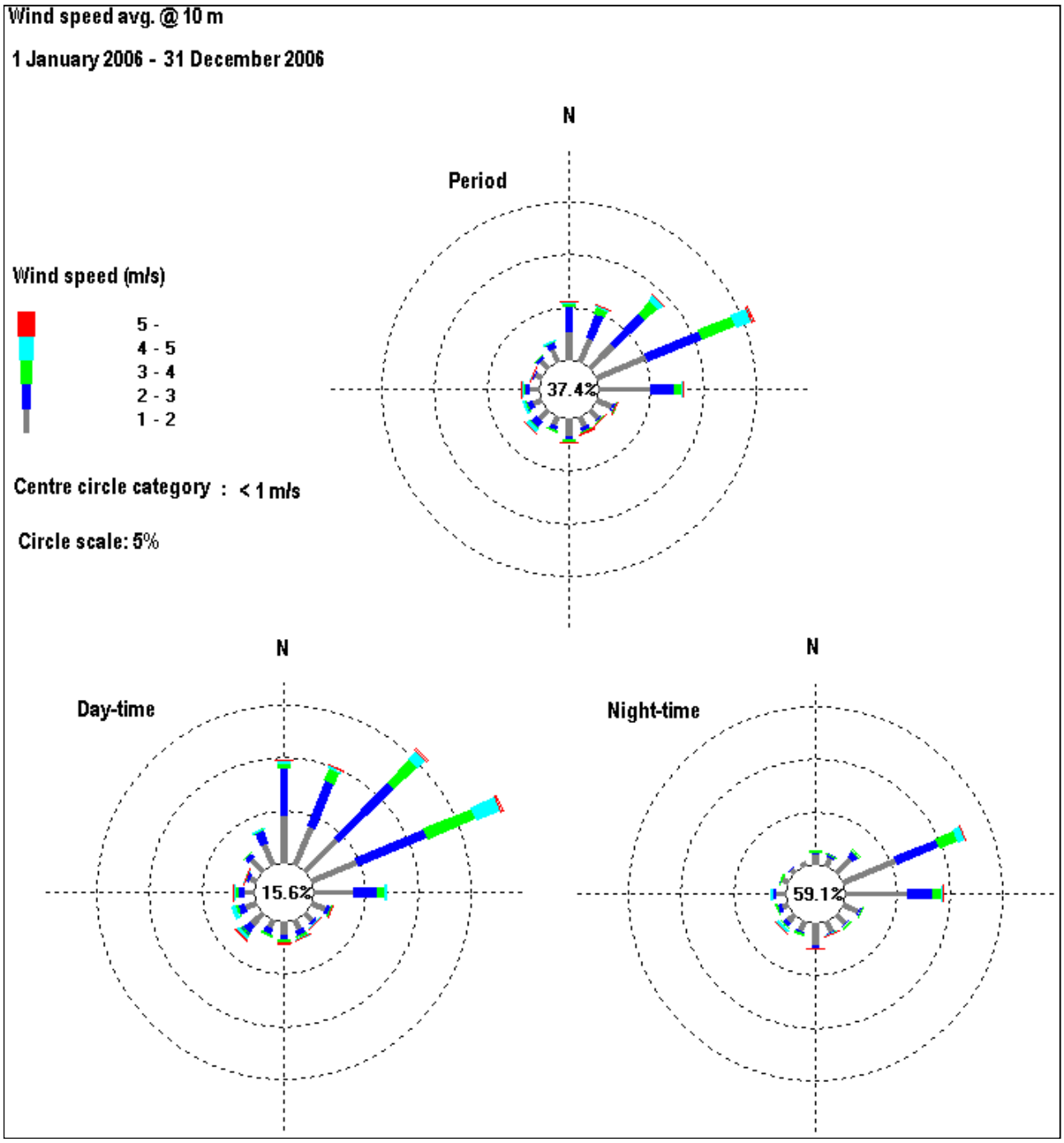


Figure 3.5: Period, Day and Night-time Wind Roses for the Lephalale (Ellisras) SAWS Station (2006) (Airshed, 2011)

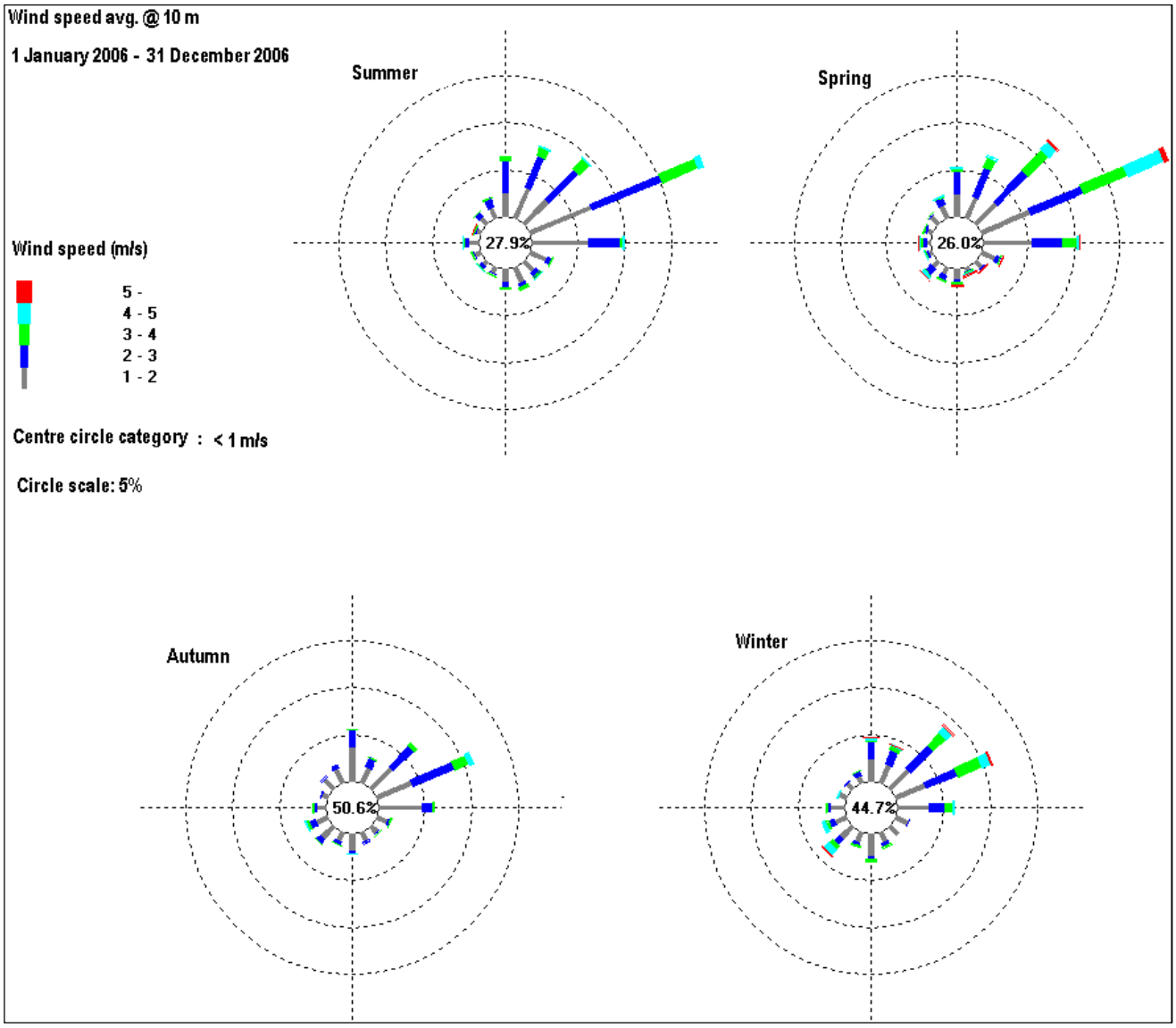


Figure 3.6: Seasonal Wind Roses for Lephalale (Ellisras) Weather Station (2006) (Airshed, 2011).

3.2 Soil and Land capability

3.2.1 Topography

The elevation of Grootegeluk Mine varies from 900 to 922 m above sea level (Figure 3.7). 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 (existing plant and expansion) is approximately 915 m above sea level.

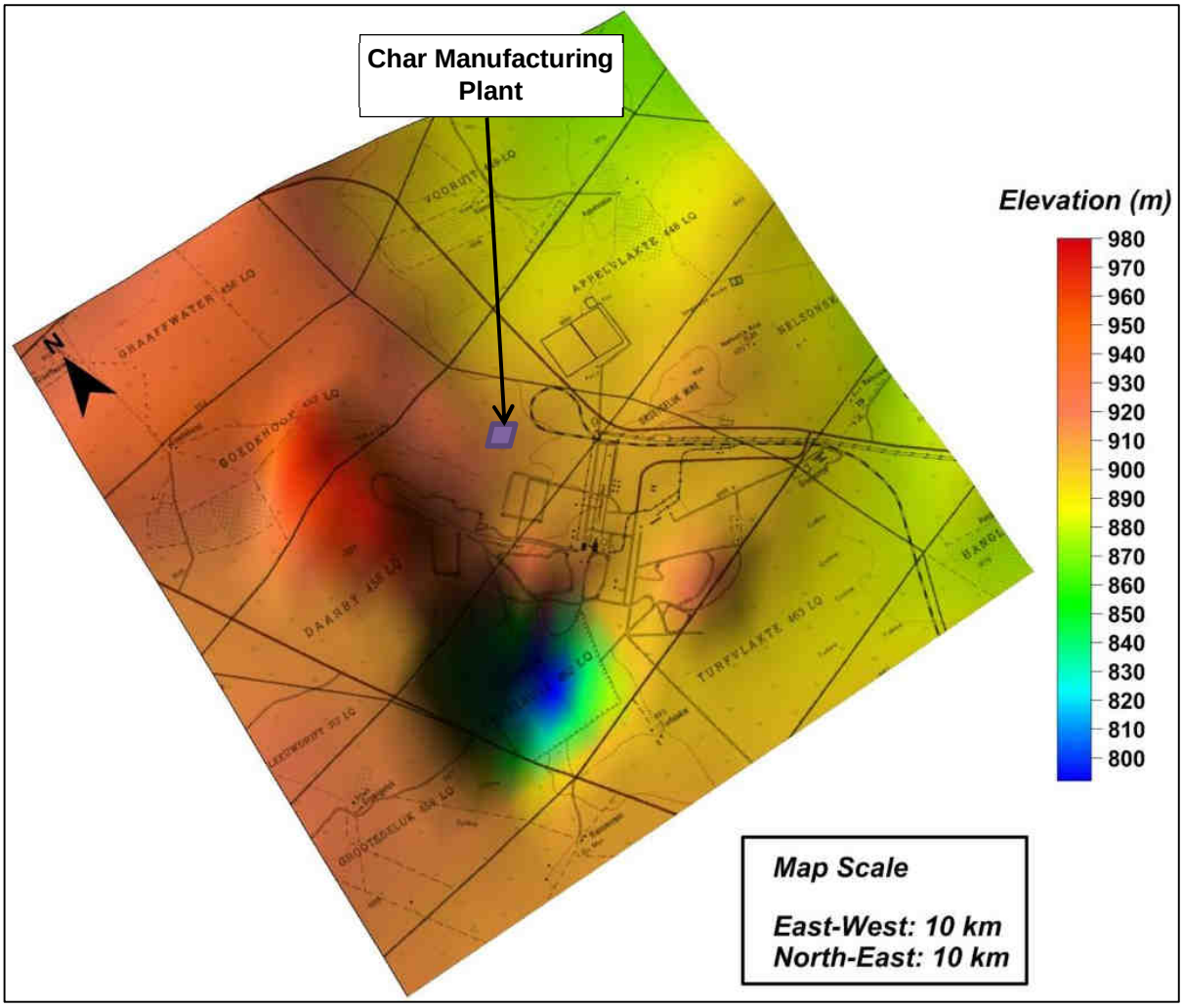


Figure 3.7: Topography of the proposed site (Airshed, 2008)

3.2.2 Soils and Land Capability

3.2.2.1 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, Appendix 4). 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 3.8 illustrates the surface geology of the Waterberg coalfield. Figure 3.9 illustrates the cross-section of the Waterberg coalfield in an east to west direction across the Daarby Fault.

3.2.2.2 Soil Forms

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.

Soils samples were collected from potentially contaminated areas within the plant. The samples were sent to Eurofins Analytico in Netherlands for analysis and the soil analytical data were evaluated by comparing them to soil screening values (SSV1) detailed in the Framework of the Management of

Contaminated Land in South Africa (DWA, 2010) as well as the published background concentrations for South Africa by Henselman *et al.*, 2007. The soil was sampled at different depth intervals depending on the soil profile layers. The major soil types encountered on the site were a mixture of yellow-brown apedal soils and red apedal soils.

Soils in the study area can be grouped into five main categories (Figure 3.10):

- Red and Yellow: Well drained sandy soil with high base status
- Red soil with high base status
- Red, yellow and/or greyish soil with high base status
- Rock with limited soil
- Soils with negligible to weak profile development, usually occurring on deep alluvial deposits.

3.2.2.3 Nutrient Status and Chemical Characteristics

The waste stream analysis specialist study (Appendix 6) also examined the composition of the soil on the Char Manufacturing Plant (existing plant and expansion) site. The results of this study show that the soil qualifies as a contaminated land in respect of the NEMWA. In 2005, 1839.36 hectares were surveyed within the Grootegeluk mining area with an area of 180.30 hectares being impacted by infrastructure associated with mining activities. The Char Manufacturing Plant (existing plant and expansion) is included within the impacted area. The area surrounding the Grootegeluk Coal Mine is mainly used for cattle and game farming. Previously, the area used to be cultivated, however; there is no longer cultivation of crops in the area (Clean Stream, 2005).

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, Appendix 6). 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).

There are elevated levels of As, Pb and V concentrations in the soils, however, this is not as a result of spillage of wastes as the levels of these COC's in samples taken from waste samples (i.e. tar, liquor etc.) were low. Instead, these 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).

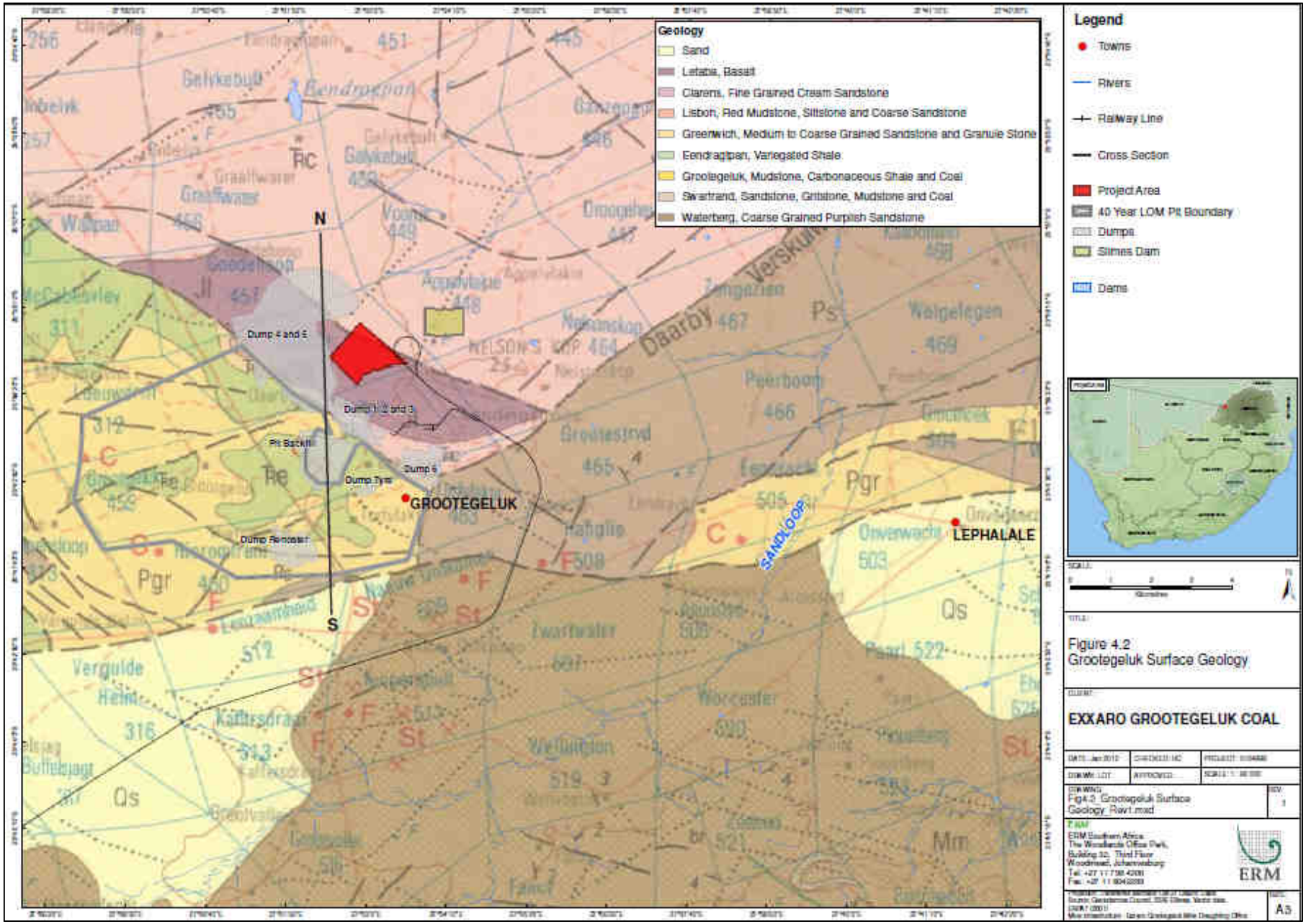


Figure 3.8: Surface geology of the greater Study Area (ERM, 2012)

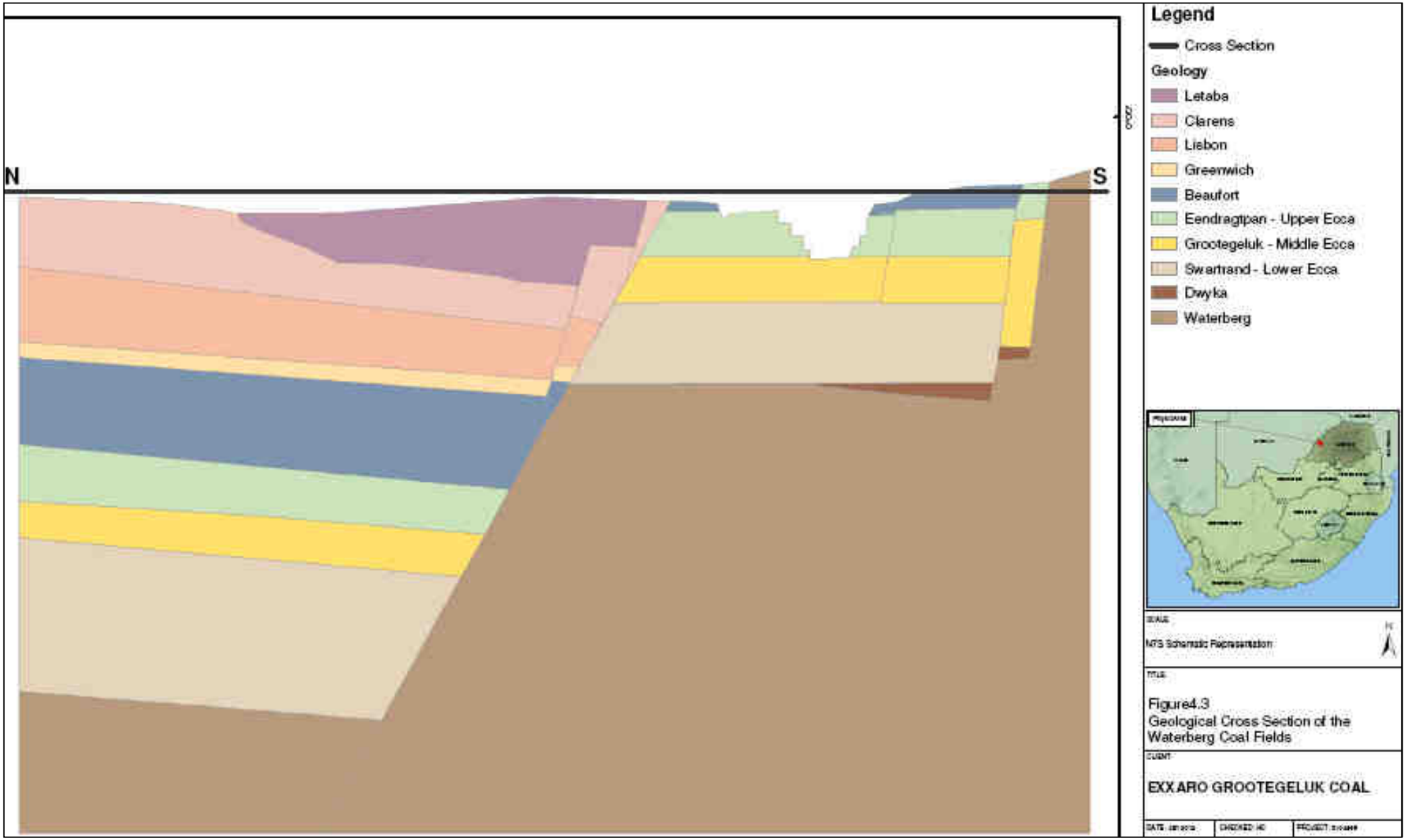


Figure 3.9: Geological Cross Section of the Waterberg Coal Fields (from ERM, 2012).

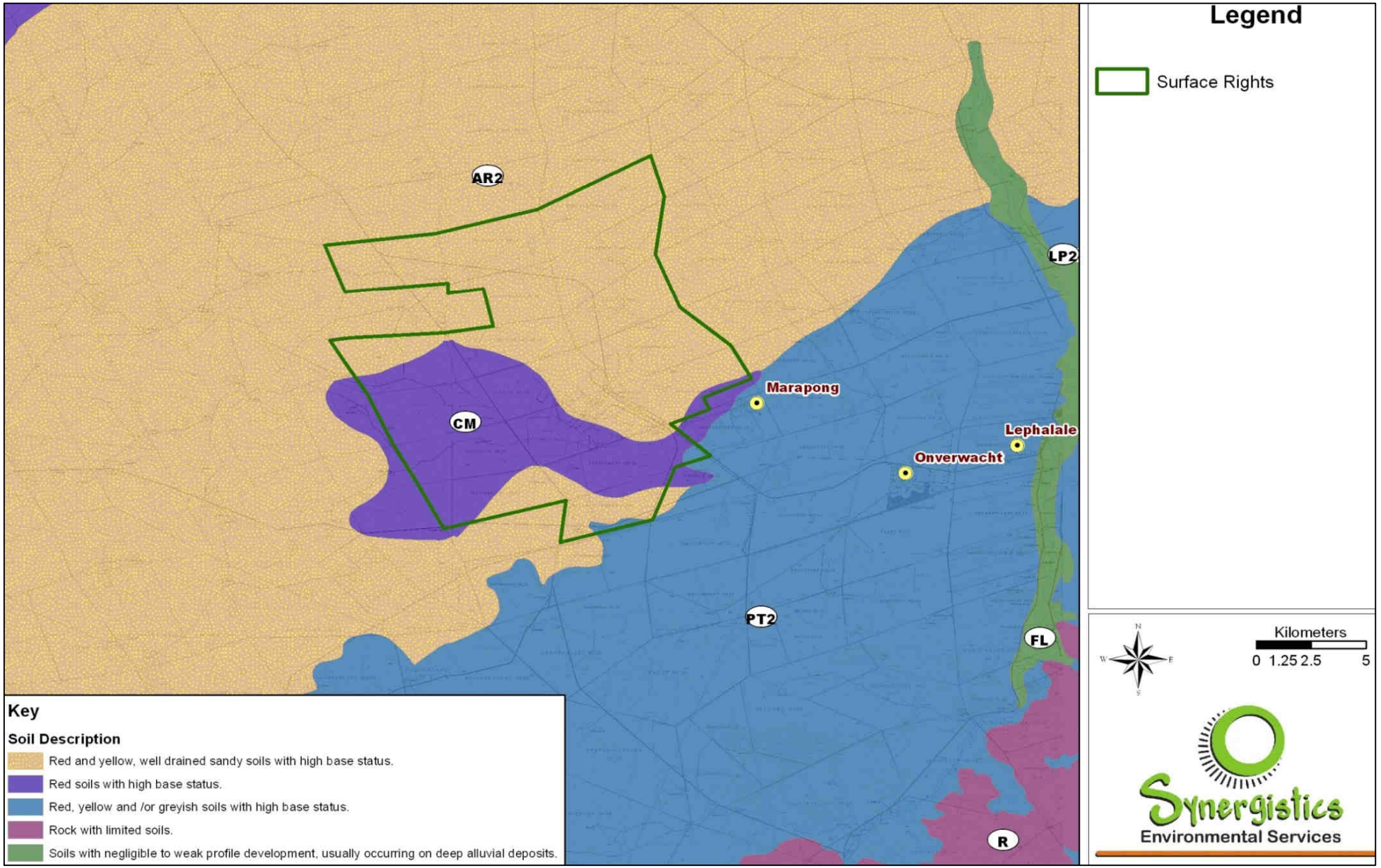


Figure 3.10: Soil types in the study area (the green polygon is the Grootegeluk Mine area)

3.2.2.4 Soil Physical Characteristics

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 area are the Hutton type (Hu35) (Figure 3.8). 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.

3.2.2.5 Land Capabilities

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 (Figure 3.11). Land in these classes has very limited potential for use as arable landand is generally used as grazing land or wildlife habitat.

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

3.2.3 Land Use

As illustrated in Figure 3.12 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 3.13, 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.

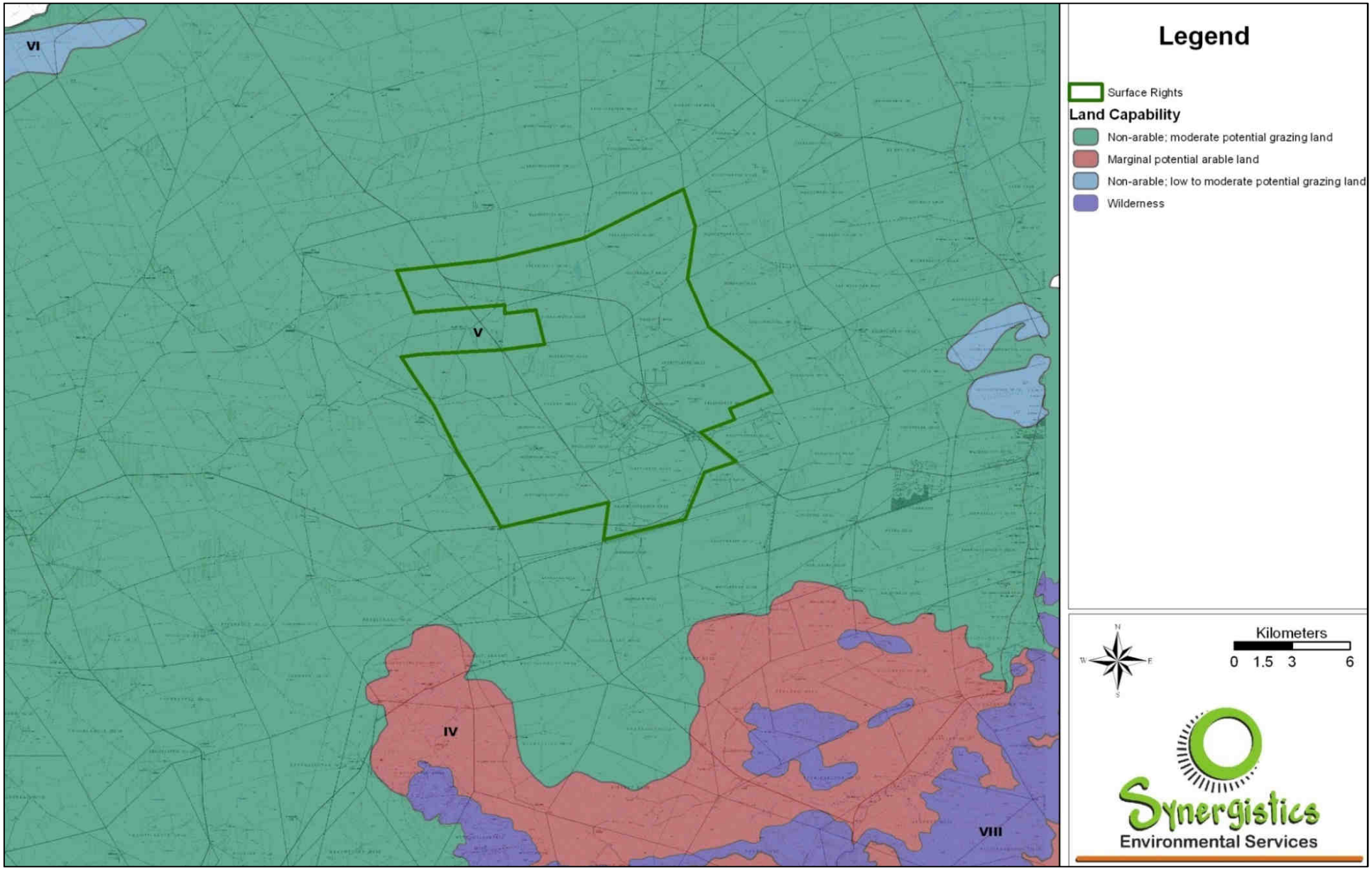


Figure 3.11: Land Capability in the Study Area

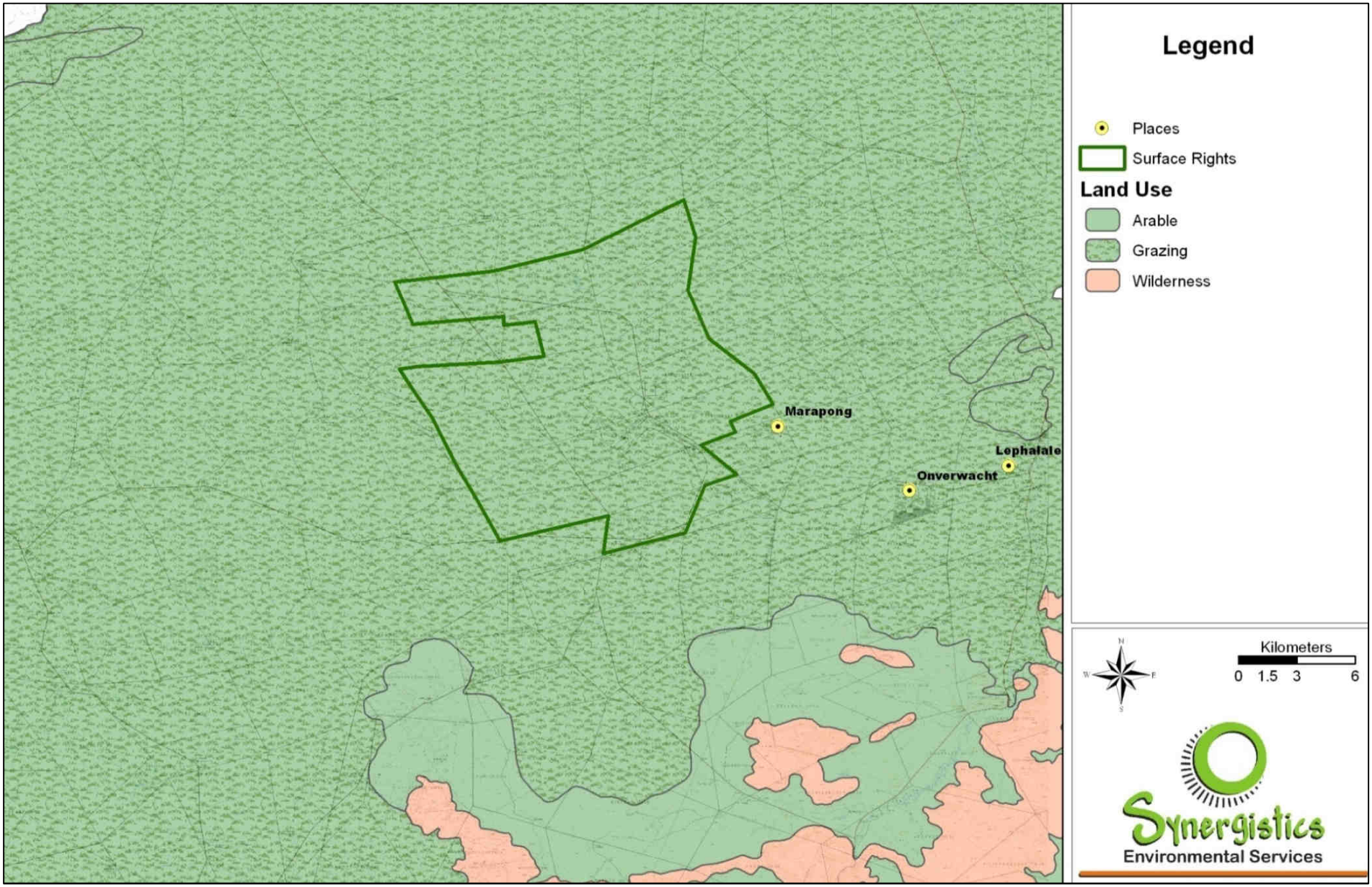


Figure 3.12: Land Use in the Study Area

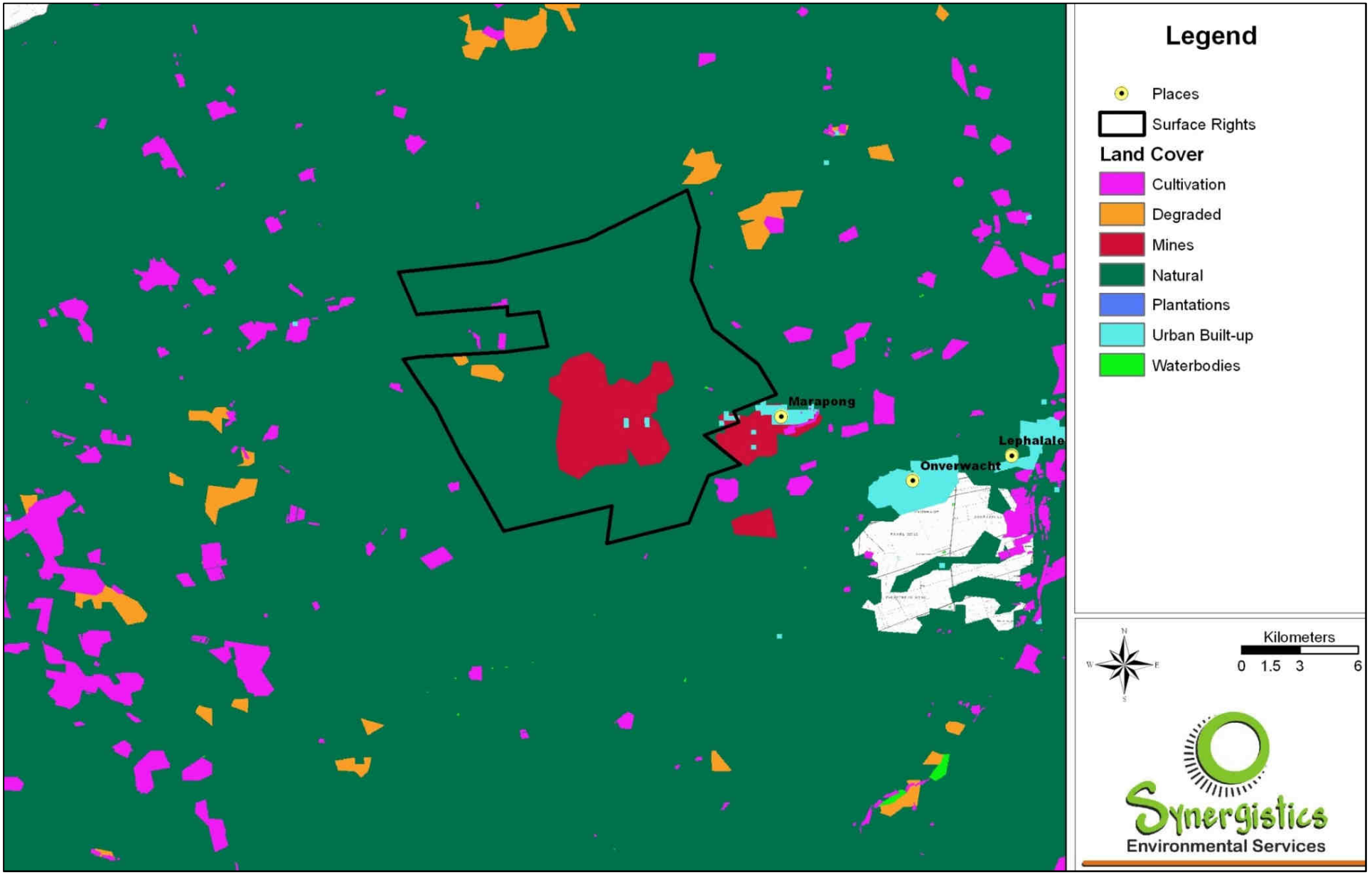


Figure 3.13: Land Cover Types in the Study Area (source Natural Scientific Services, 2010).

3.3 Surface Water

A surface water specialist study was undertaken for this project in order to determine the baseline surface water environment and to assess the potential impacts of the Char Manufacturing Plant Expansion Project on the surface water. This study is contained in Appendix 5.

3.3.1 Water Management Area

The Char Manufacturing Plant Expansion Project site is located in the Limpopo Water Management Area (WMA 1) and the Primary catchment A (Limpopo River). The quaternary catchment is A42J (the Sandloop River) and the tertiary catchment is A42 (the Mokolo River).

3.3.2 Surface Water Hydrology

3.3.2.1 Drainage in surrounding areas

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 Mokolo River is approximately 810 m above sea level, while the project site 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. The area drains via an unnamed tributary, which runs in an easterly direction, discharging initially into the ephemeral Sandloop River and then into the Mokolo River approximately 20 km east of the site (Figure 3.14). The Mokolo River has its source in the Waterberg mountains to the south east. It exits the mountainous region just south of Lephalale, drains across the flat plain between Lephalale and the Limpopo River, and discharges into the Limpopo about 50 km north of the Grootegeluk site (Jones & Wagener, 2012).

Surface water on the site 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 closest wetland is the Eendragpan which is a large pan (1 km in length) located approximately 6.5 km from the project 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).

3.3.2.2 Drainage in Char Manufacturing Plant Site

Within the Char Manufacturing Plant Site (existing plant and expansion) a small, localised catchment drains towards the north western boundary of the Char Manufacturing Plant. Being part of the Grootegeluk Mine dirty water area, this runoff is essentially dirty and is diverted around the southern boundary of the Char Manufacturing Plant by means of a storm water canal (Jones and Wagener, 2012). All runoff from the Char Manufacturing Plant terrace will therefore be directed via a piped storm water system to the Char Manufacturing Plant PCD (for the existing plant and expansion). From here it is pumped to the Char Manufacturing Plant for use in the process. If the PCD were to overflow, the water would drain towards another PCD at the Grootegeluk Mine – the Bosbok Dam located east of the Char Manufacturing Plant Expansion site (refer to figure 3.15).

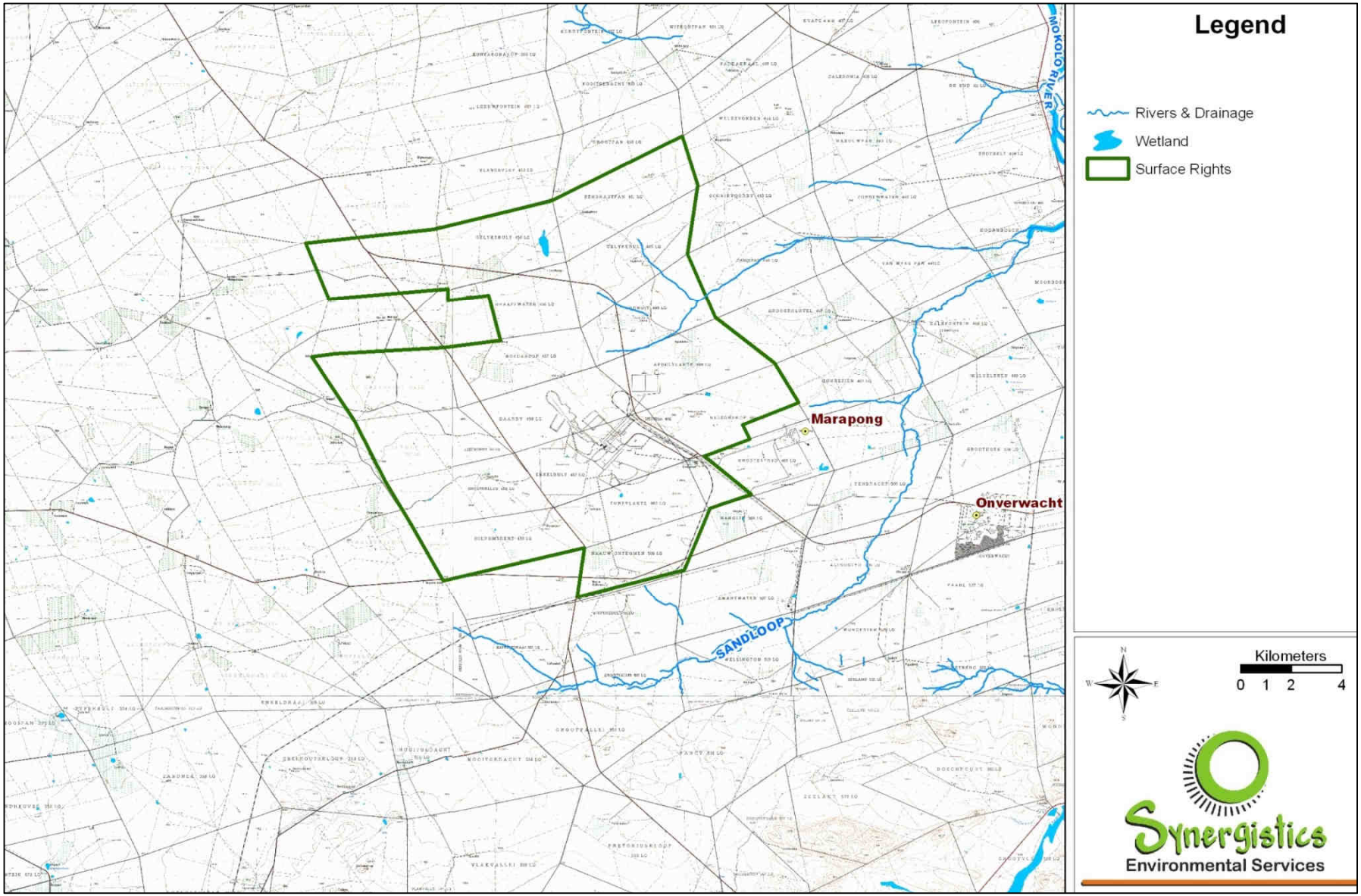


Figure 3.14: Surface Water Features in the Study Area

3.3.3 Surface Water Quality

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 existing 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 PCD (Jones & Wagener, 2012).

3.3.3.1 Mokolo river and catchment quality

In 2006 a State-Of-The-Rivers report was written for the Mokolo River as the Mokolo River Catchment was prioritised as an area for study by Limpopo Environmental Affairs in 2002. The Mokolo catchment was found to be in a fair-to-good state with water quality through the study area considered to be good (Table 3.3. River health categories (source: DEAT, 2006).

Table 3.3. River health categories (source: DEAT, 2006)

River Health Category	Ecological Perspective	Management Perspective
Good G	Ecosystems essentially in good state; biodiversity largely intact.	Some human-related disturbance but mostly of low impact.
Fair F	Sensitive species may be lost; lower abundances of biological populations are likely to occur, and/or higher abundances of tolerant or opportunistic species occur.	Disturbances associated with socio-economic development, such as: impoundment, habitat modification and water quality degradation.

However, pulsed releases from Mokolo Dam could possibly interfere with water temperatures within the lower reaches of the river, and the unseasonal flow patterns could also adversely affect the lower river system.

3.3.3.2 Water quality around Char Manufacturing Plant Site

Sampling of the Existing Char Manufacturing Plant Pollution Control Dam (GES01 and GES02) (Figure 3.15) 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 existing Char Manufacturing Plant PCD and Bosbok Dam (Figure 3.15). These were analysed for both inorganics and hydrocarbons.

Figure 3.15: Surface Water Quality Monitoring Sample Locations.

The results of the water quality monitoring conducted by Gondwana Environmental Solutions (Gondwana, 2010), are detailed in Table 3.4 below. Values shaded in red exceed the SANS 241: 2011 Standard limits for drinking water.

Table 3.4: Surface water quality for the existing 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 would pose a health risk if it were consumed. 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 3.5 below.

Table 3.5: Surface water quality for the existing 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 existing 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 3.5.

As was expected, petroleum hydrocarbons and volatile chlorinated hydrocarbons were detected within the existing Char Manufacturing Plant pollution control dam, with all measured parameters significantly exceeding the screening guideline values in the existing Char Manufacturing Plant PCD except for TPH C10-C12 (Table 3.5). Conversely, no hydrocarbons were detected within the Bosbok Dam, indicating that there is no overflow from existing Char Manufacturing Plant pollution control dam reporting to this dam.

3.3.3.3 Contaminant sources

The major sources of potential surface water pollution should the unlikely event of spillage occur include:

- 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 the table below**Error! Reference source not found.**. The summary includes the hydrochemistry of the water contained in/ at these facilities and highlights their most likely contaminants of concern.

Table 3.6: 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
Coarse 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

In order to protect the water quality in the environment, storm water control measures are currently and will continue to be in place. The management of storm water is further discussed in Chapter 6.

3.3.4 Mean Annual Runoff (MAR)

As illustrated in the figure below, the Mean Annual Runoff (MAR) in the study area is approximately 4.1 mm per year (AGIS, 2004) (Figure 3.16). The expected MAR for the site, the Sandloop River into which water from the study site drains, and the Mokolo River is presented in Table 3.7.

Table 3.7: MAR for catchments relevant to the existing 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
Sandloop 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 (existing plant and expansion) is located. The catchment is small,

with an area of 0.555 km^2 (Jones & Wagener, 2012). Table 3.8 presents the calculated peak flows for the catchment.

Table 3.8: Peak flows determined for the catchment draining past the existing 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

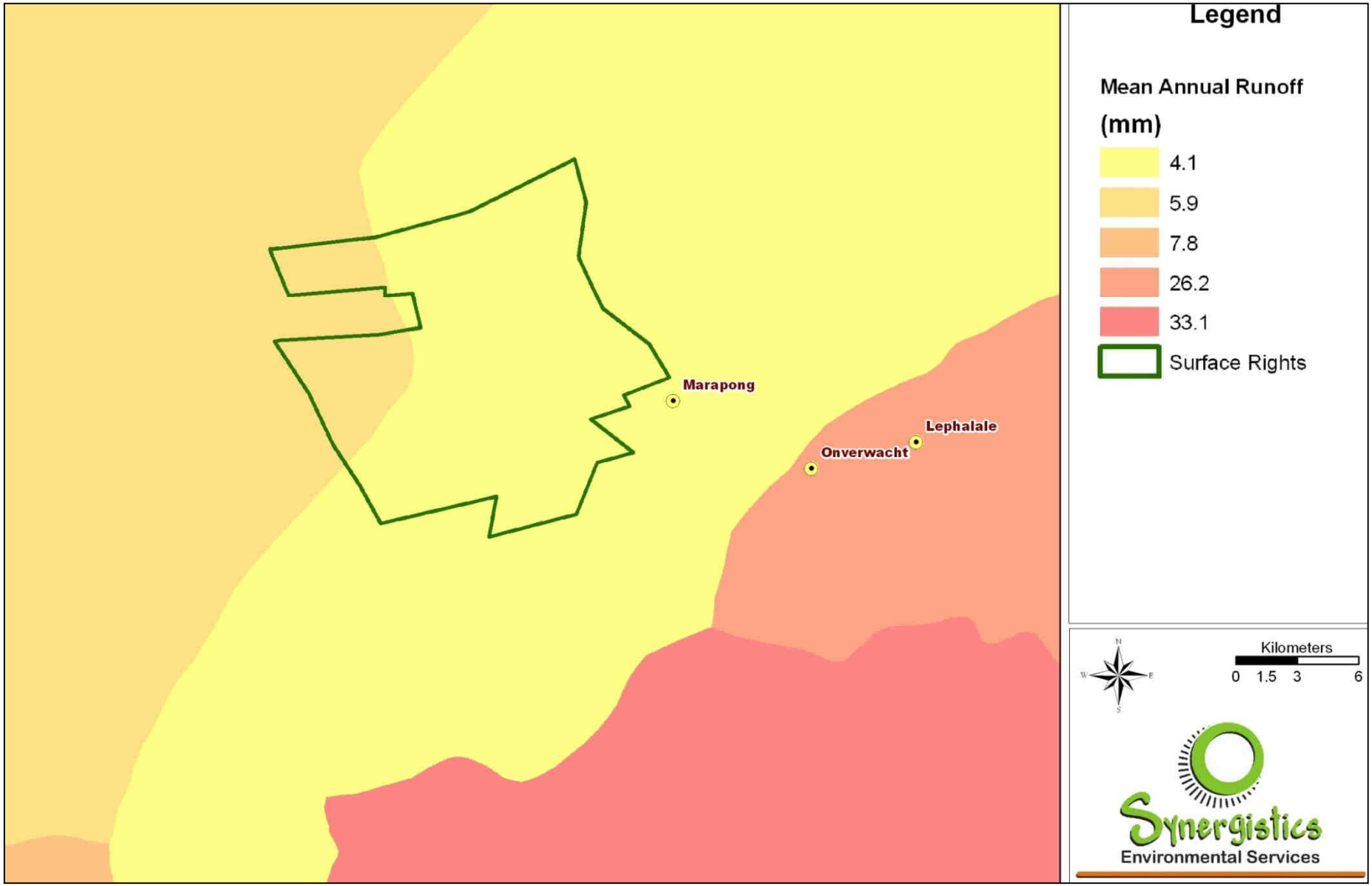


Figure 3.16: Mean Annual Runoff in the Study Area (AGIS Database, 2004)

3.3.5 Resource Class and River Health

3.3.5.1 Resource Class

The resource classification involved the assessment of the following ecological aspects:

- The presence of rare or endangered species,
- Habitat diversity,
- The importance of a river reach in providing connectivity between different sections of the river, and
- The sensitivity of the reach to environmental changes.

The water resource, A42J catchment (where the Mokolo Key area is situated) has been classified by the DWA as an ecological management Class C – Good Management Class and Good Water Resource Class (DWAF, 2004). DWAF (2006), states that the present ecological state of the Mokolo River Catchment (A42) lies predominantly in a Fair to Good Ecological Class.

The DWAF 2004 '*Integrated water resource management: Guidelines for groundwater management in the areas, South Africa'* Report illustrates the relationship between the six distinct ecological management categories (EMC) and the management and water resource classes. These categories are also used to describe the present ecological status category (PESC). The table below (Table 1.3) captures the information relevant for EMC/PESC Class C (DWAF, 2004**b**).

Table 3.9. Illustration of the relationship between EMC/PESC and water resource class (Source-DWAF, 2004**b**)

MANAGEMENT CLASS	EMC/PESC	WATER RESOURCE CLASS
Excellent	A – (Un-modified/ natural)	Natural
Good	B- (Largely natural)	**Good**
Fair	**C - (Moderately modified)**	**Fair**
	D- (Largely Modified)	
	E- (Seriously modified)	Poor
	(Critically modified)	

DWAF (2006) added that while the Mokolo Catchment is currently in a Fair to Good state, increasing water demands within the catchment are likely to cause a downward trend in the overall status of the system.

3.3.5.2 River Health

The groundwater quality in much of the Mokolo Key Area is poor due to the coal and gas fields. However, the groundwater quality the North-Western part of the Mokolo Catchment (A42J) is generally good whereas the groundwater quality in the Northern part of the catchment is poor.

For surface water quality, as mentioned previously in section 3.3.3, the Mokolo River Catchment was found to be in a fair-to-good state of health (DEAT, 2006) (Table 3.10).

Table 3.10. River health categories (source: DEAT, 2006)

River Health Category	*Ecological Perspective*	*Management Perspective*
Good G	Ecosystems essentially in good state; biodiversity largely intact.	Some human-related disturbance but mostly of low impact.
Fair F	Sensitive species may be lost; lower abundances of biological populations are likely to occur, and/or higher abundances of tolerant or opportunistic species occur.	Disturbances associated with socio-economic development, such as: impoundment, habitat modification and water quality degradation.

3.3.6 Set Resource Class Objectives

According to DWAF (2004), the Mokolo catchment lacks a proper water quality management plan. The broad management objectives include gaining a better understanding of the current and potential future water requirements in the Mokolo catchments as well as the Mokolo key area (DWAF, 2004).

For the Limpopo Water Management Area (WMA), the resource quality objectives are described in the table below.

Table 3.11. Reserve and Resource Quality Objectives Strategy - General Strategy Applicable to Whole WMA (Source- DWAF, 2004)

Situation assessment	None of the river systems in the Limpopo WMA have been classified nor have the resource quality objectives been determined. The methodology for classifying the river systems is in the process of being developed nationally. Rapid Reserve determinations have been done for some of the rivers based on the license applications, but none have yet seen either intermediate or comprehensive determinations. A need for the Reserve in the river systems of the Limpopo WMA are discussed below: Mokolo River: The Mokolo River system is perennial. The flow regime in the lower reaches downstream of the Mokolo Dam has been modified by releases from the dam. Irrigators also abstract water downstream of the Mokolo Dam. To ensure that there is a balance between the irrigators requirements and ecological environment, Reserve determination for the river reach downstream of the dam should be conducted at an Intermediate level. The Ecological requirements of the Mokolo Key Area have not been determined in any detail, but the NWRS estimates the impact of the Reserve on the currently available yield at 17 million m^3/a. This can theoretically be supplied from currently available water although this would require a re-allocation from the Mokolo Dam and/or the curtailment to irrigation upstream of the dam.
Broad Management Objectives	This strategy seeks to ensure that all the river systems, their tributaries and reaches in the Limpopo WMA are classified according to Chapter 3 (sections 12-15) of the NWA and that the class and resource quality objectives have been determined for all or part of the river systems that have been considered significant. In addition this strategy seeks to prioritise the various main river systems in the Limpopo WMA in terms of Reserve determination.
Overall Strategic Approach	DWAF will do everything possible to set a stage for River Classification, determinations of the Resource Quality Objectives and Reserves. Once the river systems, reaches and tributaries have been classified and Resource Quality Objectives determined, the Department will determine the human & ecological Reserves in catchments where there is pressure to do so.
Actions, Responsibility & Priority	Prioritize the river systems with regard to Reserve determination. The following rivers should receive priority:- *Mokolo, Mogalakwena, Nzhelele and Nwanedi*. • Assemble the data that would assist in the classification of the river systems. Typically this would include aquatic ecosystems in each river reach, socioeconomic activities etc. • Once appropriate data has been assembled, classify the river systems, reaches and tributaries. • Once the methodology for classifying the river systems has been established, this should be applied to all systems. • Develop management guidelines and procedures for each river system • Liaise with all stakeholders to ensure that the concept of Reserve is well understood.

3.3.7 Surface Water User Survey

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. Thus surface water use near the Char Manufacturing Plant expansion site is likely to be very limited. Only the Mokolo River itself may have enough surface water that could be used.

The water uses in the catchment broadly comprise of agricultural activities (>80%) industrial and mining activities (>10%), power generation and domestic water supply service sectors (municipalities) (<10%) (DWAF, 2005).

3.3.8 Sensitive Areas Survey

3.3.8.1 Sensitivity of vegetation and fauna on site

Natural Scientific Services conducted a vegetation survey (NSS, 2010) of Grootegeluk Mine as part of an ecological impact assessment completed in 2010. The footprint of the proposed Char Manufacturing Plant Expansion will be increased from approximately 7.4 ha to 13.4 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 are therefore considered negligible. The Char Manufacturing Plant Expansion site is located within the Grootegeluk Mine and thus the land surrounding the plant is also highly disturbed through coal mining activities.

The Manketti Reserve, owned by Exxaro, is adjacent to the Grootegeluk mining area (refer to figure 3.17). The property was initially used for mixed livestock and game farming before the decision was made by the Ferroland Board to consolidate this valuable area into a single wildlife biosphere. The game fencing was completed in 2000, all livestock and related infrastructure were removed in 2001, and endemic game species such as sable antelope were reintroduced to the area. The reserve houses a variety of species, including a few endangered plants and animals. In 2008 the African and Giant bullfrogs were found for the first time. The Manketti Reserve should thus be included in the considerations of sensitive areas close to the Char Manufacturing Plant Expansion Site.

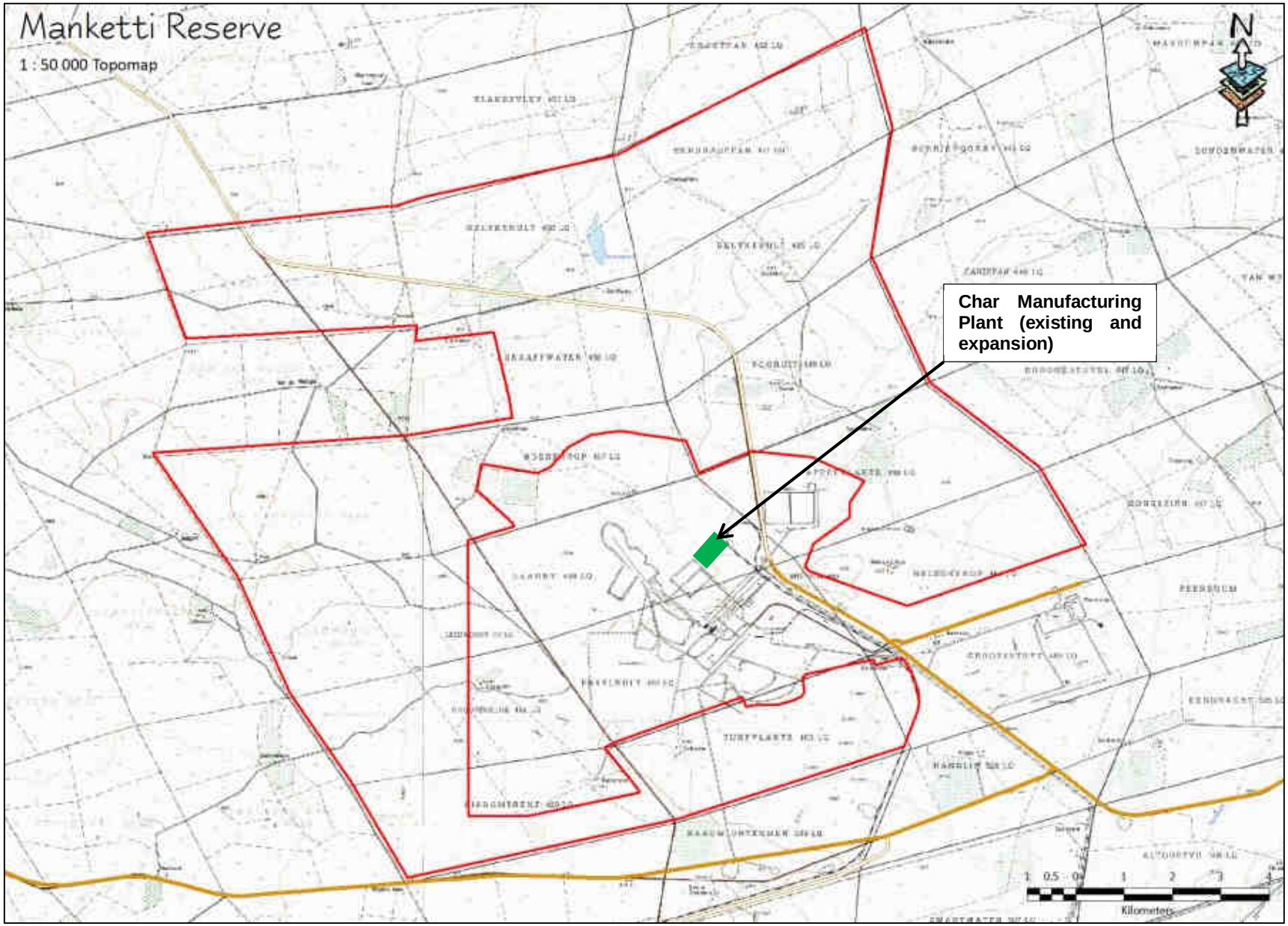


Figure 3.17: Locality map showing the Manketti Reserve (red outline) on Exxaro property, adjacent to the Grootegeluk Mine.

3.3.8.2 Regional Vegetation

The proposed site is in the Savanna Biome and falls entirely within the Limpopo Sweet Bushveld vegetation type (SVcb 19), as described by Mucina and Rutherford (2006). 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). 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.

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 (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).

3.3.8.3 Plant Species of Special Concern

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).

3.3.8.4 Faunal Species of Special Concern

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 a 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, including the Manketti Reserve which is adjacent to the Grootegeluk Mine.

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 (Manketti 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 3.12). Sixteen of the 48 mammal species identified are considered to occur as managed or introduced populations.

Table 3.12: 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

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).

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 3.13.

Table 3.13: 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.

3.4 Groundwater

A groundwater specialist study was undertaken for this project in order to determine the baseline groundwater environment and to assess the potential impacts of the Char Manufacturing Plant Expansion Project on the groundwater. This study is contained in Appendix 4.

3.4.1 Aquifer Characterisation

3.4.1.1 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.

3.4.1.2 Letaba Formation Aquifer

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).

3.4.1.3 Clarence Formation Aquifer

The Clarence 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.

3.4.1.4 Ground Water 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 existing 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 3.18). 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 3.18).

3.4.1.5 Ground Water 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 (existing plant and expansion) 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.

3.4.2 Groundwater Quality

There is currently an on-going groundwater monitoring protocol in the vicinity of the existing Char Manufacturing Plant and a review of the protocol was conducted by ERM in 2012. Currently three boreholes are monitored annually.

3.4.2.1 Contaminant Sources

The major sources of potential groundwater pollution associated with the existing Char Manufacturing Plant include (ERM, 2012) (Refer to Figure 3.19):

- 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.

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 from both the site and the surrounding borehole users.

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 ().

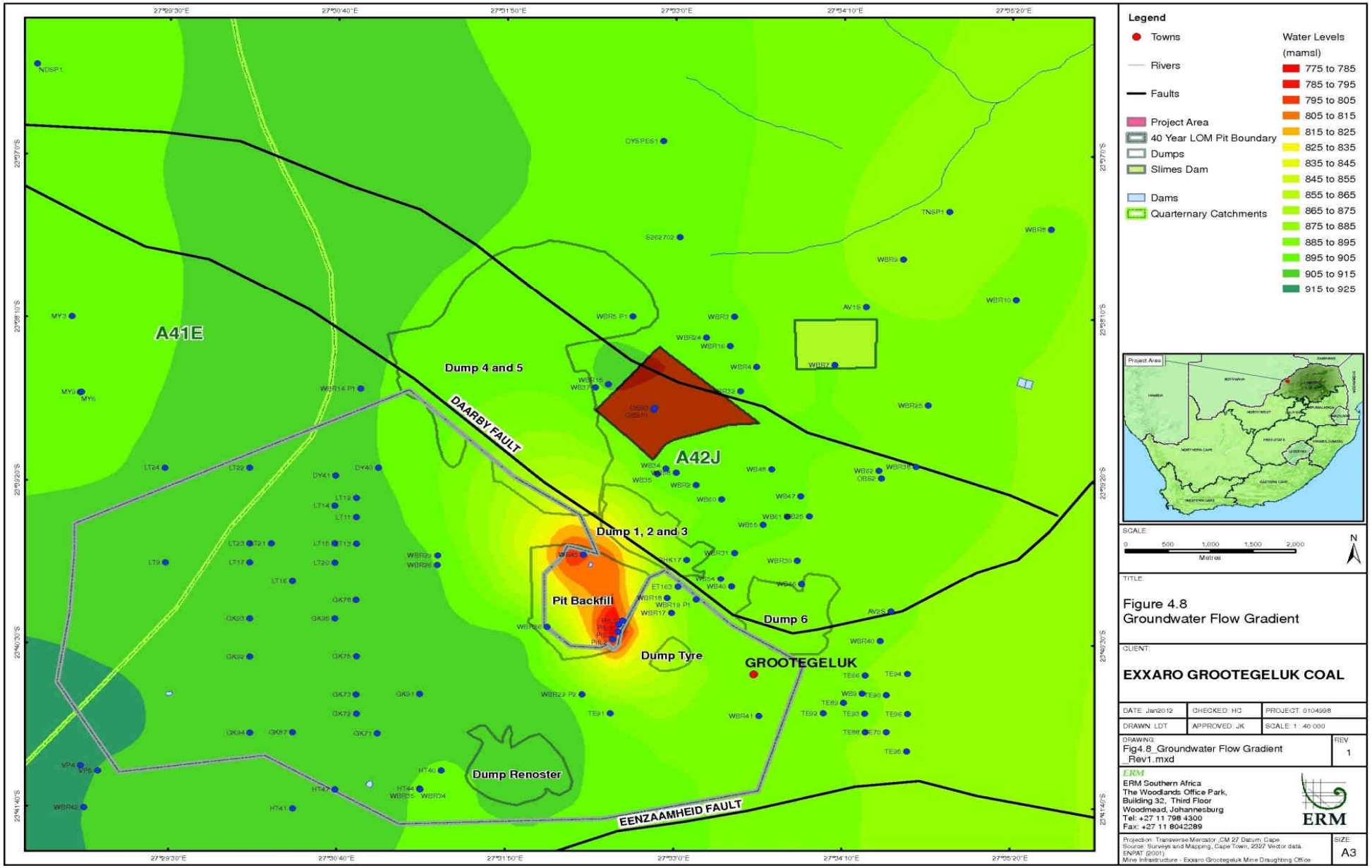


Figure 3.18: Groundwater Levels Around the proposed Char Manufacturing Plant Expansion (ERM, 2012)

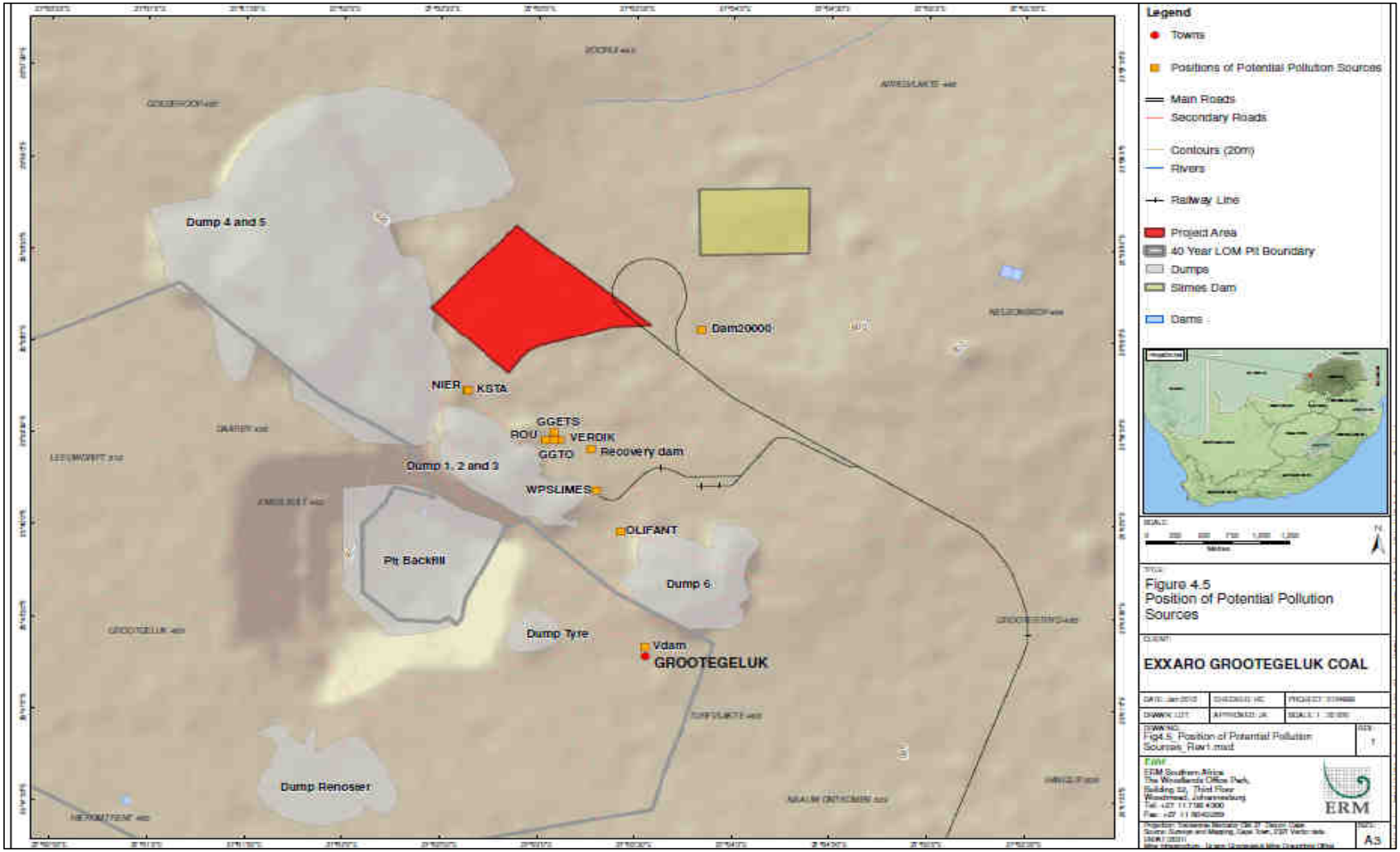


Figure 3.19: Position of Potential Groundwater Pollution Sources (ERM, 2012)

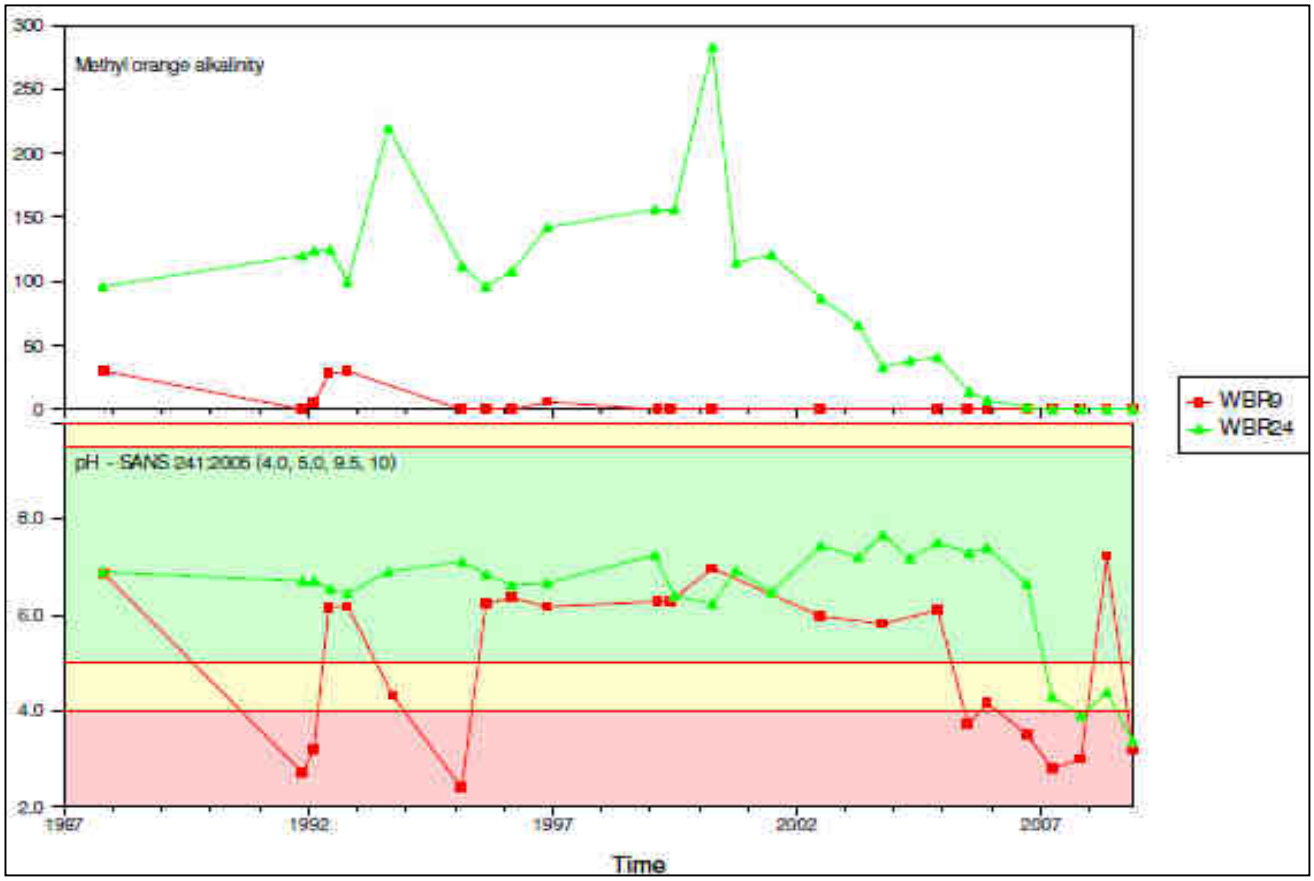


Figure 3.20: pH and Alkalinity in Samples WBR9 and WBR24 (ERM, 2012)

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

Table 3.14: 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 3.15 lists the samples that exceed the SANS Drinking water standards in terms of metals.

Table 3.15: 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 existing Char Manufacturing Plant and is presented in Table 3.16 (ERM, 2012). Samples were taken from three boreholes, one up gradient (WBR15), one inside (WB58) and one down gradient of the existing Char Manufacturing Plant site (WBR43).

Table 3.16: 2011 Groundwater Quality Results (numbers in red indicate exceedance 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 SANS 241-2011 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).

3.4.3 Hydrocensus

3.4.3.1 Groundwater Use and Users

The groundwater resources in the Limpopo WMA are largely used for irrigation and rural communities and to a lesser extent municipalities, mining and livestock.

A hydrocensus targeted boreholes located around the proposed extension area. The hydrocensus was undertaken to monitor the water within the Char Manufacturing Plant Expansion Project Site extending up to 4km around the Site area (Figure 3.21).

3.4.4 Potential Pollution Source Identification

Potential sources of water pollution have been identified and these have been described in further detail in Chapter 6 below. An assessment of the impacts of the potential pollution sources has been included in Chapter 4. Potential pollution sources are:

- Pollution control dam;
- Silt traps;
- Tar storage tanks;
- Liquor storage tanks;
- Sludge mixing area;
- Coal stockpile;
- Char product stockpile;
- Contaminated soil on site;
- Plant workshops and wash bays.

3.4.5 Groundwater Model

The details of the groundwater modelling can be found in the geohydrological report which was completed for the project (refer to Appendix 4).

Seepage modelling was carried out to quantify seepage volumes and qualities from potential contamination sources including the PCD, the char (product) stockyard and the coal (feedstock) stockyard. The hydraulic properties of the foundation materials of the potential contamination sources are heterogeneous, composed of variable soil and rock as well as lining materials. In such systems where the hydraulic properties and groundwater depths are variable, numerical models are preferred to solve the seepage problem. Thus a numerical model was undertaken.

A solute transport model was also done to model the movement of potential contaminants into and through the groundwater. Model geometries for the transport model are identical with the seepage models.

The results of the groundwater model are presented in Chapter 4 where the possible impacts are described and assessed.

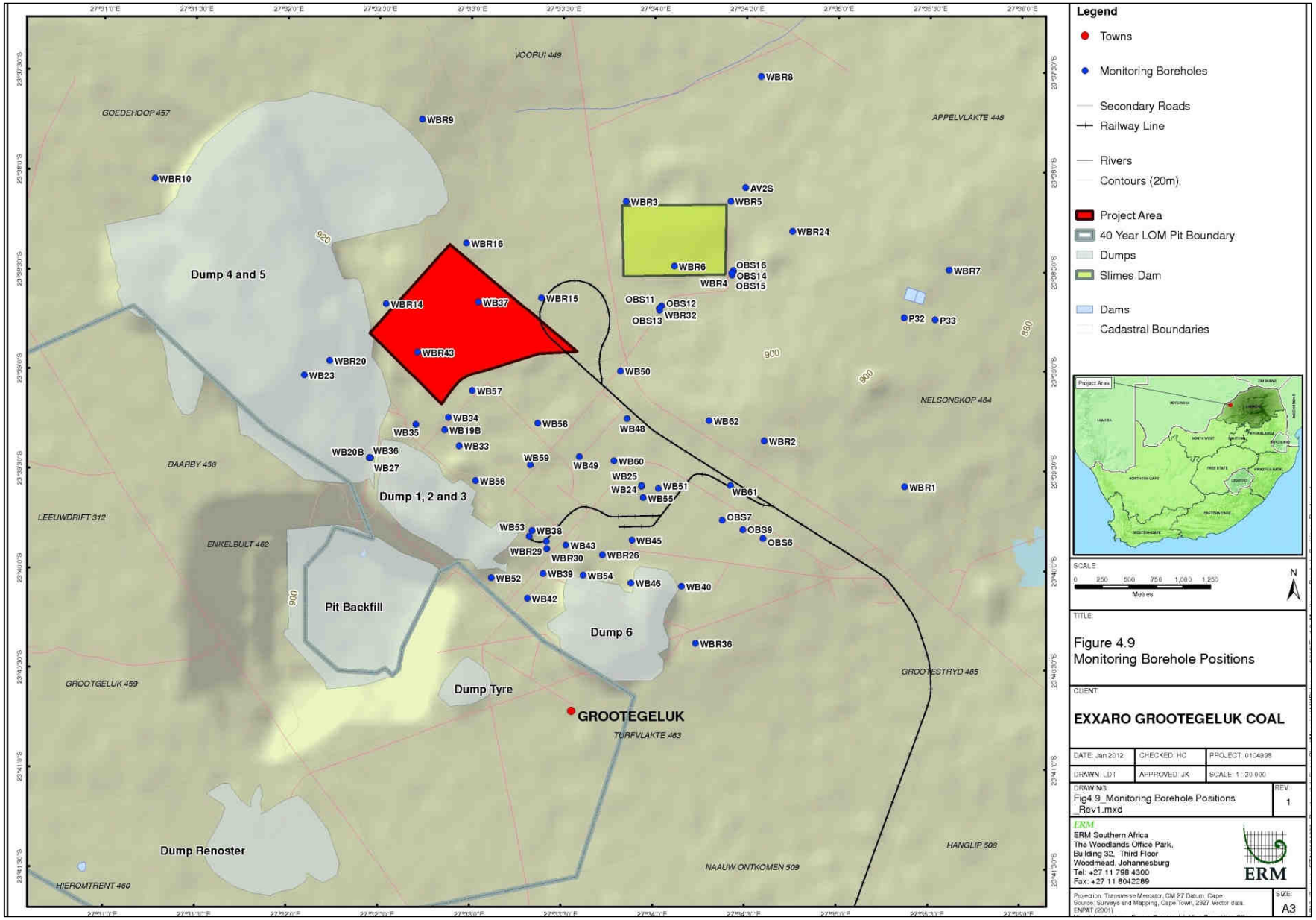


Figure 3.21: Monitoring Boreholes in the Greater Study Area (EMR, 2012).

3.5 Socio-economic Environment

3.5.1 Regional Economic Context

The Waterberg District Municipality is a well-known tourist destination with an internationally recognised Biosphere Reserve and the Nylsvley Nature Reserve that has been accorded Ramsar Convention on Wetlands status. The district is one of the major mining regions within South Africa. The Waterberg district has a population of approximately 596 092 (Statistics South Africa, 2007). The Waterberg district has a high proportion of people employed in the mining and agricultural sectors (Waterberg District Municipality: LED).

3.5.2 Local Economic Context

The Lephalale Local Municipality has a population of 80 141 (Statistics South Africa, 2007). Lephalale has approximately 49 proclaimed townships, 38 villages, and a number of service points and farm areas. All the townships are located around Lephalale town with the exception of Thabo-Mbeki, which is about 85km away in the north-eastern site in the location of the rural villages. Lephalale has been identified by Limpopo Employment Growth and Development Plan as a petrochemical cluster and has attained the status of national development node. More than 40% of the total coal reserve in South Africa is in the Waterberg coalfields.

The Char Manufacturing Plant Expansion Project area is adjacent to the Grootegeluk Mine. There will be a spurt of economic development in Lephalale Local Municipality related to mining and energy generation due to the expansion of coal mining activities.

3.5.3 Employment and Underemployment

Lephalale has an unemployment level of 15.5%. This low unemployment rate needs to be balanced against the relatively high percentage (42.5%) of the municipality's population that is not economically active. Just over 45% of the households in the Lephalale local municipal area have an income of less than R9 600 per annum; however, the situation in the various wards differs considerably with those wards close to the Grootegeluk Mine, Eskom power stations and town of Lephalale.

The majority of people that are employed are in in elementary occupations (48%). The second major occupation category is skilled agricultural workers (13%). This structure shows that there is vulnerability of the workforce in the context of expanding medium to high technology industrial activities in the local economy.

3.5.4 Social Infrastructure

3.5.4.1 Education

There are 66 primary and secondary schools in the Phaklala south and North circuit areas alone. There are a further 20 schools on various farms and Ellisras circuit area. There are three secondary schools in Maropong, Ellisras. The population growth has resulted into the building of a fourth high school in Onverwacht. There is an FET college in Onverwacht and caters for training needs for the whole Waterberg district Municipality. Four secondary schools are located in Mogalakwena municipality but fall within Lephalale circuit area.

High levels of illiteracy make it difficult for local communities to enter skilled and semi-skilled employment markets. Most of the secondary schools do offer maths and science subjects which is a requirement for the entry into engineering careers. The lack of technical high schools limits career paths

for students at an early age.

3.5.4.2 Housing

In Limpopo, the percentage of people living in informal dwellings is close to 6%, which is one of lowest in South Africa, with South Africa having 14.4%. Limpopo (as well as the Western Cape) has the highest percentage of municipalities having their households living in formal dwellings exceeding the national average of 70.6%. Limpopo also has the highest percentage of households owning their dwelling (69.2%) which exceeds the national average (61.6%) (Statistics South Africa, 2007). Lephalale Municipality has 80 141 people and 23 745 households which is likely to increase with the increase of work demand in the area.

3.5.4.3 Water and Sanitation

Mokolo dam is the main source of water in Lephalale. It delivers 16 cubic metres of water per annum to three major customers of which Lephalale Municipality receives 22%. In the Lephalale Local Municipality 32.8% of the households have flush toilets, 16.8% Ventilation Improved Pit latrines, 44.3% have Pit toilets, with 6.1% of households not having any toilets. More than 50% of the households do not have hygienic toilets. Wastewater Treatment works needs an additional 10 ML/d capacity to meet current and future demands in the area.

27.5% of households have piped water in their dwelling, 14% have piped water in their yards, 22.6% have water less than 200m away from their dwelling and 20.5% have water more than 200m from their dwelling. 15% of the households have no formal piped water (Lephalale Integrated Development Plan for 2011/2012). The Department of Water Affairs has negotiated the upgrade of the Mokolo pipeline to meet the projected water needs with Exxaro, Eskom and the Lephalale Local Municipality.

3.5.4.4 Health Facilities

There are three hospitals (two public and one private) and six clinics in the Municipal area and three mobile clinics. The Marapong clinic requires upgrading to provide adequate service for the population, which has grown threefold compared to when the clinic was originally built. The provision of health services in urban Lephalale is adequate. However, the health sector in Lephalale is faced with several problems, and these include:

- Poor clinic services
- Lack of medical specialists and qualified nurses
- No public clinic in Onverwacht
- Overnight facilities needed for patients that are referred to Lephalale hospital
- Problems with the transport of state patients from rural areas to specialist services in Polokwane
- Need for public participation in HIV/Aids and TB awareness programmes

4. QUANTITATIVE RISK ASSESSMENT

4.1 Safety, Health, Environment and Quality Policy

4.1.1 Safety

Exxaro's safety and sustainable development governance model's minimum standards include meeting legislative requirements. The risk management systems and processes are then modelled around key

risks for implementation at operational level. A risk-based approach also directs the way resources are allocated and used in the group to ensure on-going progress towards and beyond legal compliance (Exxaro, 2012). The safety plan that Exxaro operates with involves:

- **Leadership in making safety a way of life**: Leaders setting the example of safe behaviour by being directly involved in safety visits and ensuring compliance to safe work practices.
- **Zero-tolerance approach**: Introducing the 13 zero-tolerance safety rules that are a part of every employee's conditions of service. Employees who violate or ignore these rules are investigated and disciplinary action taken where necessary. This ensures that Exxaro effectively protect the lives of employees.
- **Knowledge — training for life:** Establishing a standard safety training programme across the group, for all job categories. Training will is an on-going sustainable process to ensure every employee can identify and respond to a dangerous situation.
- **Identifying risks — formal process**: Reinforcing the need to take two minutes to conduct a mini-HIRA — a task that could prevent injury or save a life by becoming a conscious action, not just a thoughtless habit. The mini-HIRA standard is revised and training material developed to ensure all employees understand how to conduct one.
- **Communication — daily**: Talking about safety and having the tools to keep safety at top-of-mind awareness are key to ensuring safety practices become a way of life for group employees

Exxaro has a policy in place that details the group's approach to identifying, preparing for and responding to emergency situations affecting employees and surrounding communities. This spans all known types of emergency including fire, flood, bomb threats etc. (Exxaro, 2012).

Exxaro's ultimate target is Zero injuries and therefore Zero Fatalities. To achieve this they have an incremental target of 30% improvement in safety performance every year. They aim to achieve this through stringent application of management protocols, programmes and systems. Formal management-worker health and safety committees are in place at all operations, and meet regularly to ensure they reach their targets (Exxaro, 2012).

4.1.2 Health

Exxaro employees are made aware of their individual roles in preventing occupational diseases. They are made aware of hazards in the work environment, and the risks these pose to their personal health (Exxaro, 2012). In Exxaro's approach (from Exxaro, 2012):

- Health risks are identified, quantified and monitored through a ventilation and occupational hygiene surveillance programme,
- Employee health status is checked through the medical surveillance programme,
- Employees are:
    - Encouraged to be vigilant about conditions that could affect their own safety and health or that of their colleagues,
    - Provided with information on the health implications of exposure to various workplace risks,
    - Made aware of measures that should be taken for them to maintain their health.
- The exposure risk to workplace hazards is managed through a hierarchy of controls by:
    - Eliminating the hazard at source,
    - Substituting equipment that generates the hazard,
    - Controlling levels of exposure by moving employees out of the work area or providing personal protective equipment.

Employees are also made aware of how occupational diseases affect quality of life and loss of potential income and are encouraged to comply with mitigation measures in the workplace. In addition an interdisciplinary collaboration team between the health specialists and disciplines such as technology, information management, human resources and supply chain management has been established (Exxaro, 2012).

4.1.3 Environment

Exxaro's core focus is on conserving natural resources and reducing the burden of pollutants on the environment by:

- Complying with all applicable environmental legislation — as a starting point. Their aim is to exceed compliance.
- Developing innovative policies and programmes for addressing environmental impacts.

All of their operations have Environmental Management Programmes as required under the Mineral and Petroleum Resources Development Act (MPRDA) and the National Environmental Management Act (NEMA). Exxaro also adopts the precautionary approach recommended by NEMA in evaluating the environmental impacts of business opportunities (Exxaro, 2012). Exxaro's desirable current and future state includes:

- Sustainable ecological systems at all Exxaro operations,
- Stable rehabilitation fund with a gradual decline in environmental liabilities as these liabilities are addressed during active operation,
- Full environmental compliance to sustainable development requirements ,
- No asset risk and reduction in land-holding costs.

Sustainable development issues are central to Exxaro's business, particularly the use of natural resources like water, air, biodiversity and land. Using these responsibly means:

- Ensuring all activities are properly authorised,
- Using energy and water as efficiently as possible,
- Ensuring activities are conducted responsibly, from the twin perspectives of compliance and natural resource use.

4.2 Objectives and Strategies

4.2.1 Objectives

The IWWMP has been compiled to achieve the following objectives:

- To provide Char Manufacturing Plant Expansion Project with a document detailing water and waste related activities on site;
- To provide an ecological baseline for the current state of the environment;
- To assess the significance of potential impacts on the environment due to water uses and waste generating activities;
- To develop a management plan for protection of water resources; and
- To provide Char Manufacturing Plant Expansion Project with a groundwater and surface water monitoring system.

4.2.2 Strategic Actions of the IWWMP

The strategic actions of the IWWMP will include:

- Establishment of the appropriate structures at corporate level and at the plant's operational

level;
- Train and communicate with all incumbents to align with Exxaro Reductants' vision;
- Develop action plans for implementing water savings measures and targets;
- Commit and drive towards continuous improvement of all water systems; and
- Establish appropriate measurement and reporting systems.

4.3 Key Performance Areas and Indicators

Due to the fact that this is an expansion of an existing plant, the initial performance indicators will be in line with the design specifications of the original and associated infrastructure. The objective will be to stay within the specifications designed for the following:

- Water recycled from the PCD;
- Dirty and clean storm water separation;
- Water usage at the plant;
- Waste treatment, storage and disposal;
- Water used for dust suppression.

These indicators will be managed, and the drive will always be to optimise all water uses and waste management at the plant.

4.4 Methodology Followed for Impact Assessment

4.4.1 Impact Ranking Criteria

The criteria used for assessing the significance of the water-related impacts are given in Table 4.1. The impact assessment method takes into account the current environment, the details of the proposed project and the findings of the specialist studies. Cognisance has been given to both positive and negative impacts that may result from the development. The significance of the impact is dependent on the consequence and the probability that the impact will occur.

impact significance = (consequence x probability)

Where:

consequence = (severity +extent)/2

and

severity = [intensity +frequency + duration]/3

Each criterion is given a score from 1 to 5 based on the definitions given in Table 4.1. Although the criteria used for the assessment of impacts attempts to quantify the significance, it is important to note that the assessment is generally a qualitative process and therefore the application of this criteria is open to interpretation. The process adopted has thus involved the application of scientific measurements and professional judgement to determine the significance of environmental impacts associated with the project. The assessment thus largely relies on experience of the environmental assessment practitioner (EAP) and the information provided by the specialists appointed to undertake studies for the EIA.

Where the consequence of an event is not known or cannot be determined, the "precautionary principle" has been adhered to and the worst-case scenario assumed. Where possible, mitigation measures to reduce the significance of negative impacts and enhance positive impacts have been recommended. The detailed actions, which are required to ensure that mitigation is successful, are provided in section 6.5 of this report.

Consideration has also been given to the phase of the project during which the impact occurs. The phase of the development during which the impact will occur has also been noted to assist with the scheduling and implementation of management measures.

Table 4.1: 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 Char Manufacturing Plant Expansion Project	4
Residual: impact is permanent (remains after plant 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 Waterberg 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.

4.4.2 Project Phases

The waste and water–related environmental impacts for the project have been assessed over five phases of the project i.e. the planning and design, construction, operation, decommissioning and post-closure phase.

The planning and design phase refers to the stage when the feasibility studies are being undertaken, the project description is being developed and the plant is being designed. During this phase the EIA is completed and environmental authorisations are applied for. This phase started in 2010 and is anticipated to be completed in late 2012.

The construction phase will commence after the WUL Amendment, AEL, WML and environmental authorisations have been obtained. This phase will involve the physical construction of the plant and its associated infrastructure. Construction is anticipated to commence in June 2013 and end approximately in September 2015.

The expanded plant operation is also anticipated to commence in 2015 and reach full capacity in March 2016. Current production at the existing plant is 162 ktpa of char and when the expansion is complete, production will ramp up from September 2015 progressively to March 2016 to a total of 486 ktpa. The expected lifetime of the new plant is 25 years.

The decommissioning phase refers to the time in the plant life when operations are reduced in preparation for closure. This phase will occur once the end of the plant life has been reached. As it is anticipated that the char production from the plant will last approximately 25 years, it is therefore estimated that decommissioning will commence in 2040.

The closure phase refers to when the plant is shut down and no further activities are undertaken, this phase will occur after successful decommissioning has been achieved.

4.4.3 Mitigation Measures

A **no net loss** approach has been adopted in terms of the management of impacts at the Char Manufacturing Plant Expansion Project (see Figure 4.1):

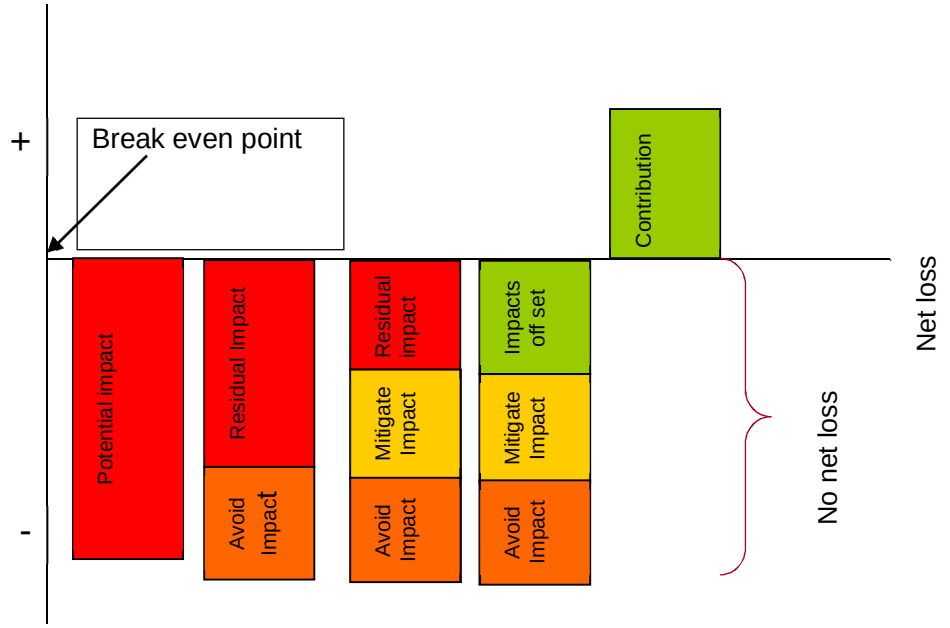


Figure 4.1: No Net Loss Approach to Environmental Management

- **Avoidance** – impacts are to be avoided where practicable e.g. through the implementation of alternatives including alternative locations or technologies;
- **Mitigation** – should it not be possible to avoid all impacts, the remaining impacts are to be mitigated to acceptable levels.
- **Offset** – should it not be possible to avoid and mitigate all impacts to acceptable levels it will be necessary to offset the remaining impacts. Suitable offsets will need to be identified.

Mitigation measures for significant impacts which cannot be avoided have been identified. The impacts have been ranked before and after the implementation of the mitigation measures. Consideration has also been given to the confidence level that can be placed on the successful implementation of the mitigation level as follows:

- **High Confidence:** mitigation measure easy and inexpensive to implement.
- **Medium Confidence:** mitigation measure expensive or difficult to implement.
- **Low Confidence:** mitigation measure expensive and difficult to implement.

Where mitigation is not sufficient to reduce the impact to acceptable levels offsets will need to be identified.

4.5 Possible Waste and Water-Related Impacts on the Environment and their Significance

The table below describes only the potential waste and water-related environmental impacts of the Char Manufacturing Plant Expansion project. Please refer to the final EIA and EMP for the project for an assessment of all of the potential environmental impacts of the project.

4.5.1 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).

4.5.2 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 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												

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

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

4.5.3 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												
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

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

4.5.4 Decommissioning Phase

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

4.5.5 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	
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

4.6 Risk to the Environment

The direct impacts will be limited to the immediate neighbour of the plant – the Grootegeluk Mine. It is however expected that impacts on surrounding landowners will be low provided that mitigation measures are successfully implemented. However, as many of the potential impacts have been simulated through models, it is important that monitoring be undertaken to verify the impacts.

Effective surface and groundwater management and monitoring are essential for long-term sustainability of the supply and to protect the resource. A monitoring programme needs to be implemented for each surface water and groundwater resource, involving regular measurements of:

- Water levels,
- Abstraction, and
- Quality.

In addition to monitoring, it is recommended that the existing forums be continued to ensure open communication and discussion of grievances that affected parties may have once project implementation commences.

4.6.1 Surface Water

In terms of assessing the impact of the project on the catchment, the total area of the existing Char Manufacturing Plant and the expansion is small compared to the Mokolo River catchment. The site covers an area of approximately 0.47 km² compared to a catchment of just under 8400 km² for the Mokolo River (the site covers only 0.006% of the Mokolo catchment) (Jones and Wagener, 2012).

A detailed description of the Char Manufacturing Plant operation impacts on surface water is given in Appendix 5. 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. The water model balance also indicates that the proposed Char plant Expansion project will operate at a water deficit. The PCD is also adequately sized 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. Thus, the risk of spillage from the PCD is very low, with a risk of less than 2% in any one year. In the unlikely event of spillage, all spills would report to the Bosbok Dam and would be reused in the process.

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 -must 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.

Further, the dirty water generated on site is distinctly different from that generated on the mine, as it can potentially have high organic hydrocarbon content. It is therefore important that the same legislated requirements that are set for clean and dirty water separation should also be set for containment of dirty water on the Char manufacturing Plant Expansion to ensure that this water does not get used in the mine process (however it is suitable for use in the char plant) (Jones and Wagener, 2012).

The existing Char Manufacturing Plant and proposed expansion site are also located within the greater Grootegeluk Colliery dirty water area. Any spillage of contaminated water or storm water around the site is collected in Grootegeluk Colliery's Bosbok Dam.

4.6.2 Groundwater

A detailed description of the mining impacts on groundwater is given in the groundwater specialist report in Appendix 4.

4.6.2.1 Seepage and Groundwater Quality

The groundwater quality at the site is currently slightly polluted due to the historic use of the site (for coal storage). If the stormwater management system, PCD lining, coal and product stockpile designs and waste management measures are implemented, then there is likely to be little additional effect on groundwater quality. Seepage water on the Char Plant site will be gathered by an underground sump and piping system, routed to the PCD.

The existing soil at the Char Manufacturing Plant site and the proposed Expansion is contaminated from previous and current practices. Therefore, the existing soil is a problem unless it is removed and treated appropriately. The removed soil will need to be managed once the expansion starts. The fill material for the Site is also contaminated already, it is important to ensure that future fill material used not contaminated (Golder, 2011). The contaminated soil which exists on the Char Manufacturing Plant Expansion site will need to be removed and appropriately remedied or disposed of to ensure that groundwater quality is not further impacted. On-going quarterly monitoring of borehole water quality on site will continue. If groundwater impacts are detected, then the reasons for this will need to be examined and any problems remedied.

The Char stockpile will be positioned on a suitably prepared terrain to reduce water seepage and manage run-off. The coal stockpiles will be kept in a concrete lined area to prevent/reduce seepage.

The PCD is lined with bentonite and a geomembrane liner. The PCD has also been designed with a leakage detection system that allows the operator to monitor the performance of the liner. The leakage detection consists of a perforated pipe embedded in a 150mm thick sand layer covering the entire base of the PCD. This also provides a cushioning layer for the protection of the liner from sharp rocks and edges (Epoch Resources, 2007). Thus any possible groundwater quality effects from the PCD will be managed.

The management of waste at the Char Manufacturing Plant Site (existing plant and expansion) is tied in with the current practices and facilities of Grootegeluk Mine. Domestic waste is disposed of through a colour coded bin system and all the domestic waste and scrap is handled by the mine through a Service Level Agreement (SLA) between the Char Manufacturing Plant and the Grootegeluk Mine. The waste is removed by an appropriately licensed waste removal contractor and disposed of at a licensed general waste facility. Solid hazardous waste will be disposed of at a licensed hazardous waste site. The liquor and tar that is generated during the process will be kept in bunded areas to prevent spillage. The liquor is then destroyed through oxidation and the tar is mixed with coal fines and transported to the mine to be used as feedstock. Since all the waste will be properly managed, there is a low chance of the waste polluting the area or the water in the area.

Should pollutants enter into the groundwater, the extent of contamination would be confined to a limited area around the source. There is dewatering in the area with pit mine dewatering taking place around

the mining area. The dewatering boreholes include WB33, WB35, WB36, WB38, WB39, WB41, WB42, WB43, WB45, WB46, WB49 WB50, WB51, WB52, WB53, WB54, WB55, WB56, WB57 and WB59 (Figure 3.21). One of the reasons for dewatering is to remove polluted groundwater to prevent further water pollution; a sustained abstraction and monitoring network could prevent further water pollution from spreading (ERM, 2012).

4.6.2.2 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. No groundwater will be abstracted on the site and thus no dewatering of the aquifers will occur as a result of the Char Manufacturing Plant Expansion project. The surface water on the site (storm water) will all be captured and contained in the PCD. Thus there will be no groundwater recharge which will occur on the site, as water will not be allowed to percolate to the water table.

4.6.2.3 Groundwater Receptors

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. Thus water users are not likely to be affected by changes to the groundwater at the project site.

A water user that may be affected by the Char Manufacturing Plant Expansion is the adjacent Grootegeluk Mine. As discussed above, the Char Manufacturing Plant Expansion project is unlikely to have any negative effects on groundwater quality and thus is unlikely to impact the Grootegeluk Mine's water use. The removal of the coal stockpiles and contaminated soil on the expansion site is likely to improve the quality of the groundwater in the long term.

4.6.3 Ecology

4.6.3.1 Waste and Water-related Impacts on Vegetation

NSS conducted a biodiversity assessment in 2010 of the Grootegeluk Mine, including the Char Manufacturing Plant Expansion site. The diversity of the vegetation in the surrounding areas of the Char Manufacturing Plant Expansion site is included. The area where the Char Manufacturing Plant Expansion Site is to be located is within the "Low Sensitivity Scale" meaning the area is a degraded and highly disturbed/transformed systems with little ecological function and is generally very poor in species diversity (most species are usually exotic or weeds) (NSS, 2010)

The footprint of the proposed Char Manufacturing Plant Expansion will be increased from approximately 7.4 ha to 13.4 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 are therefore considered negligible. Therefore, the possibilities of waste or water-related impacts on vegetation near the Char Manufacturing Plant (existing plant and expansion) are considered very low.

Measures are already in place to manage the potential impacts of waste and water pollution will continue to function with the plant expansion, to prevent contaminants from impacting the surrounding areas and affecting the surrounding vegetation

4.6.3.2 Waste and Water-related Impacts on Faunal Species

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 a suitable habitat for animals.

NSS conducted a biodiversity assessment in 2010 of the Grootegeluk Mine including the Char Manufacturing Plant Expansion site. The diversity of the faunal species in the surrounding areas of the Char Manufacturing Plant Expansion site is included. As with the vegetation, the area where the Char Manufacturing Plant Expansion Site is to be located is within the “Low Sensitivity Scale” meaning the area is a degraded and highly disturbed/transformed system with little ecological function and is generally very poor in species diversity (NSS, 2010).

As with the vegetation, measures in place to manage the potential impacts of waste and water pollution will continue to operate, to prevent contaminants from impacting the surrounding areas and affecting the surrounding fauna.

4.6.4 Socio-Economic Impacts

It is expected that for the Char Manufacturing Plant Expansion, 369 employment opportunities will be created. A large percentage of these employment opportunities will benefit the surrounding communities. As far as possible, labour will be sourced from Lephalale Local Municipality especially neighbouring communities. In addition to employment, Exxaro Reductants will contribute to the surrounding communities through implementation of socio-economic development projects and skills development as stipulated in their Social and Labour Plan.

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 (the Grootegeluk Mine). There are no sensitive receptors which have been identified nearby.

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.

4.7 Risks to Human Health

The greatest risk to human health would be a change in the surface or groundwater quality, or the

mismanagement of wastes. Human health could also be affected if the plant workers are not appropriately trained in safe work procedures or if they do not wear the appropriate PPE.

Potential water pollution sources include the following facilities:

- Char and coal stockpiles and handling areas;
- Settling pond / silt trap;
- Pollution Control Dam;
- Sewage pipelines and sump;
- Existing soil (contaminated with coal);
- Liquor, tar and sludge temporary storage areas.
- Fill material for site construction (if this is contaminated).

The potential for seepage of contaminants from these sources into the groundwater is expected to be low due to the fact that suitable management measures will be in place for these areas. Storm water will be stored in the PCD and then recycled back into the process and will not be allowed to enter the environment. Thus, there is little risk of surface water pollution as a result of the activities at the Char Manufacturing Plant Expansion. Thus there is little potential for water pollution reaching neighbouring users and affecting human health.

All facilities are provided with measures to mitigate the potential for contaminants entering the groundwater resource. These largely comprise the placement of impervious surfaces in areas where there is a risk of spillage or seepage of contaminants like the lining that is under the PCD and its settling pond.

As there is unlikely to be any water pollution, there are unlikely to be any human health impacts related to water at the Char Manufacturing Plant Expansion Project.

5. COST-BENEFIT ANALYSIS

5.1 Requirement for a Cost-Benefit Analysis

The IWWMP has been compiled in accordance with the requirements stipulated in the Draft Operational Guideline to assist in the Compilation of an Integrated Water and Waste Management Plan, September 2009, compiled by the Department of Water Affairs. The guideline requires that a Cost-Benefit Analysis be compiled for all high-risk impacts stemming from industrial water use. As can be seen in the impact assessment section 4.5, there are no high-risk impacts as a result of the industrial water use. Thus, a detailed Cost-Benefit Analysis has not been included as it is not required for the level of impacts expected for the Char Manufacturing Plant Expansion Project.

6. INTEGRATED ENVIRONMENTAL MANAGEMENT

6.1 Management Principles and Philosophy

There are several key principles that apply to all aspects of water management at the Char Manufacturing Plant Expansion Project:

- The water management hierarchy approach shall be applied;
- Exxaro Reductants is the temporary and responsible steward of water on the Char Manufacturing Plant Expansion project, and shall not cause harm or adverse social conditions through their use of this resource;

- Exxaro Reductants shall endeavour to optimally use water for business to generate value, both in the long and short term (within the concept of sustainable development);
- Water has both quantity and quality aspects that need to be considered for each Water Resource;
- Access to water is considered a human right.

6.2 Environmental Management Systems and Procedures

Exxaro have developed an extensive Environmental Management System (EMS) for the Grootegeluk Mine. The Char Manufacturing Plant Expansion project will incorporate this where applicable, into their EMS. A copy of the EMS has been attached as Appendix 9.

Environmental Management procedures have also been developed for the most significant environmental aspects at the existing Char Manufacturing Plant. These procedures will also be carried out for the Char Manufacturing Plant Expansion project. A copy of these procedures is also included in Appendix 9.

6.3 Water Use and Management

Exxaro Reductants is committed to the following DWA Resource Protection and Waste Management hierarchy of decision-making (see Figure 6.1). The hierarchy will inform the principles of water management applicable to the Char Manufacturing Plant Expansion Project.

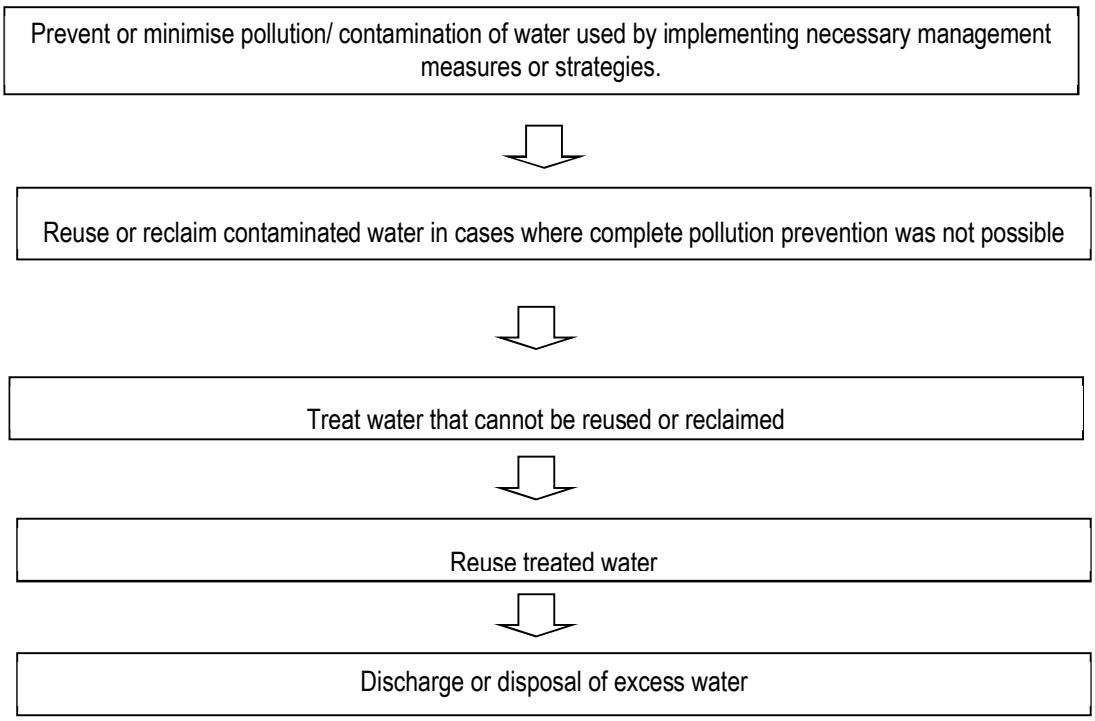


Figure 6.1: Resource Protection Hierarchy

6.3.1 Water Supply

The water supply process for the Char Manufacturing Plant Expansion Project is illustrated in the water balance diagram below in Figures 6.2 and 6.3.

6.3.1.1 Groundwater abstraction

There will be no groundwater abstraction taking place for the Char Manufacturing Plant Expansion project. Groundwater will not be used at the plant. The only time when small amounts of groundwater may be abstracted is during the monitoring of groundwater quality when samples will be analysed.

6.3.1.2 Raw Water Supply

Raw water is required for use in the production of steam in the boilers and for the gas cooling water circuit for the Char Manufacturing Plant Expansion.

The Char Manufacturing Plant Expansion will require an average of approximately 1108 m³/day (1.108 Mℓ) of raw water (including the requirements of the existing plant). Raw water is sourced from the Mokolo Dam and delivered to the Grootegeluk Mine by an underground pipeline from where Grootegeluk manages the distribution of water to the various points of use at the mine, including the existing Char Manufacturing Plant (Refer to Figure 6.2 and Figure 6.3 for the Schematic water balance of the Existing Plant and the Proposed Expansion respectively). The Char Manufacturing Plant Expansion project will also make use of the existing Grootegeluk water allocation for its potable and raw water needs. Grootegeluk Mine will thus increase its allocation of water to the site for the Char Manufacturing Plant Expansion project.

Please note that the Grootegeluk Mine will not require any additional water from the Mokolo Dam as a result of this project. The additional water will come from the Grootegeluk Mine's existing allocation. A Service Level Agreement between the Grootegeluk Mine and Exxaro Reductants has been drawn up to clarify this.

The table below (Table 6.1) indicates the existing consumption and planned raw water needs for the expanded 12 retort char production facility.

Table 6.1: 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	Expanded Plant Total (12 Retorts)
Boiler Feedwater and make-up water	29.64	59.28	88.92
Gas cooling make-up water	105.12	210.24	315.36
Storage Reservoir	1	26	27
Char Total	**134.76**	**269.52**	**404.28**

A 440 m³ raw water storage facility will be provided for this project. The envisaged buffer dam size is likely to be 15 m x 2.5 m.

Jones & Wagener
Consulting Civil Engineers
59 Bevan Road PO Box 1434 Rivonia 2128 South Africa
Tel: (011) 519-0200 Fax: (011) 803-1456 email: post@jaws.co.za

Client:	Exxaro Grootegeluk
Job:	Char, Coke and Co-gen Plant
	Char Plant and 4 Retorts Process Flow Diagram
	Phase I: 4 Retorts

Our Ref:	C050
Set no.:	1
Made by:	HGR
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

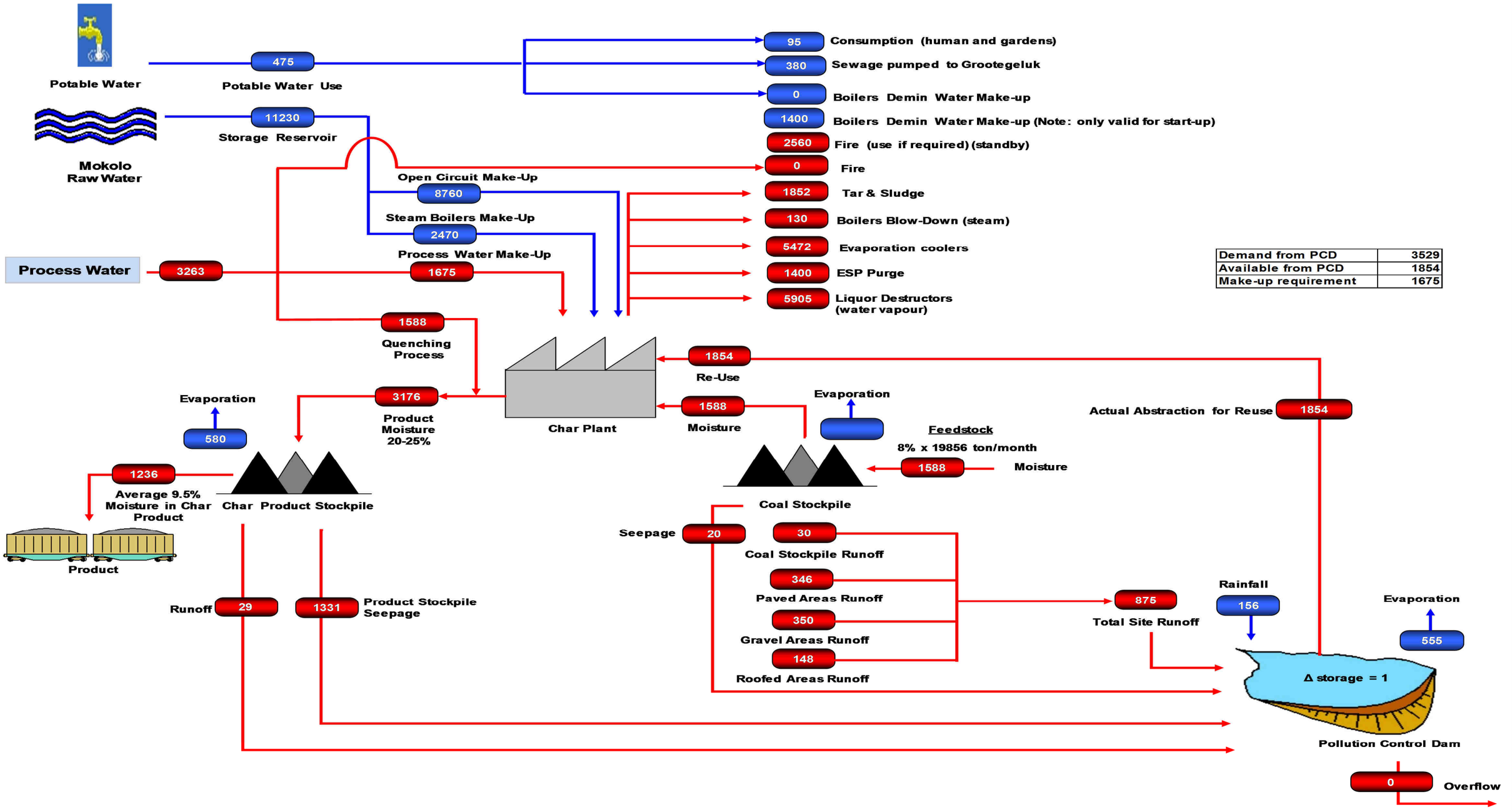


Figure 6.2: Schematic water balance diagram: Existing Char Manufacturing Plant: 4 retorts

Jones & Wagener
Consulting Civil Engineers
59 Bevan Road PO Box 1434 Rivonia 2128 South Africa
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 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

Clean

Dirty

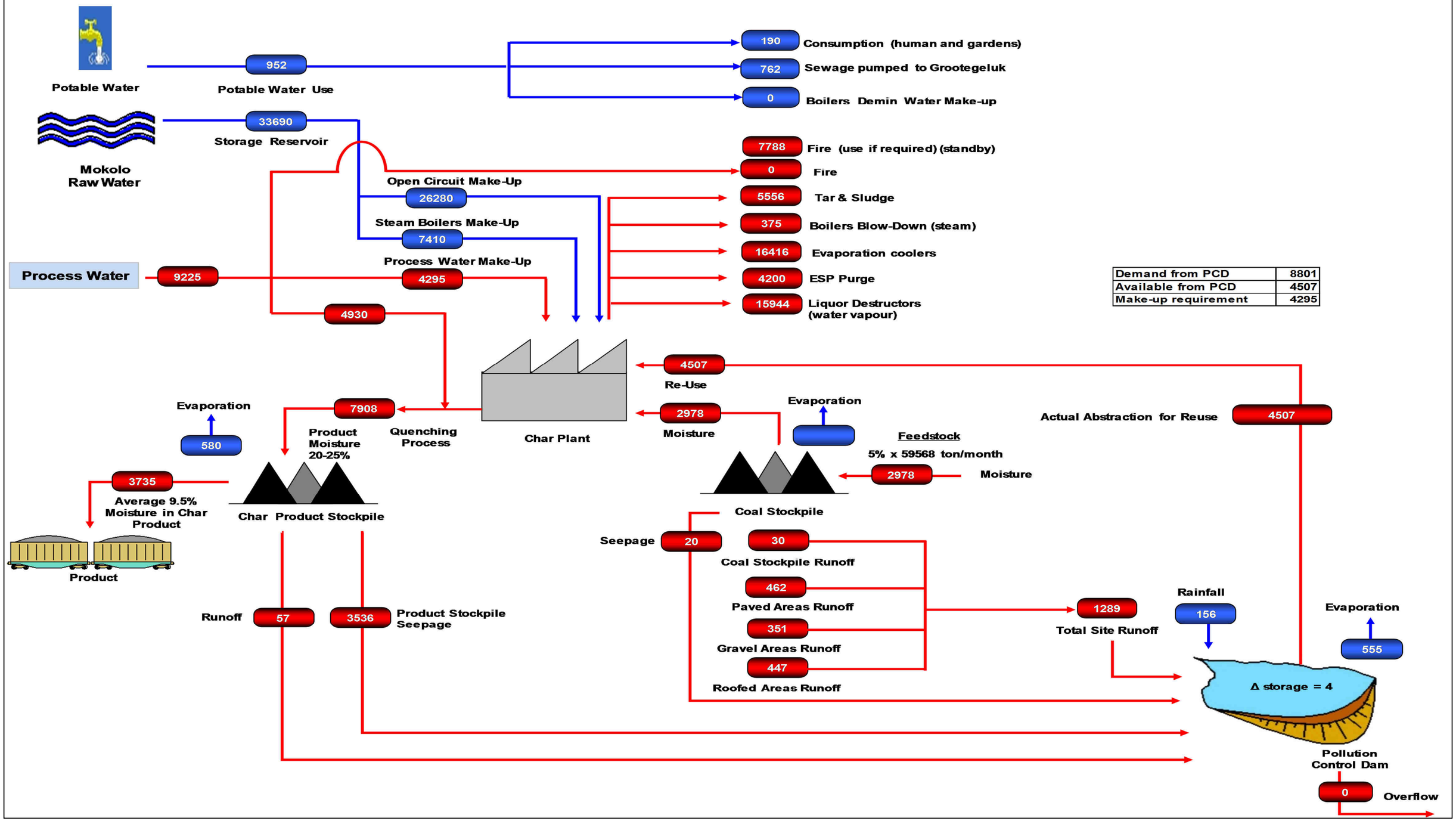


Figure 6.3: Schematic water balance diagram: Expanded plant: 12 retorts

6.3.1.3 Potable Water Supply

The Char Manufacturing Plant Expansion will require an average of approximately 31.3 m³/day of potable water (including the requirements of the existing plant).

Sufficient potable water is already available at the existing Char Manufacturing Plant (obtained from the Grootegeluk Mine) for the expansion project. Additional pipelines which may be required within the Char Manufacturing Plant Expansion area will be constructed as required.

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 table below Table 6.2

Table 6.2: 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	Expanded Plant Total (12 Retorts)
Consumption (gardens etc.)	1.14	1.14	2.28
Sewage	4.56	4.58	9.14
Char Total	**5.7**	**5.72**	**11.42**

6.3.1.4 Process Water Supply

Process water for the char manufacturing process is supplied to the existing Char Manufacturing Plant from Grootegeluk Mine via existing HDPE pipelines and the PCD dam.

Process water is sourced from the Grootegeluk Mine process water circuit via two dedicated pipelines to the existing Char Manufacturing Plant. This process water circuit draws water from the mine's dirty water dams. The Char Manufacturing Plant Expansion requires 303 m³/day of process water (including the requirements of the existing plant). 148.2 m^3/day is sourced from the existing Char Manufacturing Plant PCD, 141.2 m^3/day from the Grootegeluk Mine's dirty water dams and the remainder comes from the moisture within the coal feedstock and the recycling of water within the system. No changes will be made to the pipelines feeding the existing Char Manufacturing Plant since these were adequately sized for the proposed expansion during the original plant establishment. The table below, **Table 6.3**, indicates the current and future process water demand based on design figures. Please note that within the Char Manufacturing Plant (existing plant and expansion), the process water from the PCD and the mine's dirty water dams becomes combined with recycled water in the system, thus the water in the table below does not show the full amount of water needed in the process.

Table 6.3: 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	Expanded Plant Total (12 Retorts)
Char quench water system	38.1	56.8	94.9
Other process water	1.06	14.74	15.8
Char Total	**39.16**	**71.54**	**110.7**

At the existing Char Manufacturing Plant, a firewater tank with a capacity of 2560 m^3 is present. For the

Char Manufacturing Plant Expansion this tank capacity will be increased to 7788 m^3.

6.3.2 Dams and Water Storage

The water storage for the settling pond, central pollution control and raw water storage for the Existing Char Manufacturing Plant and the Proposed Expansion are detailed in Table 6.4.

Table 6.4: 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	Expanded Plant Total (12 Retorts)
Settling Pond	0	100	100
Central pollution control dam	12 828 (maximum)	0	12 828 (maximum)
Raw water storage tank	0	440	440
Char Total	**12 828**	**540**	**13368**

Please note that none of the dams will have walls higher than 5 m and thus none are classified as dams with a safety risk.

6.3.2.1 Pollution Control Dam

The main purpose of the PCD is to capture and store dirty storm water, used process water and seepage water. All runoff from the existing Char Manufacturing Plant site and the proposed plant expansion site is therefore directed via a piped / canalised storm water system to the PCD. From here it will be pumped to the Char Manufacturing Plant Expansion for use in the process.The PCD will supply more than half of the process water as discussed in Section 6.3.1.4.

The PCD has a small existing silt trap, but a new one will be built as part of the Char Manufacturing Plant Expansion Project. The new settling pond (silt trap) will be located near the new retorts with a volume of 100 m^3, which allows for the trapping of silt before the storm water flows into the PCD. The design of the new silt trap will be very similar to the existing one. Effluent from the Char Manufacturing Plant Expansion process will also be disposed of via the silt trap to the Char Manufacturing Plant PCD. The silt traps are designed to allow the cleaning out of settled particles by mechanical means and they settle particles with a diameter equal to or larger than 200 micrometers. The silt trap design includes reinforced concrete design to accommodate the traffic from a TLB-type excavator for cleaning purposes. The silt trap has a pipeline from the char plant, 4 valves, an energy dissipater and two paddocks of the concrete lined settling facility. Different valves are opened or closed depending on when different paddocks need to be cleaned or water needs to re-enter after paddocks have been cleaned of sediment (Epoch Resources, 2007).

The PCD has a maximum capacity of 12 828 m^3 at a depth of 2.3 m. The dam is operated to allow for the 1:50 year flood and with a minimum freeboard of 0.8 m, with a maximum available depth of 2.3 m (this is also a requirement of GN704). See Figure 6.4 and Figure 6.5 for the PCD dam designs. The PCD has been designed with a leachate (leakage) detection system. The leachate detection system consists of a perforated pipe embedded in a 150 mm thick sand layer covering the entire base of the PCD. This also provides a cushioning layer for protection of the liner from sharp rocks and edges (Epoch Resources, 2007).

A site water balance that was compiled indicated that the existing PCD has sufficient capacity to prevent spillage of contaminated water for rainfall events up to at least the 1:50 year recurrence

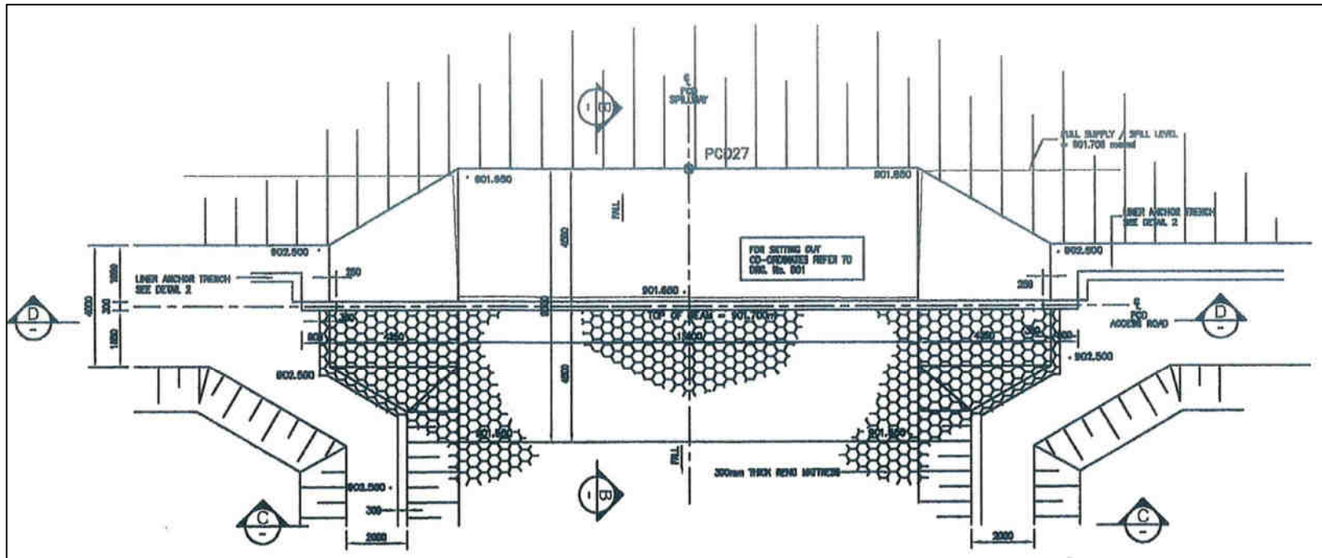
interval, for both the current and the expanded operation.

The detailed inputs and outputs of the PCD are described in the table below (Table 6.5). The modelled performance of the PCD for the Existing Plant with 4 retorts and for the Proposed Expansion with 12 retorts is illustrated in Figure 6.6 and Figure 6.7. These figures show the total dam capacity and the modelled historic volume of water in the dam (based on rainfall records) for both the Existing circumstances and the Proposed extension.

Table 6.5: Inputs and outputs of the existing PCD

PCD inputs (Mℓ/year)	**Current Plant (4 Retorts)**	**8 Retort Expansion**	**Expanded Plant Total (12 Retorts)**
Char product stockpile seepage	1331	2205	3536
Char product stockpile runoff	29	28	57
Coal stockpile seepage	20	No change	20
Total site runoff	875	414	1289
Rainfall	156	No change	156
PCD outputs (Mℓ/year)			
Abstraction for reuse in the plant	1854	2653	4507
Evaporation	555	No change	555
Overflow	0	No change	0

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.



GENERAL ARRANGEMENT ON POLLUTION CONTROL DAM SPILLWAY
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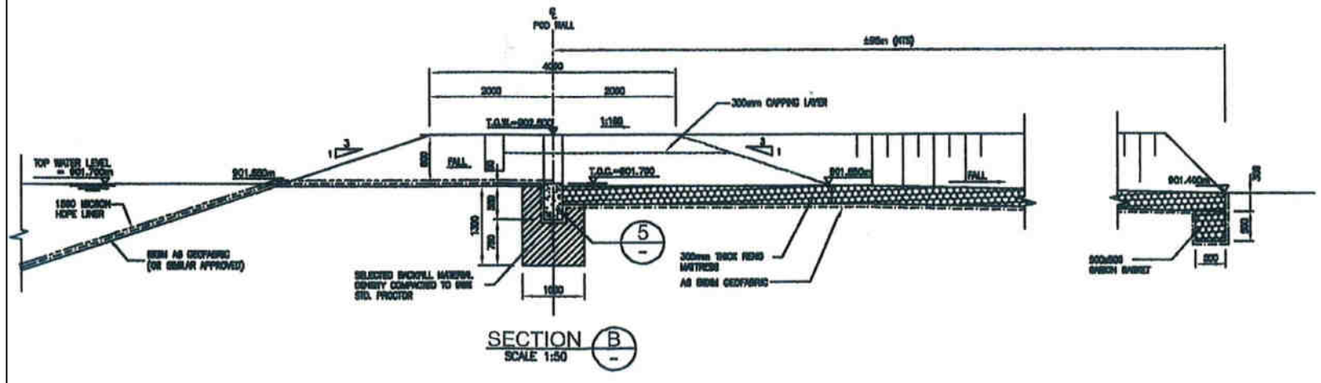
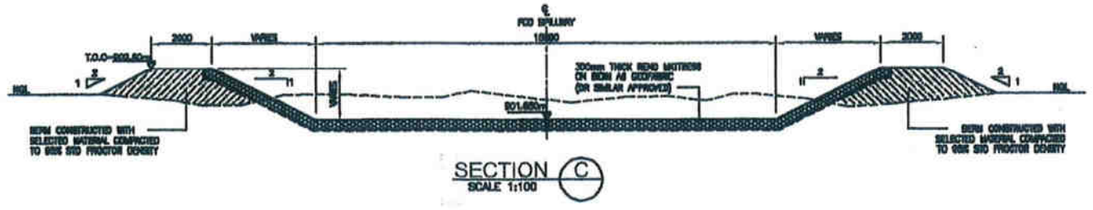


SECTION B
SCALE 1:50



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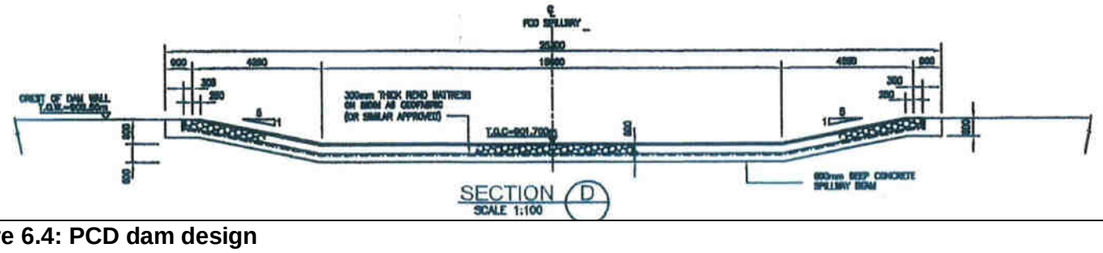

SECTION D
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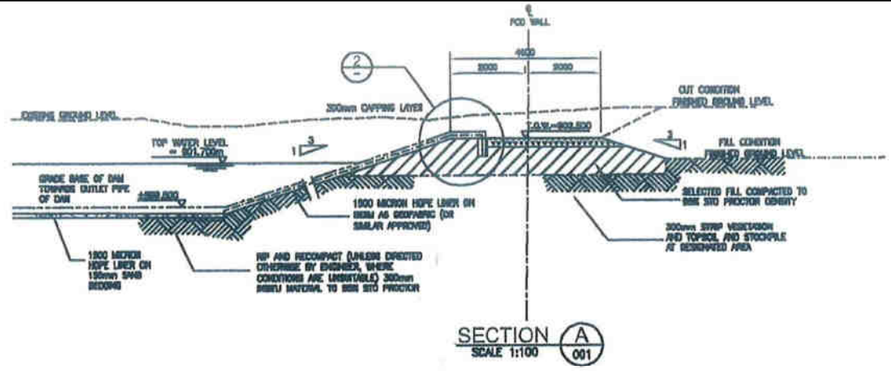
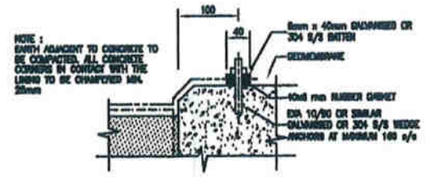


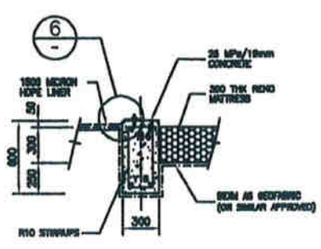
SECTION A
SCALE 1:100

TYPICAL CROSS SECTION THROUGH PCD WALL

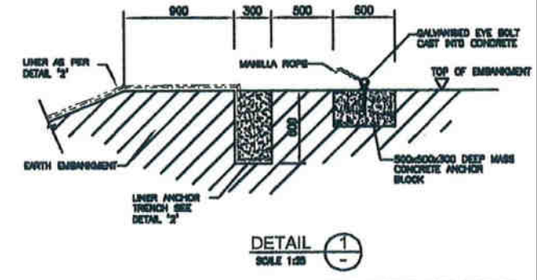


DETAIL 6
SCALE 1:5

LINER TO CONCRETE ANCHOR DETAIL

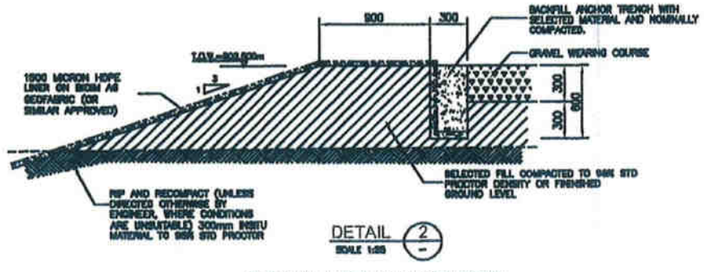


DETAIL 5
SCALE 1:25



DETAIL 1
SCALE 1:25

TYPICAL DETAIL SHOWING SAFETY ROPE AND ACHOR



DETAIL 2
SCALE 1:25

TYPICAL LINER ANCHOR DETAIL

NOTES:

1. ALL CONSTRUCTION WORK SHALL CONFORM WITH THE REQUIREMENTS OF THE RELEVANT SANS 1200 SPECIFICATIONS, THE REQUIREMENTS OF THE CONSTRUCTION DRAWINGS AND THE SPECIFICATIONS OF KUMBA RESOURCES (PTY) LTD.

Figure 6.4: PCD dam design

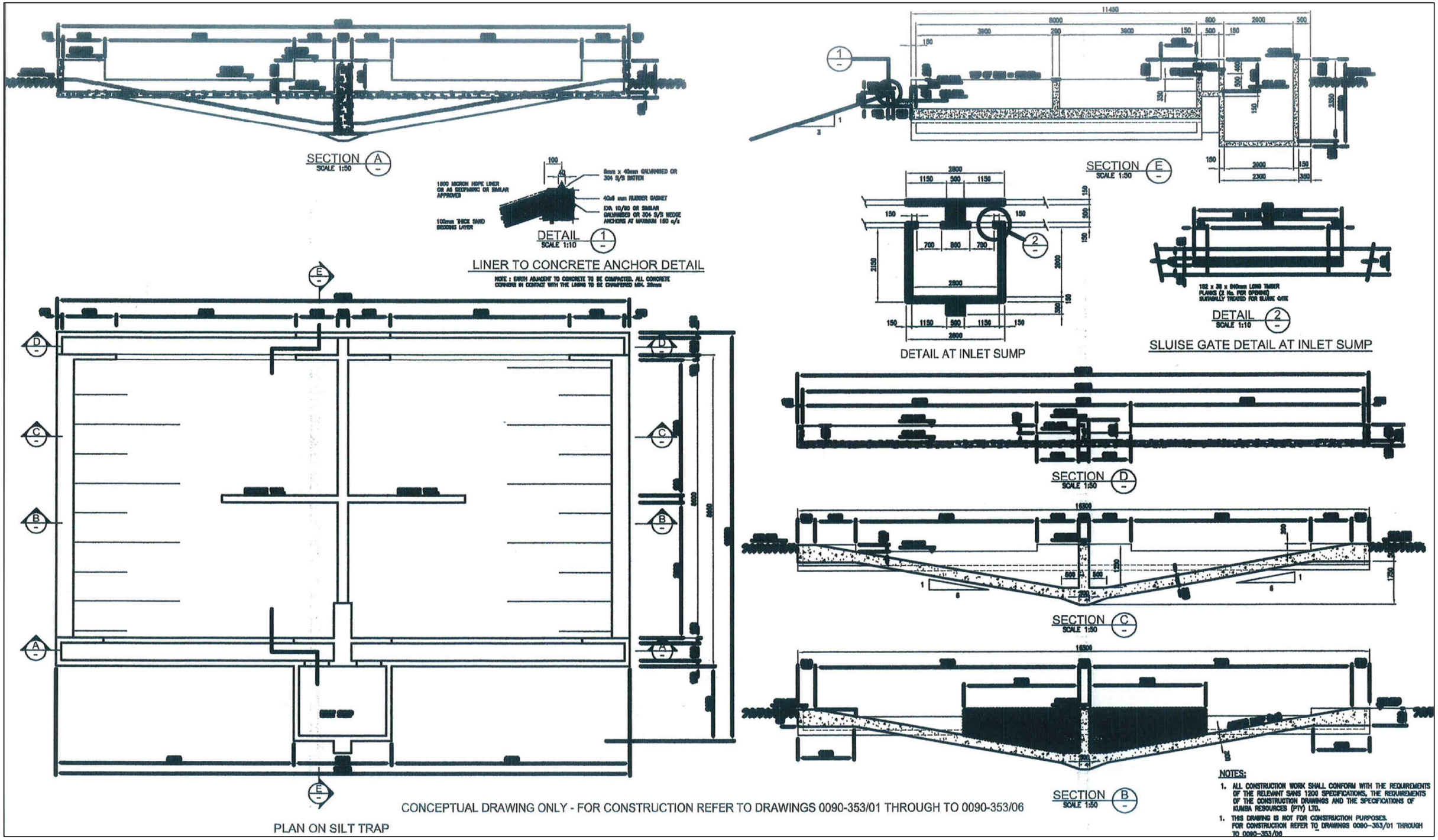


Figure 6.5: PCD dam design

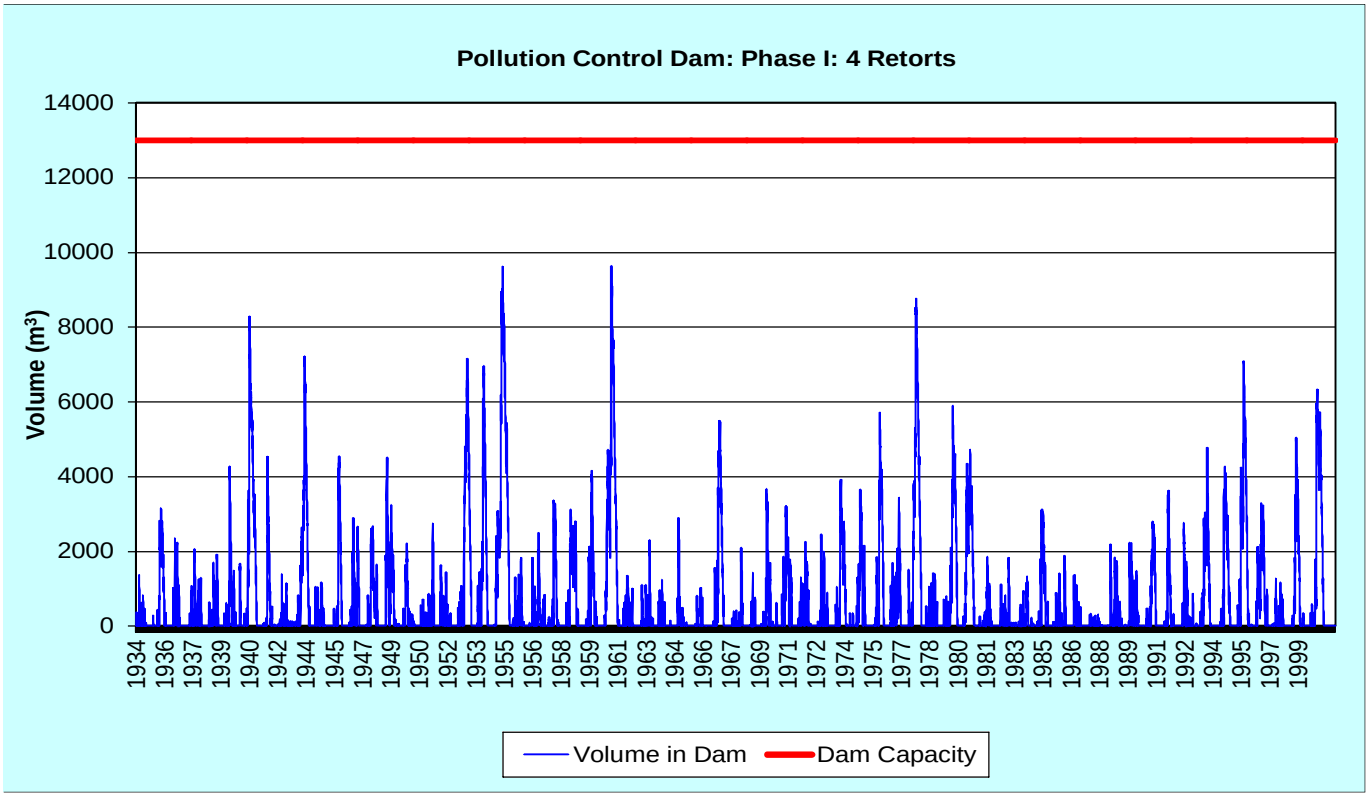


Figure 6.6: Modelled performance of PCD: Current plant: 4 retorts

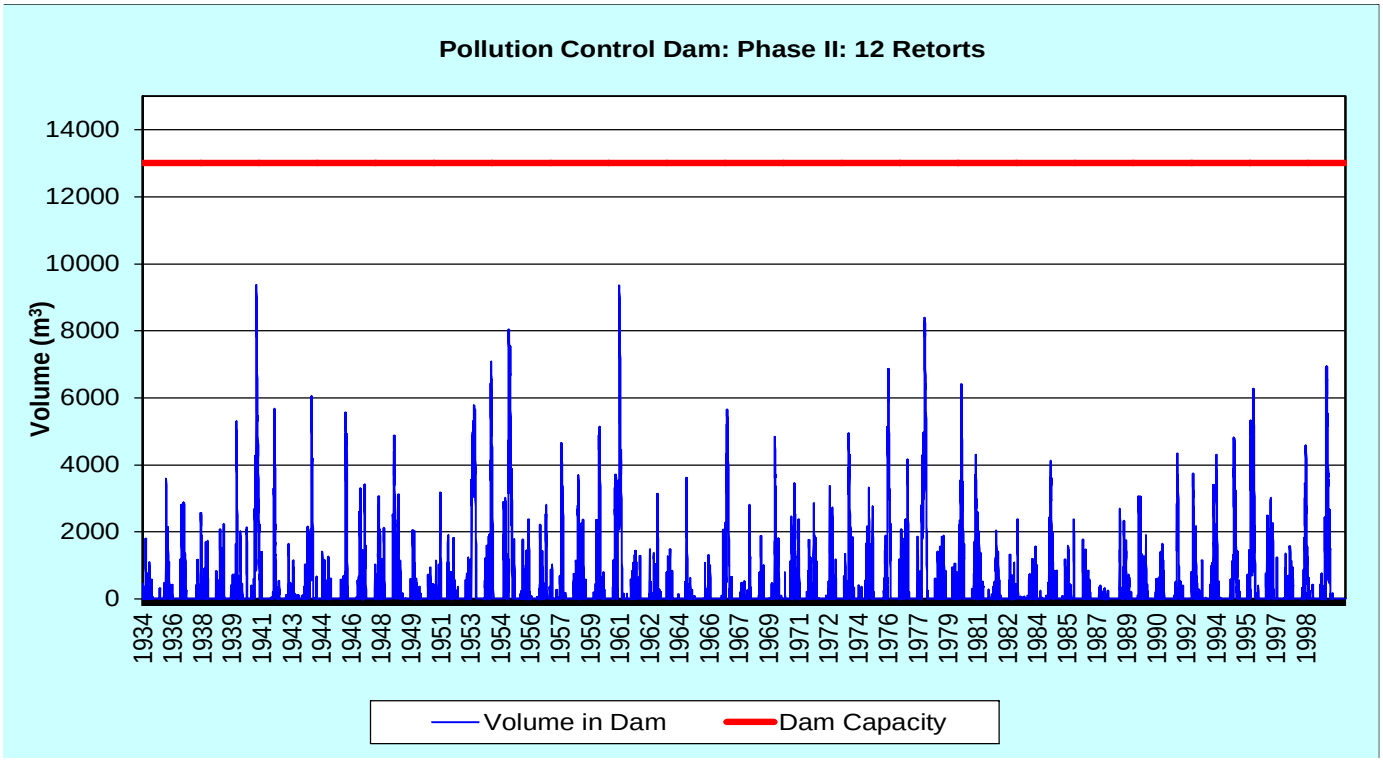


Figure 6.7: Modelled performance of PCD: Expanded plant: 12 retorts

6.3.3 Clean Water Management Facilities

As previously mentioned, the Char Manufacturing Plant Expansion Site is located within a dirty water area on the Grootegeluk Mine property, there are no clean areas surrounding or within the Char Manufacturing Plant area (existing plant and expansion). All of the dirty storm water on the plant site, all used process water and all storm water runoff on the site will be collected in the PCD. A storm water

cut-off drain will also be constructed around the perimeter of the site in accordance with Regulation GN 704 (of June 1999). Thus dirty storm water from the areas surrounding the site flow into the existing Bosbok Dam PCD on the Grootegeluk Mine (refer to figure 3.15).

6.3.4 Dirty Water Management Facilities

The dirty water management facility includes the Pollution Control Dam which has been discussed in 6.3.2.1 above.

Further measures that are in place include a leachate detection system as well as a storm water management system that directs all storm water runoff to the PCD. Further, storm water cut-off drains have been constructed around the site. A comprehensive groundwater-monitoring network has also been established to assess any changes in the state of groundwater (quality and depth). Details of the monitoring are contained in section 6.5.

Stockpile areas will have HDPE and concrete lining systems. The stockpiles will also be equipped with a catchment channel and sump to pump coal stockpile seepage water to the existing PCD. The sludge will be temporarily stored in a concrete bunded storage area and then will be transferred to a mixing station where it will be mixed with char product to be finally transferred to the nearby Eskom Matimba Power Station. The tar will be temporarily be stored in tanks in a concrete bunded area before being sold as a byproduct to customers. The liquor will be temporarily stored and then destroyed in a liquor destructor by burning it with coal gas produced in the retorts during the charring process. The contaminated soil will also need to be removed and disposed of or appropriately remedied.

6.3.5 Sewage Management Facilities

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 and pumped from there to Grootegeluk Mine for treatment in the existing sewage treatment plant at the mine. 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.

The sewerage sump has capacity for 300 people and thus has sufficient capacity to also handle the increased demand of the Char Manufacturing Plant Expansion Project.

6.3.6 Storm Water Management Facilities

As mentioned previously the Char Manufacturing Plant Expansion Project site is located within a dirty water area, there are no clean areas surrounding or within the Char Manufacturing Plant area (existing plant and expansion). Thus all storm water runoff on the site will be collected in the PCD. A storm water cut-off drain will also be constructed on the site in accordance with Regulation GN 704.

Stormwater runoff within the Char Manufacturing Plant (existing plant and expansion) is directed towards and runs into the existing PCD with a sediment trap. The proposed Expansion is depicted in Figure 6.8 with the water management scheme represented in Figure 6.9. The catchment of the Char Manufacturing Plant Site (existing plant and expansion) and its drainage is shown in Figure 6.10.

Figure 6.8: Proposed Layout of the Char Manufacturing Plant Expansion

Figure 6.9: Layout of the storm water management system (showing the stormwater cut-off drain) for the Char Manufacturing Plant Expansion

Figure 6.10: Catchment and Nodes around the proposed Char Manufacturing Plant Expansion Site

6.3.7 Operational and Environmental Water Balance

Two water balance scenarios were modelled, as follows:

- Current site (4 retorts) – the current Char Manufacturing Plant, prior to implementation of the expansion project (Figure 6.2).
- Expansion project site (12 retorts) – the expanded Char Manufacturing Plant (Figure 6.3).

A schematic water balance flow diagram is shown for each scenario in Figure 6.2 and Figure 6.3, indicating the expected flows under average conditions.

6.4 Solid Waste Management

Please note that a Waste Management License (WML) application has been submitted to the Department of Environmental Affairs (DEA) for certain waste generated as a result of this project (tar, liquor and sludge). A copy of the WML application has been included in Appendix 8.

6.4.1 General Waste – Domestic and Industrial

General 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 will be collected in rubbish bins and disposal will be handled by the mine through a Service Level Agreement between the Char Manufacturing Plant Expansion and the Grootegeluk Mine. All domestic, commercial, industrial waste, builders' rubble and other waste classified as General Waste under the South African Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998) will be removed from the site by an appropriately licensed waste removal contractor and disposed of at a licensed general waste facility.

Stormwater runoff will enter the PCD and this water will then be recycled in the char manufacturing process. The contaminated water will not be allowed to enter the environment. The silt which collects in the silt trap, settling pond and PCD will be periodically removed and disposed of as general waste.

6.4.2 Hazardous Waste – Domestic and Industrial

6.4.2.1 Solid Waste

The non-process waste classified as hazardous, including grease, oils, acids, fluorescent tubes, medical waste etc. will also be handled by the Grootegeluk Mine through their existing systems which will involve disposing of the waste at a licensed hazardous waste site.

The process solid hazardous waste will include waste sludge removed from the Char Manufacturing Plant Expansion equipment. This sludge will be transferred to a mixing station where it will be mixed with char product fines to form a dry consistency. The sludge/char fines mix will then be transferred to the nearby Eskom Matimba Power Station as part of the coal feed for power generation.

6.4.2.2 Liquid Waste

Tar and Liquor

Tar generated during the char production process will be collected in a tar tank near the bottom of each retort. The tar storage tanks are contained in a concrete bunded area to prevent spillage. The tar is sold as a by-product of the process. When customers come to collect the tar at the loading facility it will be transferred to the customers tar tanks for transport. As the tar generated at the plant will be sold to customers, it will not require disposal.

Water condensate (liquor) from the cooling systems and gas booster fans will be collected in tanks at the liquor destructors (Plate 2.19). The liquor is destroyed by oxidation (burning) at high temperature. As the liquor will be incinerated as the method of disposal, there is no need to dispose of it to land. Bunds will be provided to prevent spillage of liquor during temporary storage.

Table 6.6 displays the quantities of hazardous waste of tar, liquor and sludge that is and will be produced at the Char Manufacturing Plant (and its proposed Expansion).

Table 6.6: Additional Hazardous substances production for the Existing and Expanded Char Manufacturing Plant

Char Manufacturing Plant hazardous substances production (tonnes/month)	Current Plant (4 Retorts)	Additional 8 Retort Expansion	Expanded Plant Total (12 Retorts)
Tar	2779	5559	8338
Liquor	852	1704	2556
Sludge	1055	2111	3166

Sewerage

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.

Waste Water

The management of waste water has been discussed in detail in section 6.3 above.

6.4.2.3 Gaseous Waste

Waste gas is produced from the heating of the coal to produce char. The waste gas which still remains after the tar and liquor has been removed will be recycled in the plant and primarily burnt as a fuel gas to heat the retorts. Some of the gas will also be used to fuel a boiler which 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 gas which still remains will be flared and will exit the plant through the flare stack (refer to plate 2.20).

6.4.2.4 Expansion of non-process facilities

The wastes described above include both process and non-process wastes. As mentioned above, non-process wastes classified as hazardous, include grease, oils, acids, fluorescent tubes, medical waste, sewerage etc.

General non-process wastes include construction waste from the construction of the Char Manufacturing Plant Expansion, and domestic waste from site offices, the canteen and ablutions.

6.4.2.5 On-site accumulation of waste

Waste Management License applications have been made to the relevant Regulatory Authority (DEA due to the hazardous nature of the wastes) to ensure that temporary on-site storage of waste complies with legislative requirements.

A new sludge mixing and storage area will also be constructed in the area labelled C17 in Figure 6.9. The tar, sludge and liquor storage facilities will be provided with bund walls. Thus the waste storage areas will be protected from the ingress of rainwater from surrounding areas and surface water pollution by the waste is unlikely to occur. Table 6.7 indicates the sizes of the storage facilities.

Table 6.7: 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	Expanded Plant Total (12 Retorts)
Tar storage tanks (4 m high x 8 m diameter for existing tanks) (6 m high x 11 m in diameter for new tanks)	201 x 3 tanks	570 x 4 tanks	2883 (7 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

6.4.2.6 Off-site waste disposal

General and hazardous waste which requires disposal should only be disposed of at appropriately permitted sites. In order to demonstrate compliance with this obligation, Exxaro Coal (Pty) Ltd. (who will dispose of Exxaro Reductants waste) should retain proof of the following:

- The off-site disposal facility is appropriately authorised for such purpose,
- The waste is suitable for disposal at the particular waste disposal facility in accordance with the methodology outlined in Chapter Five of the DWAF's Minimum Requirements for the Handling, Classification and Disposal of Waste, Second Edition, 1998,
- Proof that the waste was indeed disposed of at such appropriately permitted destination,
- The required disposal method for the particular waste type has been followed by the operator of the applicable landfill site.

Recycling of some of the solid general waste will also take place. Wastes will be separated into colour coded bins and recyclable waste will be recycled through the existing Grootegeluk Mine waste disposal system. Scrap metal will also be sold to a scrap metal recycling company. Appropriate records of wastes sent to recycling companies should also be kept.

6.4.3 Other Wastes

All wastes have been described above. There will be no other wastes generated at the Char Manufacturing Plant Expansion site.

6.5 Rehabilitation and Mitigatory Measures

6.5.1 Mitigatory Measures - Environmental Management Programme

The Environmental Management Programme (EMP) outlined in this chapter presents commitments on actions to be taken to address the water and waste related impacts identified for the Char Manufacturing Plant Expansion Project. This section also identifies environmental monitoring that will be undertaken for the project. The plan of action is detailed for all the pertinent stages of the development, which are listed below:

- **Planning and design** phase refers to the stage when the feasibility studies are being undertaken, the project description is being developed and the plant is being designed. During this phase, the EIA is completed and environmental authorisations are applied for. This phase started in 2009 and is anticipated to be completed in late 2012.
- **Construction phase** will commence after the mining right and environmental authorisations

have been obtained. This phase will involve the physical construction of the plant and its associated infrastructure. The required services will be expanded to the construction site by constructing the necessary trenches and placing the pipelines etc. Construction of the Char Manufacturing Plant Expansion is due to begin in early 2013 and the first retort should be completed by September 2015.

- **Operations** of the expanded Char Manufacturing Plant should begin in September 2015 and ramp up to full capacity in March 2016. The plant operation is anticipated to last 25 years.
- **Decommissioning phase** refers to the time in the plant life when operations are reduced in preparation for closure. It is anticipated that plant activities will last 25 years, it is therefore estimated that decommissioning will commence in 2040.
- **Post-closure phase** refers to after the plant has been shut down and no plant activities are undertaken.

The structure of the EMP is presented in a way that for each impact that has been identified in the EIA report the following information will be included:

- The objectives of each of the actions to be implemented for management
- The time periods in which the actions are to be implemented; and
- The person responsible for the implementation of the actions

There is already an approved EMP for the existing Char Manufacturing Plant. An amendment to the existing EMP for the Char Manufacturing Plant Expansion Project has been compiled and the tables below from section 6.5.1.1 to 6.5.1.5 include the original and amended points. Please note that the table below is only for water and waste related impacts. The complete EMP for all impacts is included as part of the EIA for the project.

6.5.1.1 Planning and Design

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
1. SOILS AND GROUNDWATER RESOURCES					
Objective: Protection of utilisable soils and preventing contamination of groundwater.					
1.1.	Plan for impervious surfaces, bunding and dirty water management areas.	Plant Manager	Prior to construction	Suitable engineering designs to plan for the management of this impact.	Not included in original EMPr.
1.2.	Plan for facilities for the management of general and hazardous waste.	Plant Manager	Prior to construction	Suitable engineering designs to plan for the management of this impact.	Not included in original EMPr.
1.3.	Waste management procedure to be developed including the management of builders' rubble and recyclable wastes.	Plant Manager	Prior to construction	Waste management procedure	Not included in original EMPr.
1.4.	Agreements to be sought with the Grootegeluk Mine for the use of waste disposal sites and sewage treatment facilities.	Plant Manager	Prior to construction	Service agreement with Grootegeluk Mine.	Not included in original EMPr.
Objective: To prevent any impact on the proposed Char Manufacturing Plant Expansion in terms of geotechnical instability due to the high ground water table of the site and immediate surrounding area.					
1.5.	If necessary, appropriate measures will be implemented to ensure the geotechnical stability of the Char Manufacturing Plant (existing plant and expansion) due to the high groundwater table.	Plant Manager	As required	Consult a geotechnical engineer.	5.7 (c)
1.6.	Groundwater abstraction could be implemented in order to reduce the level of the groundwater table. The abstracted groundwater could be utilised for dust suppression during the construction phase or in the Char Manufacturing Plant (existing plant and expansion).	Plant Manager	As required	Consult a geohydrologist.	5.7 (d)
1.7.	If ground water abstraction is implemented, then the appropriate water use license in terms of the National Water Act, 1998 (Act 36 of 1998) must be obtained.	Environmental Manager	As required	N/A	5.7 (e)
2. SURFACE WATER QUALITY					
Objective: To ensure adequate planning regarding potential impacts on surface water prior to the construction phase.					
2.1.	The storm water management measures for the Char Manufacturing Plant (existing plant and expansion) must be designed by a suitably qualified	Plant Manager	Prior to construction	Specialist surface water engineer to compile a surface water (incl. storm water)	5.2 (d); 5.6 (f)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
	person and in accordance with the requirements of Regulation GN 704, dated June 1999, under the National Water Act, 1998 (Act 36 of 1998).			management report.	
2.2.	Storm water management for construction must be planned.	Plant Manager	Prior to construction	Ensure that there are suitable structures to contain all stormwater runoff.	Not included in original EMPr.
3. ENVIRONMENTAL AWARENESS AND TRAINING					
Objective: To ensure that all persons working at the Plant are aware of the objectives of the EMPR as well as the consequences of their individual actions					
3.1.	Environmental induction training material must be ready prior to construction period for use in environmental induction training.	Environmental Manager	Prior to construction	Review of environmental training requirements.	Not included in original EMPr.
3.2.	Where necessary, Exxaro Reductants must develop Environmental Procedures to give effect to the commitments of the EMPr.	Environmental Manager	Prior to construction	Review of EMPR commitments.	Not included in original EMPr.
3.3.	Exxaro Reductants procurement contracts to make provision for compliance with EMPR by all contractors.	Plant Manager	Prior to construction	Appropriate procurement contract	Not included in original EMPr.
4. ENVIRONMENTAL LEGAL COMPLIANCE					
Objective: To ensure the Char Manufacturing Plant Expansion is environmentally legally complaint					
4.1.	Exxaro Reductants to make provision for suitably qualified personnel to oversee and monitor EMPR compliance during construciton and operations (ECO).	Environmental Manager	Prior to start of construction.	Appointment of ECO.	Not included in original EMPr.
4.2.	Any operational changes or new projects at the Char Manufacturing Plant Expansion must be reviewed by a suitably qualified person to ensure the necessary environmental authorisation procedures	Environmental Manager	Prior to operational changes or new projects.	Review of environmental legislation.	Not included in original EMPr.
4.3.	Exxaro Reductants must ensure overall environmental legal compliance with all relevant legislation.	Environmental Manager	Prior to construction.	Review of environmental legislation.	Not included in original EMPr.

6.5.1.2 Construction

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
5. ENVIRONMENTAL AWARENESS AND TRAINING					
Objective: To ensure that all persons working at the Plant are aware of the objectives of the EMPR as well as the consequences of their individual actions					
5.1.	Environmental induction training must be provided to all persons undertaking work at the Char Manufacturing Plant Expansion (to be incorporated into normal induction training) including permanent workers,	Plant Manager	Prior to site establishment. For all new	Environmental induction and training material	5.15 (b)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
	contractors and consultants. As part of the induction all workers on site must be made aware of the conditions of the EMPr.		personnel.		
5.2.	All employees and contractors should be exposed to the environmental awareness programme.	Plant Manager	Prior to site establishment.	Environmental awareness plan (Appendix D)	Not included in original EMPr.
5.3.	Compliance with the EMPR must be included as a contractual condition in any contract with a contractor.	Plant Manager	In tender documentation	Condition in contract	Not included in original EMPr.
5.4.	All contractors must be provided with a copy of the EMPR and all Environmental emergency procedures.	Plant Manager	On appointment of each contractor	EMPr Environmental emergency procedures	Not included in original EMPr.
6. ENVIRONMENTAL MONITORING					
Objective: To recognise impacts on air, ground and surface water resources in the area.					
6.1.	All groundwater monitoring points for the plant shall be monitored. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43. Both groundwater level and groundwater quality are to be measured.	Environmental Manager	Quarterly	Groundwater monitoring schedule, protocol and equipment.	Not included in original EMPr.
6.2.	All surface water quality monitoring points for the plant shall be monitored. Sampling points include the Pollution Control Dam (PCD) – South (GES01), PCD – North (GES02) and the Bosbok Dam.	Environmental Manager	Quarterly	Surface water monitoring schedule, protocol and equipment.	Not included in original EMPr.
6.3.	All sampling is to be conducted by suitably qualified and competent persons using appropriate sampling techniques. All 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 plant and expansion), or which are specified in the relevant environmental authorisations.	Environmental Manager	Quarterly	Check qualifications and competency of persons conducting sampling. Analysis of samples by an accredited laboratory.	Not included in original EMPr.
6.4.	Records of air, ground and surface water monitoring must be kept for the site.	Environmental Manager	During construction	Record-keeping.	5.7 (i)
6.5.	Air, ground and surface water monitoring results must be made available to the Plant Manager on a monthly basis. Potential negative impacts should be identified and addressed as soon as possible.	Environmental Manager	During construction	Record-keeping.	5.7 (j)
7. EMPR COMPLIANCE					
Objective: To ensure implementation of the required management measures and to ensure compliance with the EMPr					
7.1.	A copy of the EMPR and all environmental authorisations must be kept at the main site office.	Plant Manager	During Construction	EMPr, licenses and authorisations,	Not included in original EMPr.
7.2.	Each contractor must keep a copy of the EMPR at their office and this copy must be available to their staff.	Contractor	Throughout length of contract.	EMPr	Not included in original EMPr.

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
7.3.	Contractors must comply with the EMPR where it applies to the nature of their activities and their contract with Exxaro Reductants.	Contractor	Throughout the duration of the contract.	Appropriate contract with contractors.	Not included in original EMPr.
7.4.	Contractors must implement any procedures and written EMPR instructions issued to them by Exxaro Reductants.	Contractor	Throughout the duration of the contract.	Appropriate instructions and contract with contractors.	Not included in original EMPr.
7.5.	Contractors must not deviate from the EMPR or written instructions without approval from Exxaro Reductants.	Contractor	Throughout the duration of the contract.	Appropriate contract with contractors.	Not included in original EMPr.
7.6.	A daily site diary must be kept by each contractor to record any environmental incidents for the day. Environmental incidents must be rectified and reported to the Environmental Manager.	Contractor	Throughout the duration of the contract.	Contractor's Environmental site diary	Not included in original EMPr.
7.7.	Exxaro Reductants must appoint, in writing, a capable and suitably qualified environmental compliance officer (ECO) to monitor all environmental aspects and EMPR compliance.	Environmental Manager	During construction	Appointment of ECO.	5.15 (a)
7.8.	The ECO will monitor and audit the construction activities to ensure compliance with this EMPR and the Environmental Authorisation.	Environmental Compliance Officer	Weekly during construction	EMPr Monitoring and auditing. Record-keeping.	5.15 (b)
7.9.	A register of all environmental incidents is to be maintained. The Environmental Manager is to be notified of all environmental incidents.	Environmental Manager	During construction	Environmental incident register.	Not included in original EMPr.
7.10.	All environmental incidents must be investigated to assess: the cause; the effectiveness of the response; the actions taken to rectify the damage and measures needed to prevent recurrence. A close-out report must be compiled.	Environmental Manager	For each incident	Environmental incident report.	Not included in original EMPr.
7.11.	Records relating to the compliance and non-compliance with the conditions of the EMPR and Record of Decision will be kept in good order. Such records will be available for inspection at the site office and must be made available to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) within seven (7) working days of the date of the written request by the Department for such records.	Environmental Manager	During construction	Environmental compliance records.	5.15 (c), 5.15 (e)and 5.15 (f)
8. ENVIRONMENTAL EMERGENCIES AND RISKS					
Objective: To minimise the risk for environmental emergencies occurring and implement controls to deal with situations, should they occur.					
8.1.	Risk assessments to be undertaken for all construction facilities and activities. Environmental emergency procedures to be developed in	Environmental Manager	Prior to site establishment.	Risk assessments Environmental emergency procedures	Not included in original EMPr.

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
	response to potential risks.		For any new activty or facility.	(Appendix D)	
9. GROUNDWATER RESOURCES					
Objective: To reduce the potential impact on the groundwater associated with the site.					
9.1.	The excavated coal layer/carbonaceous material (from the disused coal stockpile) must be removed from the Char Manufacturing Plant expansion site and either returned to the Grootegeluk beneficiation plants or disposed of on the Grootegeluk discard dumps where there is no risk of combustion. The coal/carbonaceous material may not be stockpiled on the surrounding area.	Plant Manager	Commencement of construction	Discussions with Grootegeluk Mine to locate a suitable position for the material.	5.7 (a)
9.2.	Remove the upper soil layer to a depth of 60 cm, where contamination has been identified (Refer to the report by Golder, 2011 – Appendix 2 of the EIA Volume 1). The contaminated soil must be disposed of on the Grootegeluk Mine discard dumps.	Environmental Manager	Commencement of construction	Discussions with Grootegeluk Mine to locate a suitable position for the material.	5.3 (c)
9.3.	~~An appropriate sewage system (e.g. Biogeza or Lily put system) will be implemented for the plant in order to reduce any potential impact on the ground water environment. This system will have sufficient capacity.~~ THIS MITIGATION MEASURE FROM THE ORIGINAL APPROVED EMPR IS NO LONGER REQUIRED AS THE SEWAGE WILL BE PUMPED TO THE GROOTEGELUK MINE FOR TREATMENT IN THEIR SEWAGE TREATMENT PLANT.	~~Plant Manager~~	~~During construction~~	N/A	~~5.7 (g)~~
9.4.	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.	Plant Manager/ Procurement Manager	During construction	Estimation of sewerage system capacity and personnel numbers on site.	5.7 (f)
9.5.	Water use is to comply with water use licensing requirements.	Plant Manager	During construction	A copy of the water use license and regular compliance monitoring.	Not included in original EMPr.
10. SURFACE WATER RESOURCES					
Objective: To reduce the potential impact on surface water run-off and reduce water consumption.					
10.1.	Appropriate storm water control measures must be provided for the site, and must comply with the GN704 Regulations on the Use of Water for Mining and Related activities.	Plant Manager	During construction	Designs done according to specifications by a suitably qualified surface water engineer.	5.2 (b); 5.6 (d)
10.2.	A storm water cut-off drain according to the GN704 Regulations must be constructed and maintained around the site.	Plant Manager	During construction	Designs done according to specifications by a suitably qualified surface water engineer.	5.2. (c); 5.6 (e)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
10.3.	Designed storm water management measures will be implemented to contain all contaminated runoff generated within the dirty water management area.	Plant Manager	During construction	Designs done according to specifications by a suitably qualified surface water engineer.	5.6 (g)
10.4.	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.	Plant Manager	During construction	Obtain suitable material for the construction of these facilities.	5.2 (e), 5.6 (h)
10.5.	Sediment originating from construction activities is to be removed from storm water by installing sediment traps.	Plant Manager	During construction	Sediment traps to be included in designs done according to specifications by a suitably qualified surface water engineer.	Not included in original EMPr.
10.6.	Uncontrolled discharge of any contaminants such as fuels, oils, detergents, cement and organic materials into any watercourse or storm water drain is prohibited.	Plant Manager	During construction	Include in environmental induction and training material	Not included in original EMPr.
10.7.	Grey water from the office, kitchen and bathrooms shall be discharged into the sewage system for treatment.	Plant Manager	During construction	The water reticulation infrastructure must be appropriately designed.	Not included in original EMPr.
10.8.	Water used for dust suppression shall be in quantities small enough not to generate significant run-off.	Plant Manager	During construction	Monitoring of dust suppression activities.	Not included in original EMPr.
11. SOIL AND LAND CAPABILITIES					
Objective: To ensure that construction activities have the least impact on the apedal sandy soils in terms of soil quality, structure and erosion potential					
11.1.	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 stockpiled for use in rehabilitation.	Environmental Manager	Commencement of construction	Designated topsoil storage area.	Not included in original EMPr.
11.2.	Contaminated topsoil may not be utilised as fill material or disposed of.	Environmental Manager	During and post construction.	Environmental induction and training	Not included in original EMPr.
11.3.	All infrastructure including foundations and concrete surfaces that will not be used during Char Manufacturing Plant Expansion operations must be removed from site.	Contractor and Plant Manager	After construction is complete.	Demolition equipment.	Not included in original EMPr.
12. AIR QUALITY					
Objective: To ensure that construction activities have the least possible impact on air quality of the site and immediate surroundings.					
12.1.	Minimise the generation of dust as a result of construction activities. Such measures must include regular and effective wetting or chemical dust suppression of gravel access roads and working areas, sweeping of silt from roads and covering of stockpiles.	Plant Manager/ Contractor	During construction phase	Water supply for dust suppression purposes. Dust supression work procedures and equipment.	5.8 (a) and 5.8 (c)
12.2.	Intensify dust suppression or suspend dust generating activities during windy conditions.	Plant Manager/ Contractor	During construction phase	Dust supression work procedures and equipment.	5.8 (b)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
12.3.	Dust suppression should be done with water hoses in inaccessible areas where vehicular traffic is impossible.	Plant Manager/ Contractor	During construction phase	Dust supression work procedures and equipment.	5.8 (d)
12.4.	Abstracted groundwater could be used for dust suppression purposes since groundwater quality only marginally exceeds SANS 241: 2011 drinking standards. PCD water must not be used for dust suppression.	Plant Manager/ Contractor	During construction phase	Dust supression work procedures and equipment.	5.8 (e)
13. PUBLIC RELATIONS					
Objective: To ensure good relations with all Interested and Affected Parties (IAPs) by creating open channels of communication to address matters of concern that may arise.					
13.1.	Communication between the contractors, Grootegeluk Coal Mine and the various interested and affected parties will be established and maintained through regular notifications and providing IAPs with a means of providing feedback on an ongoing basis. 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.	Public Relations Officer	During construction phase	Communication policy and protocols.	5.15 (a)
13.2.	Maintain a complaints register at the site entrance. 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).	Environmental Manager	During construction phase	Complaints register	5.15 (b) and (c)
13.3.	Any complaints regarding the said development will be brought to the attention of the Environmental Manager within 24 hours after receiving the complaint.	Environmental Manager	During construction	Complaints register	5.15 (d)
13.4.	The complaints must be investigated and remedied where possible. A response should be proovided to the complainant.	Environmental Manager	During construction within 72 hours	Environmental Manager will determine what is required.	Not included in original EMPr.
13.5.	The complaints register will be kept up to date for inspection by members of the LEDET.	Environmental Manager	During construction	Complaints register	5.15 (e)
14. SPILL PREVENTION					
Objective: To minimise environmental impact from spills.					
14.1.	Within the construction area, self-contained bunded areas must be provided at: • Chemcial storage facilties • Hazardous waste storage facilities (e.g. liquor); • Flammable and combustible liquid stoage facilites (e.g. hydrocarbons); • Electrical transformers containing oil and/or PCBs and	Plant Manager	On commencement of construction	Construction of appropriate bunded areas.	5.7 (a)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
	• Locations where spills are common, including trasfer points, workshops, and where hazardous substances are transferred and used regularly.				
14.2.	The self-contained bunded areas must be lined with an impermeable material to limit seepage into the ground water environment. Any spillage must either be recycled or transferred to be treated to environmentally acceptable standards.	Plant Manager	On commencement of construction	Work procedure for the recovery, transfer and recycling of spillage.	5.7 (b)
14.3.	For flammable substances, bunded areas should have 110% of the capacity of the total storage volume for the substance. Bunds should be provided with valves for the controled release of rainwater.	Plant Manager	On commencement of construction	Construction of appropriate bunded areas.	Not included in original EMPr.
14.4.	Non flammable hazardous substances must be stored within bunded areas with the capacity to contain 100% of the largest container stored.	Plant Manager	On commencement of construction	Construction of appropriate bunded areas.	Not included in original EMPr.
14.5.	Ensure adequate signage at hazardous storage areas and Material Safety Data (MSD) sheets for all chemicals must be displayed in close proximity to the area of storage.	Plant Manager	During construction phase	Suitable signs and MSD sheets for all relevant chemicals	Not included in original EMPr.
14.6.	Chemical spills are to be regarded as an environmental incident and reported through the incident reporting system.	Environmental Manager	During construction phase	Incident reporting system and procedure	Not included in original EMPr.
14.7.	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.	Plant Manager	During construction phase	Hazardous chemical handling procedure. Environmental induction and trianing	Not included in original EMPr.
14.8.	Fuel and other petrochemicals must be stored in receptacles that comply with SANS100-1:2003 (SABS089-1:2003).	Plant Manager	During construction phase	Construction / use of suitable receptacles.	Not included in original EMPr.
14.9.	All fuel tanks used in construction must be aboveground and bunded in accordance with the requirements for flammable liquids.	Plant Manager	On commencement of construction	Construction of appropriate bunded areas.	Not included in original EMPr.
14.10.	Appropriate containers must be used for storage and transport of hazardous substances.	Plant Manager	During construction phase	Use of suitable receptacles.	Not included in original EMPr.
14.11.	Personnel dealing with hazardous substances must be appropriately trained.	Environmental Manager	During construction phase	Environmental induction and training.	Not included in original EMPr.
14.12.	Manage dedicated areas used for washing, maintenance and repair of vehicles and equipment.	Plant Manager	During construction phase	N/A	Not included in original EMPr.
14.13.	Regular inspection to be carried out on areas where hazardous substances are stored or handled.	Environmental Manager	During construction phase	Monitoring schedule and protocol.	Not included in original EMPr.
14.14.	Obtain proof from contractors removing hazardous waste (such as oil and diesel) of final destination and disposal.	Environmental Manager	During construction phase	Safe disposal cerficates.	Not included in original EMPr.
14.15.	All vehicles must be checked for leaks before commencing work on site.	Plant Manager	During construction	Inspection.	Not included in original

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
			phase		EMPr.
14.16.	Drip trays must be placed beneath parked vehicles which drip oil.	Plant Manager	During construction phase	Inspection schedule and procedure Environmental induction and training	Not included in original EMPr.
14.17.	All equipment that leaks fluid must be repaired immediately or removed from site when necessary.	Plant Manager	During construction phase	Inspection. Environmental induction and training	Not included in original EMPr.
14.18.	Vehicle and equipment maintenance and repair only to be undertaken in designated areas.	Plant Manager	During construction phase	Construction of vehicle maintenance area.	Not included in original EMPr.
14.19.	Maintenance and workshop areas must be provided with impervious surfaces.	Plant Manager	On commencement of construction	Construction of vehicle maintenance area.	5.7 (d)
14.20.	Hydrocarbon handling areas must be supplied with storm water diversion measures.	Plant Manager	On commencement of construction	Designs done according to specifications by a suitably qualified surface water engineer.	Not included in original EMPr.
14.21.	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.	Plant Manager	During construction phase	Spill procedure. Drizit or oclansorb	5.7 (e)
14.22.	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.	Plant Manager	During construction phase	Procedure for treatment or disposal of contaminated soils.	Not included in original EMPr.
14.23.	Ensure appropriate inspections are conducted to ensure early detection of spills. The integrity of bunds are to be monitored regularly to ensure that no seepage escapes.	Plant Manager	During construction phase	Monitoring schedule and protocol	Not included in original EMPr.
15. WASTE MANAGEMENT					
Objective: To effectively manage wastes generated at the Plant.					
15.1.	Provide designated waste collection points and ensure that these have adequate capacity and are frequently cleaned.	Plant Manager	During construction phase	Waste receptacles.	Not included in original EMPr.
15.2.	Control of litter on an on-going basis.	Environmental Manager	During construction phase	Waste receptacles.	Not included in original EMPr.
15.3.	Ensure regular inspections of waste handling, storage and disposal areas.	Environmental Manager	During construction phase	Monitoring schedule and protocol	Not included in original EMPr.
15.4.	Records should be kept of quantities delivered, used and/or recycled.	Environmental Manager	During construction phase	Record keeping.	Not included in original EMPr.
15.5.	Separate waste receptacles must be provided for hazardous and general waste. No illegal dumping or disposal will take place.	Environmental Manager	During construction phase	Waste receptacles. Appropriate signage	5.7 (c)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMEN-TATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
15.6.	Separate receptacles should be provided for recyclable materials.	Environmental Manager	During construction phase	Waste receptacles. Waste recycling procedure	Not included in original EMPr.
15.7.	Provide waste management training to all personnel.	Environmental Manager	During construction phase	Waste management procedure Environmental induction and training	Not included in original EMPr.
15.8.	General waste must be removed from site on a regular basis and disposed of at a licensed landfill site.	Plant Manager	During construction phase	Waste disposal procedure Service agreement with Grootegeluk Mine.	Not included in original EMPr.
15.9.	All hazardous waste must be handled and stored on impervious surfaces.	Plant Manager	During construction phase	Hazardous chemical handling procedure.	Not included in original EMPr.
15.10.	Liquid and solid hazardous waste must be separated.	Plant Manager	During construction phase	Hazardous chemical handling procedure.	Not included in original EMPr.
15.11.	Solid hazardous waste which requires off-site disposal must be disposed of at a licensed hazardous waste site.	Plant Manager	During construction phase	Waste disposal procedure. Service agreement with Grootegeluk Mine.	Not included in original EMPr.
15.12.	Hazardous waste must not be kept on site for longer than 3 months.	Plant Manager	During construction phase	Waste disposal procedure. Service agreement with Grootegeluk Mine.	Not included in original EMPr.
15.13.	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.	Plant Manager / Procurement Manager	On commencement of construction	Chemical toilets if required.	Not included in original EMPr.
15.14.	Sewage must be disposed to a licensed sewage treatment works.	Plant Manager	During construction phase	Waste disposal procedure. Service agreement with Grootegeluk Mine.	Not included in original EMPr.
16. OCCUPATIONAL HEALTH AND SAFETY					
Objective: To ensure safety of construction workers at the Char Manufacturing Plant Expansion.					
16.1.	The 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, 1996 (Act 29 of 1996).	Plant Manager/ contractor	During construction phase	Induction and environmental training.	Not included in original EMPr.
16.2.	All personnel must wear job-specific PPE at all times.	Plant Manager/ Contractor	During construction phase	Induction and environmental training. PPE. Signage at each work area.	Not included in original EMPr.
16.3.	Fire fighting equipment must be available and maintained on site at all times, particularly in areas where any flammable substance is stored.	Plant Manager/ Contractor	During construction phase	Appropriate fire fighting equipment.	Not included in original EMPr.

6.5.1.3 Operational Phase

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
17. ENVIRONMENTAL AWARENESS AND TRAINING					
Objective: To ensure that all personnel are aware of the objectives of the EMPR as well as the consequences of their individual actions					
17.1.	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 EMPr.	Environmental Manager	On appointment	Environmental induction training material	5.15 (b)
17.2.	On the job environmental training to be undertaken by each person working at the Plant.	Environmental Manager/ Supervisors	Throughout life of plant	General Environmental Training/Training of supervisors	Not included in original EMPr.
17.3.	An environmental awareness programme to be implemented for plant work force addressing pertinent topics as required.	Environmental Manager	Throughout life of plant	Programme for implementation of awareness topics. Environmental Awareness Plan (Appendix D).	Not included in original EMPr.
17.4.	Environmental emergency procedures should be addressed as part of environmental training.	Environmental Manager	Throughout life of plant.	Environmental emergency procedures Environmental induction and training material	Not included in original EMPr.
17.5.	A copy of the EMPR and all environmental authorisations must be kept at the main site office.	Environmental Manager	Throughout life of plant.	EMPr, licenses and authorisations	Not included in original EMPr.
17.6.	Compliance with the EMPR must be included as a contractual condition in contract with any contrator	Plant Manager	In tender documentation	Condition in contract	Not included in original EMPr.
17.7.	All contractors must be provided with a copy of the EMPR and all Environmental emergency procedures A	Plant Manager	On appointment of each contractor	EMPr Environmental emergency procedures	Not included in original EMPr.
17.8.	Each contractor must keep a copy of the EMPR at their office and this copy must be made available to staff.	Contractor	Throughout length of contract.	EMPr	Not included in original EMPr.
17.9.	Create awareness about water consumption and encourage staff to use water sparingly.	Environmental Manager	Throughout life of plant.	Include in environmental awareness and induction and training material (refer to Appendix D)	Not included in original EMPr.
17.10.	Environmental emergency procedures should be addressed as part of environmental induction training.	Environmental Manager	Throughout life of plant.	Environmental emergency procedures Environmental induction and training material	Not included in original EMPr.
17.11.	Operators of specialist equipment must be suitably trained/qualified. Operator training must include awareness of job-specific environmental risks.	Human Resources Manager	Throughout life of plant.	Training/qualification requirements for operators of specialist equipment. Checking training certificates before any job commences.	5.15 (e)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
17.12.	All personnel must wear the correct PPE at all times.	Plant Manager	Throughout life of plant.	Required PPE. PPE Inspections	Not included in original EMPr.
18. ENVIRONMENTAL MONITORING					
Objective: To recognise impacts on air, ground and surface water resources in the area.					
18.1.	All groundwater monitoring points for the plant shall be monitored. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43. Both groundwater level and groundwater quality are to be measured.	Environmental Manager	Quarterly during operational phase	Groundwater monitoring schedule, protocol and equipment.	Not included in original EMPr.
18.2.	All surface water quality monitoring points for the plant shall be monitored. Sampling points include the Pollution Control Dam (PCD) – South (GES01), PCD – North (GES02) and the Bosbok Dam	Environmental Manager	Quarterly during operational phase	Surface water monitoring schedule, protocol and equipment.	Not included in original EMPr.
18.3.	All sampling is to be conducted by suitably qualified and competent persons using appropriate sampling techniques. All 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 plant and expansion), or which are specified in the relevant environmental authorisations.	Environmental Manager	Quarterly	Check qualifications and competency of persons conducting sampling. Analysis of samples by an accredited laboratory.	Not included in original EMPr.
18.4.	Records of air, ground and surface water monitoring must be kept for the site.	Environmental Manager	Throughout life of plant.	Record-keeping.	5.7 (i)
18.5.	Air, ground and surface water monitoring results must be made available to the Plant Manager. Potential negative impacts should be identified and addressed as soon as possible.	Environmental Manager	Monthly during operational phase.	Record-keeping. Management procedure to address potential negative impacts.	5.8 (h)
19. EMPR COMPLIANCE					
Objective: To ensure effective implementation of the EMPr					
19.1.	Monthly internal audits of EMPR compliance	Environmental Manager	Monthly throughout life of plant	EMPR checklist	Not included in original EMPr.
19.2.	Annual external audit of EMPR compliance	Independent Auditor	Annually	EMPr	Not included in original EMPr.
19.3.	Submission of external annual report to environmental authorities	Environmental Manager	Annually	N/A	Not included in original EMPr.
19.4.	Awareness training	Environmental Manager	Annually	N/A	Not included in original EMPr.
19.5.	Performance assessments will be undertaken as required in Regulation 527 of the MPRDA.	Independent consultant	Every two years	EMPr	Not included in original EMPr.

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
19.6.	The proponent will appoint a suitably qualified person to conduct EMPR Performance Assessments.	Environmental Manager	Every two years	N/A	Not included in original EMPr.
19.7.	Annual update of financial provision for rehabilitation to ensure sufficient funding.	Environmental Manager	Annually	N/A	Not included in original EMPr.
19.8.	A register of all environmental incidents is to be maintained. The Environmental Manager is to be notified of all environmental incidents.	Environmental Manager	Throughout life of plant.	Environmental incident register.	Not included in original EMPr.
19.9.	All environmental incidents must be investigated to assess: the cause; the effectiveness of the response; the actions taken to rectify the damage and measures needed to prevent recurrence. A close-out report must be compiled.	Environmental Manager	For each incident	Environmental incident report.	Not included in original EMPr.
19.10.	Records relating to the compliance and non-compliance with the conditions of the EMPR and Record of Decision will be kept in good order. Such records will be available for inspection at the site office and must be made available to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) within seven (7) working days of the date of the written request by the Department for such records.	Environmental Manager	Throughout life of plant.	Environmental compliance records.	5.15 (c), 5.15 (e)and 5.15 (f)
20. ENVIRONMENTAL RISKS AND EMERGENCIES					
Objective: To minimise the risk for environmental emergencies occurring and implement controls to deal with situations, should they occur.					
20.1.	Risks and emergencies must be managed in accordance with relevant Exxaro Reductants Emergency Procedures.	Environmental Manager	Throughout life of plant.	Environmental emergency procedures (Appendix D)	Not included in original EMPr.
20.2.	Telephone numbers of emergency services, including fire-fighting services, shall be clearly displayed on notice boards.	Environmental Manager	Throughout life of plant.	The required information should be displayed.	Not included in original EMPr.
21. GROUNDWATER RESOURCES					
Objective: To minimise contamination risk to groundwater					
21.1.	Spill prevention measures to be implemented during operational phase as described in construction phase.	Plant Manager/ Contractor	Throughout life of plant.	As described in construction phase.	As described in construction phase.
21.2.	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 oclanzorb. Appropriate soil remediation measures will be implemented where soil has been contaminated with oil.	Environmental Manager	Throughout life of plant	Suitable cleaning materials. Soil remediation procedure.	5.7 (e)
21.3.	Water abstraction is to comply with water use licensing requirements.	Plant Manager	Throughout life of plant	Water abstraction records. Water Use License.	Not included in original EMPr.
22. SURFACE WATER RESOURCES					
Objective: To reduce the potential impact on surface water run-off during the construction phase.					

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
22.1.	Surface water pollution prevention and spill prevention measures to be implemented as described in construction phase.	Plant Manager/ Environmental Manager/ Contractor	During operation phase.	As described in construction phase.	Not included in original EMPr.
22.2.	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.	Plant Manager	Throughout life of plant.	Inspection schedule and procedure. Work procedure for the maintenance of storm water control measures.	5.2 C(f); 5.2 O(c); 5.6 O(b) (c);
22.3.	Accumulated contaminated water will be stored and treated in a liquor destructor.	Plant Manager	During operational phase	Correct operation of the liquor destructor to ensure compliance with the emission levels.	5.6 (d)
22.4.	~~Process water (0.5 m^3/h) will be bled into the mine process water system. A water meter would have to be provided in order to record the amount of process water bled from the plant.~~ THIS MITIGATION MEASURE FROM THE ORIGINAL APPROVED EMPR IS NO LONGER REQUIRED AS THE CHAR MANUFACTURING PLANT EXPANSION PROJECT WILL USE ADDITIONAL WATER FROM THE GROOTEGELUK MINE PROCESS WATER SYSTEM. WATER WILL NOT BE BLED FROM THE CHAR MANUFACTURING PLANT (existing plant and expansion) TO THE GROOTEGELUK MINE'S WATER SYSTEM.	~~Environmental Manager~~	~~During operational phase~~	~~Installation of water meters where required~~	~~5.6 (e)~~
22.5.	Monitor the quality of the process water obtained from the Grootegeluk Mine to prevent any impact on the Char Manufacturing Plant Expansion water system.	Plant Manager	Monthly during operational phase	Monitoring schedule and protocol	5.6 (f)
22.6.	~~Washwater will also be returned into the mine water system. A water meter would have to be provided in order to record the amount of washwater returned into the mine water system.~~ THIS MITIGATION MEASURE FROM THE ORIGINAL APPROVED EMPR IS NO LONGER REQUIRED AS THE CHAR MANUFACTURING PLANT EXPANSION PROJECT WILL USE ADDITIONAL WATER FROM THE GROOTEGELUK MINE PROCESS WATER SYSTEM. WATER WILL NOT BE BLED FROM THE CHAR MANUFACTURING PLANT (existing plant and expansion) TO THE GROOTEGELUK MINE'S WATER SYSTEM.	~~Environmental Manager~~	~~During operational phase~~	~~Installation of water meters where required~~ ~~Reporting procedure~~	~~5.6 (g)~~
22.7.	~~Monitor the quality of the washwater in order to prevent any impact on the mine water system.~~	~~Environmental Manager~~	~~During operational phase~~	~~Monitoring schedule and protocol~~	~~5.6 (h)~~

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
	THIS MITIGATION MEASURE FROM THE ORIGINAL APPROVED EMPR IS NO LONGER REQUIRED AS THE CHAR MANUFACTURING PLANT EXPANSION PROJECT WILL USE ADDITIONAL WATER FROM THE GROOTEGELUK MINE PROCESS WATER SYSTEM. WATER WILL NOT BE BLED FROM THE CHAR MANUFACTURING PLANT (existing plant and expansion) TO THE GROOTEGELUK MINE'S WATER SYSTEM.				
22.8.	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.	Environmental Manager	During operational phase	Monitoring schedule and protocol Water balance to be calculated by a suitably qualified geohydroligist	5.6 (i)
22.9.	Dirty water run-off must be contained and not allowed to enter into the surrounding environment.	Plant Manager	During operational phase.	Implementation of surface water control measures	Not included in original EMPr.
22.10.	Sediment originating from operation activities is to be removed from storm water.	Plant Manager	During operational phase.	Stormwater infrastructure must be maintained.	Not included in original EMPr.
22.11.	Ensure adequate maintenance of water tanks, pipes and taps and repair all drips and leaks as soon as possible.	Plant Manager	Throughout life of plant.	Regular maintenance should include water infrastructure when required.	Not included in original EMPr.
22.12.	Maximise the recovery and re-use of water to minimise consumptive water use.	Plant Manager	Throughout life of plant.	Operate the plant in accordance with the design specifications which incorporate water recycling.	Not included in original EMPr.
22.13.	Water used for dust suppression shall be in quantities small enough not to generate significant run-off.	Plant Manager	Throughout life of plant.	Monitoring of dust suppression activities.	Not included in original EMPr.
23. SOILS AND LAND CAPABILITIES					
Objective: To minimise potential soil erosion and soil pollution during the operational phase.					
23.1.	Spill prevention measures to be implemented as in construction phase.	Environmental Manager/ Contractors	During operational phase.	As described in construction phase.	5.3 & 5.4
23.2.	In addition, the integrity of concrete surfaces is to be checked and maintained on a continuous basis to ensure that contaminants do not enter into underlying soils.	Plant Manager	During operational phase.	Stormwater infrastructure must be inspected and maintained if required.	Not included in original EMPr.
24. AIR QUALITY					
Objective: To ensure that operational have the least possible impact on air quality of the site and immediate surroundings.					
24.1.	Use water sprays to limit coal dust generation when discharging coal into the coal bunker.	Plant Manager	During operational phase.	Allocate water for this task.	5.8 (c)
Objective: To minimise dust creation at the Plant during Operations and from plant vehicles.					
24.2.	Minimise the generation of dust as a result of operation activities. Such	Plant Manager/	Throughout life of	Water supply for dust suppression	5.8 (a) and 5.8 (c)

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
	measures must include regular and effective wetting or chemical dust suppression of gravel access roads and working areas, sweeping of silt from roads and covering of stockpiles.	Contractor	plant	purposes. Dust supression work procedures and equipment.	
24.3.	Intensify dust suppression or suspend dust generating activities during windy conditions.	Plant Manager/ Contractor	Throughout life of plant	Dust supression work procedures and equipment.	5.8 (b)
24.4.	Dust suppression should be done with water hoses in inaccessible areas where vehicular traffic is impossible.	Plant Manager/ Contractor	Throughout life of plant	Dust supression work procedures and equipment.	5.8 (d)
24.5.	Abstracted groundwater could be used for dust suppression purposes since groundwater quality only marginally exceeds SANS 241: 2011 drinking standards. PCD water must not be used for dust suppression.	Plant Manager/ Contractor	Throughout life of plant.	Dust supression work procedures and equipment.	5.8 (e)
25. PUBLIC RELATIONS					
Objective: To ensure good relations with all interested and affected parties by creating open channels of communication to address matters of concern that may arise.					
25.1.	Measures to be implemented as described in Construction Phase	Public Relations Officer/ Environ-mental Manager	Throughout life of plant	Complaints register, Employment Policy, Procurement policy.	5.15 (c), (d), (e)
26. SPILL PREVENTION					
Objective: To minimise environmental impact from spills.					
26.1.	Ensure adequate signage at hazardous storage areas and Material Safety Data (MSD) sheets for all chemicals must be displayed in close proximity to the area of storage.	Plant Manager	Throughout life of plant.	Suitable signs and MSD sheets for all relevant chemicals	Not included in original EMPr.
26.2.	Chemical spills are to be regarded as an environmental incident and reported through the incident reporting system.	Environmental Manager	Throughout life of plant.	Incident reporting system and procedure	Not included in original EMPr.
26.3.	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.	Plant Manager	Throughout life of plant.	Hazardous chemical handling procedure. Environmental induction and trianing	Not included in original EMPr.
26.4.	Fuel and other petrochemicals must be stored in receptacles that comply with SANS100-1:2003 (SABS089-1:2003).	Plant Manager	Throughout life of plant.	Construction / use of suitable receptacles.	Not included in original EMPr.
26.5.	Appropriate containers must be used for storage and transport of hazardous substances.	Plant Manager	Throughout life of plant.	Use of suitable receptacles.	Not included in original EMPr.
26.6.	Personnel dealing with hazardous substances must be appropriately trained.	Environmental Manager	Throughout life of plant.	Environmental induction and training.	Not included in original EMPr.
26.7.	Manage dedicated areas used for washing, maintenance and repair of vehicles and equipment.	Plant Manager	Throughout life of plant.	N/A	Not included in original EMPr.

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
26.8.	Regular inspection to be carried out on areas where hazardous substances are stored or handled.	Environmental Manager	Throughout life of plant.	Monitoring schedule and protocol.	Not included in original EMPr.
26.9.	Obtain proof from contractors removing hazardous waste (such as oil and diesel) of final destination and disposal.	Environmental Manager	Throughout life of plant.	Safe disposal cerficates.	Not included in original EMPr.
26.10.	All vehicles must be checked for leaks before commencing work on site.	Plant Manager	Throughout life of plant.	Inspection.	Not included in original EMPr.
26.11.	Drip trays must be placed beneath parked vehicles which drip oil.	Plant Manager	Throughout life of plant.	Inspection schedule and procedure Environmental induction and training	Not included in original EMPr.
26.12.	All equipment that leaks fluid must be repaired immediately or removed from site when necessary.	Plant Manager	Throughout life of plant.	Inspection. Environmental induction and training	Not included in original EMPr.
26.13.	Vehicle and equipment maintenance and repair only to be undertaken in designated areas.	Plant Manager	Throughout life of plant.	Construction of vehicle maintenance area.	Not included in original EMPr.
26.14.	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.	Plant Manager	Throughout life of plant.	Spill procedure. Drizit or oclansorb	5.7 (e)
26.15.	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.	Plant Manager	Throughout life of plant.	Procedure for treatment or disposal of contaminated soils.	Not included in original EMPr.
26.16.	Ensure appropriate inspections are conducted to ensure early detection of spills. The integrity of bunds are to be monitored regularly to ensure that no seepage escapes.	Plant Manager	Throughout life of plant.	Monitoring schedule and protocol	Not included in original EMPr.
27. WASTE MANAGEMENT					
Objective: To effectively manage wastes generated at the Plant.					
27.1.	Provide designated waste collection points and ensure that these have adequate capacity and are frequently cleaned.	Plant Manager	Throughout life of plant.	Waste receptacles.	Not included in original EMPr.
27.2.	Separate waste receptacles must be provided for hazardous and general waste. No illegal dumping or disposal will take place.	Environmental Manager	Throughout life of plant.	Waste receptacles. Appropriate signage	5.7 (c)
27.3.	Separate receptacles should be provided for recyclable materials.	Environmental Manager	Throughout life of plant.	Waste receptacles. Waste recycling procedure	Not included in original EMPr.
27.4.	Records should be kept of quantities of waste generated, disposed and/or recycled.	Environmental Manager	Throughout life of plant.	Record keeping.	Not included in original EMPr.
27.5.	Ensure regular inspections of waste handling, storage and disposal areas.	Environmental Manager	Throughout life of plant.	Monitoring schedule and protocol	Not included in original EMPr.

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
27.6.	Provide waste management training to all personnel.	Environmental Manager	Throughout life of plant.	Waste management procedure Environmental induction and training	Not included in original EMPr.
27.7.	General waste must be removed from site on a regular basis and disposed of at a licensed landfill site.	Plant Manager	Throughout life of plant.	Waste disposal procedure Service agreement with Grootegeluk Mine.	Not included in original EMPr.
27.8.	All hazardous waste must be handled and stored on impervious surfaces.	Plant Manager	Throughout life of plant.	Hazardous chemical handling procedure.	Not included in original EMPr.
27.9.	Solid hazardous waste requiring off-site disposal must be disposed of at a licensed hazardous waste site.	Plant Manager	Throughout life of plant.	Waste disposal procedure. Service agreement with Grootegeluk Mine.	Not included in original EMPr.
27.10.	Liquid and solid hazardous waste must be separated. Certain liquid hazardous waste (e.g. liquor) will be incinerated at the Char Manufacturing Plant Expansion.	Plant Manager	Throughout life of plant.	Hazardous chemical handling procedure.	Not included in original EMPr.
27.11.	Hazardous waste must not be kept on site for longer than 3 months.	Plant Manager	Throughout life of plant.	Waste disposal procedure. Service agreement with Grootegeluk Mine.	Not included in original EMPr.
27.12.	Sewage must be disposed to a licensed sewage treatment works.	Plant Manager	Throughout life of plant.	Waste disposal procedure. Service agreement with Grootegeluk Mine.	Not included in original EMPr.
27.13.	Control of litter on an on-going basis.	Environmental Manager	Throughout life of plant.	Waste receptacles.	Not included in original EMPr.
28. OCCUPATIONAL HEALTH AND SAFETY					
Objective: To ensure safety of workers at the Char Manufacturing Plant Expansion.					
28.1.	The 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, 1996 (Act 29 of 1996).	Plant Manager/ contractor	Throughout life of plant	Induction and environmental training.	Not included in original EMPr.
28.2.	All personnel must wear job-specific PPE at all times.	Plant Manager/ Contractor	Throughout life of plant	Induction and environmental training. PPE. Signage at each work area.	Not included in original EMPr.
28.3.	Fire fighting equipment must be available and maintained on site at all times, particularly in areas where any flammable substance is stored.	Plant Manager/ Contractor	Throughout life of plant	Appropriate fire fighting equipment.	Not included in original EMPr.

6.5.1.4 Decommissioning

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
29. AIR QUALITY					

Objective: To minimise the generation of dust during decommissioning.					
29.1.	Dust mitigation measures to be implemented as described in Construction Phase.	Plant Manager/ Environmental Manager	During decommissioning phase	As described in construction phase.	Not included in original EMPr.
30. SOCIO-ECONOMIC					
Objective: To minimise the impacts of job loss.					
30.1.	Measures identified in the SLP for promoting portable skills for workers must be implemented.	Plant Manager / Human Resources Manager	During the Decommissioning phase	SLP	Not included in original EMPr.
31. SOILS					
Objective: To minimise the impacts on soils after site closure and facilitate successful rehabilitation					
31.1.	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.	Environmental Manager/ Contractors	During decommissioning phase	Contaminated land assessment. Spill clean-up protocol. Hazardous chemical handling protocol.	Not included in original EMPr.
31.2.	Spill prevention measures to be implemented as described in construction and operational phase.	Environmental Manager/ Contractors	During decommissioning phase	Chemical spill clean-up protocol Hazardous chemical handling protocol	Not included in original EMPr.

6.5.1.5 Post Closure

REF.	ACTION	RESPONSIBILITY	TIME PERIOD FOR IMPLEMENTATION	REQUIREMENTS FOR IMPLEMENTATION	REF. IN APPROVED EMPr FOR EXISTING CHAR MANU-FACTURING PLANT
32. SOCIO-ECONOMIC					
Objective: To minimise the impacts of job loss.					
32.1.	Measures identified in the SLP for promoting portable skills for workers must be implemented.	Plant Manager	During post closure phase	SLP	Not included in original EMPr.
33. WATER					
Objective: To minimise groundwater and surface water contamination					
33.1.	The groundwater and surface water monitoring programme should be continued for the period stipulated by the relevant authorities.	Environmental Manager	After closure for a minimum of three years	Monitoring protocol	Not included in original EMPr.

6.5.2 Rehabilitation and Closure Objectives

The closure objectives for the existing Char Manufacturing Plant and the Expansion will be the same as those for the Grootegeluk Coal Mine. The following closure objectives have been extracted from the approved EMP for the Grootegeluk Mine:

- After closure, the safety and health of humans and animals will be safe from hazards resulting from mining (and plant) operations.
- Residual impacts will be identified and adequate management strategies will be put in place to ensure that these impacts will be adequately dealt with. Environmental damage or residual environmental impacts will be minimised through a public involvement programme, to such an extent that they are acceptable to all involved parties. The purpose of the EMP will also be to ensure that there are no foreseeable residual impacts that will be inherited by parties acquiring such land.
- As far as practicable, the land will be rehabilitated to its natural state or to a predetermined and agreed standard of land use, which conforms to the concept of sustainable development. The most probable final land use will be game farming.
- The physical and chemical stability of any remaining structures, such as residue dumps and infrastructure, will be such that the risk to the environment will not be increased by naturally occurring forces, to the extent that such increased risk cannot be contained by the installed measures.
- The EMP will predict long-term impacts and will focus on pollution prevention, minimisation and control. Monitoring programs will be used to confirm the accuracy of the predictions.
- The mine (and plants) will be closed efficiently and cost effectively.
- The mine (and plants) will make financial provision for post-closure environmental management and for the maintenance of pollution control measures.
- The Best Practical Guidelines that are available at the time of closure will be used.

Scientifically designed monitoring systems will be implemented as an integral part of the rehabilitation to ensure that preventative measures are adequate and efficient. The Char Manufacturing Plant Expansion activities that have an impact on the environment over the remaining life of the plant will be determined and provisions for the financial assurances for the current and future plant site rehabilitation will be made.

In terms of current legislation (MPRDA), provision for plant closure has to be made during the operational life of the plant. Therefore, closure objectives have been set for the Char Manufacturing Plant Expansion and the expansion and a closure plan has been developed. Objectives have been set realistically and adequate provision has been made for meeting them. This includes taking legislative requirements, public concerns, technical constraints, economic planning, etc., into account.

It is foreseen that in some areas, rehabilitation will be done fully and that the environment will be returned to its original state, for example where old infrastructure is demolished and where waste and rubbish are removed. The potential for the re-use of such areas will be the same as it was before any mining activities took place.

Buildings and other usable structures could be used for the establishment of light industry on the site, if such industry is feasible. This will depend on the outcome and results of the social-economic assessment. Adherence to the EMP will ensure the closure objectives are achieved with the minimum impact on the environment and socio-economic environment.

6.6 Soil and Land Capability Management

The land use prior to the establishment of the Char Manufacturing Plant and the Expansion was disused mining land within the Grootegeluk Coal Mine. The site is on a 13.4 ha portion of an old coal stockpile area (also known as the old coal middling stockpile area) and a disused railway loop.

The site is within the boundaries of the Grootegeluk Mine and thus the immediate surrounding land use is mining and related activities. Other nearby land uses include livestock farming and game farming. No crop farming takes place in the vicinity. Closure objectives have therefore been developed to aim for these land uses can be continued after rehabilitation has successfully taken place.

During the different phases of the proposed Char Manufacturing Plant Expansion project, namely Planning & Design, Construction, Operation, Decommissioning and Post Closure, there are various mitigation measures in place for soil and land management. During the planning & design phase, some mitigation measures in place include: planning for impervious surfaces to prevent soil pollution, bunding and dirty water management areas and planning to include provision for the development of topsoil stockpiles.

For the construction phase once construction 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. Contaminated topsoil may not be utilised as fill material or disposed of and topsoil stockpiles must be protected through seeding as soon as possible.

During the operational phase, areas devoid of vegetation or where soil erosion has taken place should be revegetated or remediated as soon as possible and no off-road driving will be allowed on site.

During the decommissioning and closure phases, all soils that have become contaminated with oils, fuels and lubricants must be removed and managed as hazardous waste. Bioremediation of contaminated soils could also take place should such a facility be available on site. The success of rehabilitation is to be monitored for at least 3 years after closure. Should rehabilitation not prove successful, a rehabilitation specialist must be included in the rehabilitation process.

For a more comprehensive list of the mitigation measures in place for soil and land capability management for the Char Manufacturing Plant Expansion Project, refer to the EMP which forms part of the EIA.

7. MONITORING AND AUDITING SYSTEMS

7.1 Water Monitoring

7.1.1 Groundwater Monitoring

A well-established groundwater monitoring programme is currently implemented at Grootegeluk Coal Mine and at the existing Char Manufacturing Plant. Since the Char Manufacturing Plant Expansion site is located within the existing Grootegeluk Coal Mine boundary area, this groundwater monitoring programme will be updated to include the Char Manufacturing Plant Expansion site.

The main objective of the groundwater management that is currently implemented and will continue to operate at the Char Manufacturing Plant Expansion site, is to prevent additional groundwater impacts

as a result of the Char Manufacturing Plant Expansion. The following objectives were considered for the development of the current groundwater management strategy at the Char Manufacturing Plant (existing plant and expansion):

- Determination and quantification of additional impacts as a result of the char manufacturing and related activities, or the lack thereof, on the groundwater at the site,
- Generation of information regarding the groundwater quality and quantity through monitoring,
- Managing the impacts on groundwater at the Char Manufacturing Plant (existing plant and expansion) site to reduce the infiltration of contaminated surface water to the groundwater regime, and
- The prevention of possible further pollution of the groundwater.

Despite the best environmental practice design and anticipated operation of the Char Manufacturing Plant Expansion site's water management system, proactive action will be taken to ensure that groundwater is not impacted on.

Monitoring is to be undertaken in accordance with the schedule presented in Table 7.1 below. The following activities will form part of the groundwater monitoring programme:

- Updating of the groundwater monitoring database as information becomes available. This information will be used in understanding the Char Manufacturing Plant Expansion's groundwater impacts and updating the groundwater numerical model if required.
- Development of a monitoring response protocol after completion of the construction phase, this protocol is to describe procedures to be followed in the event that groundwater monitoring reveals that action must be undertaken.
- Compilation of an annual compliance report presenting results of the monitoring and submission to the plant manager.
- Updating and verification of the groundwater flow model on a 5 year basis to ensure that at least 5 years prior to plant closure the groundwater closure scenario is understood.

Table 7.1: Groundwater Monitoring Plan

Monitoring Position	Sampling Interval	Analysis
Construction Phase, Operational Phase		
All groundwater monitoring points for the plant shall be monitored. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43 (Figure 3.21).	Quarterly	Groundwater level and groundwater quality are to be measured. pH, electrical conductivity, Total Dissolved Solids, Sulphates, Nitrates, Ca, Mg, Na, K, Cl, SO_4, NO_3, F, Al, Fe, Mn, NH_4 and selected hydorcarbons are analysed for water quality.
Post Closure		
All groundwater monitoring points for the plant shall be monitored. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43.	After closure for a minimum of three years	Groundwater level and groundwater quality are to be measured.

7.1.2 Surface Water Monitoring

7.1.2.1 Surface water quality monitoring

The objective of the surface water monitoring system is to ensure that the water management systems perform according to specifications, to act as a pollution early warning system, to check compliance with license requirements and for reporting purposes. The objectives of these systems will be achieved if there is no impact (attributable to the Char Manufacturing Plant Expansion) on the quality and quantity of the downstream surface water.

As there are no watercourses upstream of the Char Manufacturing Plant Expansion site and the upstream catchment is small with runoff occurring only during and immediately after rainfall events, the points that will be monitored are (refer to figure 3.15):

- The existing Char Manufacturing Plant pollution control dam
- The Bosbok Dam on Grootegeluk Mine
- Any future pollution control dams which are constructed within or downstream of the Char Manufacturing Plant Expansion.

The reasoning behind the use of these locations is that any spillage from the site would be a spill from the PCD. Monitoring the water quality in the PCD will characterise the dirty water generated on the site. Any spills from the PCD will flow into the Bosbok Dam. Any changes in the water quality in Bosbok Dam, particularly the presence of hydrocarbons, may be attributed to spillages from the Char Manufacturing Plant PCD. The frequency of sampling and analysis is detailed in Table 7.2**: Surface water quality sampling and analysis**.

Table 7.2: Surface water quality sampling and analysis

Location	Frequency	Parameters to be analysed
Char Manufacturing Plant PCD	Monthly	▪ Full inorganics and trace elements, as well as pH and EC ▪ Hydrocarbons
Bosbok Dam		
Any future PCDs		

7.1.2.2 Surface Water quantity monitoring (water balance monitoring)

For efficient management of water on the site, a good understanding of the site water balance will be required. To achieve this, the following monitoring will be needed:

- Rainfall – to be measured daily on the site
- Evaporation – this is not essential but would be useful for calibration of the water balance model
- Dam water level – to be measured weekly for the PCD
- Flows – including the following, to be measured weekly:
    - o Make-up water drawn from all systems (Grootegeluk process water, raw water and potable water)
    - o Inflows to the PCD
    - o Water pumped from the PCD for reuse in the process
    - o Water circuits within the processing plant, including:
        - Make-up water to the cooling circuits
        - Water in the liquor generation and destruction
        - Char product quench water
    - o Moisture contents and tonnages of feed coal and char product
    - o Sewage volumes.

7.1.3 Bio-Monitoring

A bio-monitoring programme for the area is not necessary as there are no watercourses upstream of the Char Manufacturing Plant Expansion site and the upstream catchment is small with runoff occurring only during and immediately after rainfall events.

There are also no watercourses immediately downstream of the site in which bio-monitoring could take

place. The nearest defined surface water course is the Sandloop stream located approximately 10.3 km south east of the site.

7.2 Data Management and Reporting

7.2.1 Information System

The Char Manufacturing Plant Expansion Project will develop a system that will allow the plant to capture and manage all water data. The system will incorporate groundwater quality and borehole levels as well as the water balances for the plant.

The data will provide the physical location and flow between water management structures. It also gives the opportunity to indicate the water resources used to supply the operation as well as all the receptors.

7.2.1.1 Internal Reporting

Internal reporting will include:

- Monthly reporting to the Char Manufacturing Plant Expansion Project environmental meetings; and
- Quarterly reporting to the Exxaro Reductants environmental manager.

The time schedule of data management and reporting is tabulated below in Table 7.3.

Table 7.3: Data Management and Reporting

Reporting period	Report contents
Monthly	The monthly report is an internal report which is used to keep records of changing water qualities at the site. The report will include: ▪ Sites that are sampled ▪ Water qualities for the relevant constituents ▪ Dam levels and flow rates on site ▪ Highlight significant issues that require immediate corrective/ preventative action.
Quarterly	The quarterly report may be submitted to DMR/ DWA and consists of the following components: ▪ Brief compliance assessment description ▪ Brief description of monitoring actions performed ▪ Dam water level status report ▪ Highlight significant issues that require immediate corrective/ preventative action ▪ Historical and present source chemistry report ▪ Hydrochemical imaging: Piper and Durov diagrams. ▪ Time dependent graphs for the relevant water quality variables.
Annually	The annual report consists of all the active environmental components, and for the chapter on surface water, the following components should be included: ▪ System audit o Statutory/ regulatory requirements o Monitoring infrastructure o Data captured o Information generation o Management of system liquids ▪ Data audit

	o Verification of data o Compliance interpretation using SANS 241 Drinking Water Standard and management unit objectives o Setting of new objectives or recommendation of corrective measures o Historical and present source chemistry report o Dam level status report o Hydrochemical imaging: Piper and Durov diagrams.

7.2.1.2 Authority Reporting

A legal compliance register will be developed for the Char Manufacturing Plant Expansion Project in order to manage its compliance with environmental legislation, regulations and documents. The legal register will advise on the requirements for authority reporting. This will allow Char Manufacturing Plant Expansion Project to ensure compliance with license and permit conditions.

Authority reporting on water resource issues will be in accordance with the conditions of the WUL Amendment to be issued.

7.3 Waste Monitoring

The amount of all general and hazardous wastes being produced and disposed of will be monitored and the data will be captured and stored. The following wastes will require this monitoring:

- Non-process solid hazardous waste: e.g. grease, oils, acids, fluorescent tubes, medical waste etc.
- Process solid hazardous waste: waste sludge removed from the Char Manufacturing Plant Expansion equipment.
- Non-process liquid hazardous waste: e.g. sewerage and contaminated stormwater.
- Process liquid hazardous waste: tar, liquor, used process water returned to PCD.
- Process and non-process general wastes: construction waste, domestic waste, PCD silt.

Exxaro Coal (who will dispose of certain Exxaro Reductants' wastes) should retain proof of the following:

- The off-site disposal facility is appropriately authorised for such purpose,
- The waste is suitable for disposal at the particular waste disposal facility in accordance with the methodology outlined in Chapter Five of the DWAF's Minimum Requirements for the Handling, Classification and Disposal of Waste, Second Edition, 1998,
- Proof that the waste was indeed disposed of at such appropriately permitted destination,
- The required disposal method for the particular waste type has been followed by the operator of the applicable landfill site.

Recycling of some of the solid general waste will also take place. Wastes will be separated into colour coded bins and recyclable waste will be recycled through the existing Grootegeluk Mine waste disposal system. Scrap metal will also be sold to a scrap metal recycling company. Appropriate records of wastes sent to recycling companies should also be kept.

Authority reporting on waste management will be in accordance with the conditions of the WML to be issued (please refer to Appendix 8 for a copy of the WML application).

7.4 Environmental Management System

The EMS and environmental procedures in place for the Char Manufacturing Plant Expansion are explained in section 6.2 of this report and are attached as Appendix 9.

7.5 Incident Reporting and Investigation

7.5.1 Internal Reporting

The Char Manufacturing Plant Expansion Project will develop an incident reporting and investigation system. This system is likely to require environmental incidents to be categorised according to their significance. Moderate and high significance incidents should be reported to Exxaro Reductants and the relevant authority.

A forum will be set up with the relevant interested and affected parties, which will allow the public to lodge any complaints. All public complaints will be managed as incidents, and investigated.

7.5.2 Authority Reporting

Incidents will be reported to the authorities in accordance with the conditions to be included in the WUL Amendment and WML.

7.6 Environmental Impact Register

The Char Manufacturing Plant Expansion Project will develop an environmental aspects and impact register where applicable. This register will provide the plant with the necessary information to develop environmental management procedures (if additional procedures are required) to mitigate environmental impacts.

7.7 Auditing and Reporting

Internal and authority reporting will take place as described in section 7.5 above.

An Environmental Compliance Officer (ECO) will be appointed for the construction phase of the project. The ECO will be responsible for monitoring all environmental aspects relating to the construction phase and auditing construction activities to ensure compliance with the EMP, the Environmental Authorisation and other environmental licenses.

An annual external audit of EMP compliance will also be carried out, for the life of the plant, by an external auditor and the results will be submitted to the relevant authorities.

8. OPERATIONAL MANAGEMENT

8.1 Organisational Structure

It is the responsibility of Exxaro Reductants to implement the EMP and to make sure that all the actions are carried out. The successful implementation of the EMP is however dependent on a clearly defined organisational structure and the allocation of roles and responsibilities for each of the management actions given. Roles have been ascribed to the following parties:

Table 8.1: Roles and Responsibilities for Environmental Management

Role	Responsibility
Plant Manager:	The person, from Exxaro Reductants, responsible for the overall management of the proposed expansion of the Char Plant including its construction, operational, decommissioning and post closure phases. Takes overall responsibility for implementation of the EMP.
Environmental Manager:	Environmental Scientist responsible for: • Overseeing day to day compliance with the EMP by the contractor's staff and sub-contractors and their staff; • Issuing instructions to remediate non-compliance; • Conducting regular inspection meeting with the Project Manager to report on compliance; • Report non-compliance to the Plant Manager.
Environmental Compliance Officer (ECO):	Responsible for monitoring all environmental aspects relating to the construction phase and auditing construction activities to ensure compliance with this EMP, the Environmental Authorisation and other environmental licenses.
Operations Manager:	Engineer appointed to manage and oversee all char plant expansion operations.
Supervisor:	Persons responsible for work teams.
Public Relations Officer:	A designated person to deal with public issues.
Contractors:	Organisations or individuals that contracts with Exxaro Reductants for construction, maintenance, or any other activities required on the Char Plant Expansion site during the life of the plant.
Human Resources Manager	Person responsible for employment of persons at the Char Plant expansion.
Procurement Manager:	Responsible for coordinating purchasing of goods and services on behalf of the Plant.

8.2 Environmental Management Resources

8.2.1 Human Resources

The Char Manufacturing Plant Expansion Project will have an Environmental Manager that will be responsible for ensuring the overall environmental management taking place at the plant. The Environmental Manager is likely to be assisted by the Plant Manager, ECO and Environmental Specialists when required. External environmental consultants will also be appointed by the plant when required.

8.2.2 Environmental Equipment and Management Resources

Exxaro Reductants has numerous fixed environmental monitoring systems. The following equipment is likely to be present at the site, or will be utilised when monitoring is undertaken:

- Air quality monitoring (fallout dust buckets, PM10 monitors and gas emissions monitoring equipment);
- Groundwater and surface water monitoring (numerous boreholes, purger, bailers, dip meter, sample bottles etc.);
- Water usage meters (to measure the amount of water used by the plant and the amount provided to the plant by Grootegeluk Mine); and
- Energy usage meters.

The following environmental management infrastructure is already / will be developed at the plant to protect water resources from potential pollution:

- Hazardous waste storage areas (for temporary storage of tar and liquor);
- Temporary general waste storage dustbins;
- Pollution control dam (and future additional dam/s);

- Bunds and impervious surfaces where sludge and hazardous chemicals are handled or stored;
- Impervious surfaces underneath stockpiles;
- Storm water management structures (drains, culverts, berms).

8.3 Training and Awareness

8.3.1 Induction Training

The purpose of the induction training is to promote a general awareness of the sensitivity of the environment, the legal commitments, the aspirations of Exxaro Reductants in terms of environmental management and the environmental consequences of individual actions.

Induction is applicable to all employees, contractors and service providers that will that will be working within the Char Manufacturing Plant Expansion area. The induction training for employees, contractors and service providers is to take the form of a presentation including:

- A description of environmental sensitivities in the Char Manufacturing Plant Expansion environment.
- A description of environmental legal requirements and Exxaro Reductants' commitment to comply with these requirements;
- A description of broad-based objectives of environmental management at the Char Manufacturing Plant Expansion;
- A discussion of how individual actions can impact on the environment;
- A discussion of how individual actions can assist in the successful implementation of the EMP;
- The Code of Conduct.

All employees are to sign that they have understood and will comply with the Code of Conduct. Employees are to be re-inducted on an annual basis (after returning from their annual leave).

8.3.2 General Environmental Awareness

The purpose of the general environmental awareness programme is to promote ongoing environmental awareness amongst the workforce. It will focus on addressing particular environmental issues which have been identified as problematic through the Performance Assessment Programme and EMP compliance monitoring.

All members of the Char Manufacturing Plant Expansion workforce and contractors are to be incorporated into the general environmental awareness programme. A monthly environmental awareness topic is to be chosen by management based on the outcomes of internal audits as well as topics of general environmental interest. The topic is to be communicated to the workforce through:

- Discussions at all Safety, Health and Environment (SHE) meetings (to be itemised on the agenda).
- Posters on notice boards.

Monthly environmental topics could include:

- What is the environment;
- The Char Manufacturing Plant Expansion environment;
- You and the environment;
- The Code of Conduct;
- Reporting environmental incidents;
- Environmental emergency training;
- Preventing and cleaning up spills;
- Reduce, reuse and recycle;
- General versus hazardous waste;
- Alien vegetation control;
- Saving water;

- Environmental risks;
- Saving energy.

8.3.3 Job Specific Environmental Awareness Training

The purpose of the job specific environmental awareness training is to ensure that employees within the specific management areas are equipped to implement the actions committed to in the EMP. All members of the Char Manufacturing Plant Expansion workforce are to be subject to job specific environmental training. This training is to be undertaken by the managers of each of the management areas. Supervisors will be trained to assist with the implementation and training of the work force.

The environmental risks associated with each management area are to be identified by the supervisors together with the plant manager. The risks are to be documented and actions to reduce these risks should be developed. The actions are to ensure overall compliance with the commitments of the EMP. The findings of the performance assessment audits and EMP compliance monitoring will assist in identifying risks.

All members of the workforce (plant workers, contractors, administration etc.) are to be subject to job specific training. This may include but not be limited to:

- Preventing pollution;
- Spill prevention and clean-up procedures;
- The location and purpose of material safety data sheets (MSDSs)
- Managing wastes;
- No-go areas;
- Incident reporting.

The aspects to be covered however are dependent on the findings of the individual risk assessments. This is to be undertaken for each management area initially. Thereafter all new members of the workforce are to undergo environmental training as part of the training required to do their particular job.

Corrective Action:

- Any actions undertaken by a worker that pose a risk to the environment are to be stopped immediately.
- The worker is to be instructed in how to correct the action.
- Non-compliance is to be incorporated into the standard disciplinary procedure applicable to the Char Manufacturing Plant Expansion.

8.3.4 Community Communication and Awareness

The purpose of the external communication and awareness programme is to:

- Inform neighbouring and nearby landowners and land users of the environmental risks associated with operations at the Char Manufacturing Plant Expansion.
- Inform and update interested and affected parties regarding environmental issues and monitoring undertaken.
- Provide a forum for communication of issues.

External communication is to include residents and land users on neighbouring and nearby farms, registered interested and affected parties, and interested authorities. A complaints register is to be kept at the administration office of the Char Manufacturing Plant Expansion for the registration of internal complaints by employees and contractors. External persons must be able to officially register their

complaints in a register kept at a readily accessible point (e.g. the office at the main gate at the Grootegeluk Mine). Complaints are to be followed up by the appropriate manager and the person is to be notified (preferably in writing) of how the complaint has been addressed. Complaints can also be received by facsimile, mail or e-mail. Registered interested and affected parties are to be provided with contact details for the Char Manufacturing Plant Expansion and encouraged to direct their queries through this preferred channel of communication.

Char Manufacturing Plant Expansion personnel will participate in any relevant forums in the Lephalale Municipality or Waterberg District, with regard to issues at the plant or in the municipality/district.

8.4 Communication

Extensive communication and public participation has been undertaken for this project. The full details are contained in the Public Consultation Report in Appendix 7.

8.4.1 Identification of Stakeholders

The methodology followed for the project has taken into consideration the DEA guideline titled: "Integrated Environmental Management Guideline Series 7: Public Participation in the EIA process, 2010", and the DWA guideline titled: "Generic Public Participation Guidelines, 2001". An initial database of surrounding landowners was obtained from Exxaro Reductants based on based on information collated during prospecting work that has been undertaken in the area. This database was expanded based on responses to the press advertisement, networking and referrals, the identification of authorities with jurisdiction over activities to be undertaken at the mine and the local municipality. Response sheets were attached to the background information document (BID) requesting IAPs to supply details other people who may have interest on the project. Please refer to Appendix 7 for a copy of the IAP database.

8.4.2 Public Liaison and Forum Participation

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. This forum will allow for open communication and discussion of grievances that affected parties may have once project implementation commences. The public and authorities can also ask questions or raise concerns about the project and its impacts. Representatives of the plant (Exxaro Reductants) would be present to answer technical and process related questions. The plant's environmental representative would also be present to respond to environmental questions and concerns about environmental impacts.

8.4.3 Distribution of Information

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 7.

Press advertisements informed persons of the proposed development, the development location and provided details as to where further information could be obtained. Site notices informed persons of the proposed development, included a map indicating the site location as well as details of the public information sharing meeting. Proof of site and press notification is given in Appendix 7.

BIDs containing general information on the project, including water–related information and the requirement for a WUL Amendment Application, were circulated to IAPs via email, facsimile or registered post prior to the public information-sharing meeting on August 2010 and the March 2011. BIDs were available in English and Afrikaans.

8.4.4 Public Meeting

8.4.4.1 Initial Public Information-Sharing Meetings

Public information-sharing meetings were held on the 17th of March and the 19th of May 2011 to inform IAPs of the proposed project. Landowners, neighbours, registered IAPs, local authorities and environmental authorities were invited to the meetings. IAPs, representatives from Exxaro Reductants and Synergistics attended the meetings. The meetings were facilitated by Synergistics. Minutes of the meetings are given in Appendix 7.

8.4.4.2 Authorities Meeting

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 7.

8.4.5 Documents for Public Review

8.4.5.1 Review of the Draft and Final Scoping Reports

The draft scoping report was made available for public and authority review during June 2011. 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, would be sent to anyone who requested it. Following the closure of the review period, final modifications were made to the 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 29th 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 and the proofs of the notifications are included in Appendix 7.

8.4.5.2 Review of the Draft and Final EIA Reports

Under the NEMA process, the draft EIA report was made available for public and authority review in June 2012 for 8 weeks (60 calendar days); from 1 June 2012 until 30 July 2012. The report was made available at the Main Gate Office at the Grootegeluk Mine, the Lephalale Library and the Synergistics website. CD copies were made available to authorities and extra CD copies or hard copies were available on request. All registered IAPs were notified in writing of the availability of the document for review at the Main Gate Office at the Grootegeluk Mine, the Lephalale Library and the Synergistics website and were requested to submit comments to Synergistics via post, fax or email before 30 July 2012. The comments received are addressed in the final EIA report. Refer to Appendix 7 for proof of public consultation and comments received on the draft EIA.

The scoping and draft EIA reports were also circulated to the following authorities for review. These authorities will also receive copies of the final EIA and draft IWWMP:

- Department of Mineral Resources
- Limpopo Department of Economic Development, Environment & Tourism
- South African Heritage Resources Agency
- Department of Environmental Affairs
- Department of Water Affairs
- Lephalale Local Municipality
- Waterberg District Management Area

The public and authority comments received regarding water and waste related issues are included in tables 8.1 and 8.2 below.

Under the NEMA process, the final EIA report will be made available for public and authority review for 3 weeks in August 2012 (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).

8.4.5.3 Review of the Draft IWWMP Report

This draft IWWMP will be made available for public review for a period of 21 days during August 2012. Copies of the IWWMP will also be provided to the authorities mentioned above for their comment.

8.4.6 Collation of Issues of Concern

As part of the public participation process it is vital that the issues of concern of the stakeholders which include government, affected parties and interested parties (surrounding communities, surrounding farmers, NGO's, businesses and other parties not directly affected by the project) are taken into consideration in the EIA process. Issues of concern from the abovementioned parties were collated during the public meetings and authorities meetings, response sheets from IAPs, authorities and stakeholders and responses to the site notices, press advert and notifications sent via email.

Tables 8.2 to 8.8 provide a list of the issues of concern collated during the public participation phase. The tables include responses from the project team. Please note that only water and waste related issues have been included in the tables. Questions that were asked and answered during the meetings can be found in the meeting minutes. A complete record of all public participation is included in the comments and responses report which is attached as Appendix 7.

Table 8.2: Interested and Affected Parties Issues of Concern

Date	Name	Question/Issue Raised:	Answer:
11/08/2010	Not recorded	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.
11/08/2010	Not recorded	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.
11/08/2010	Filomaine Swanepoel	A statement was made 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.
11/08/2010	Not recorded	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.
11/08/2010	Not recorded	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.
17/03/2011	Tendani Mufamadi of 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.
17/03/2011	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 second public meeting held in May of 2011.

Table 8.3: Authorities Issues of Concern

Date	Name	Question/Issue Raised:	Answer:
12/08/2010	Masemola Mailetse, DAFF-(MM)	Where does the water that the Char Manufacturing Plant uses come from?	Guillaume de Swart – Exxaro (GS): Raw, process and potable water is supplied from the Grootegeluk Mine via dedicated pipelines.

Date	Name	Question/Issue Raised:	Answer:
12/08/2010	MM	Does the Char Manufacturing Plant have a Water Use License and how much water is extracted?	GS : The existing Char Manufacturing Plant is approved under the existing Grootegeluk Mine Water Use License. The existing Char Manufacturing Plant does not extract water for any purpose.

Table 8.4: DMR Issues of Concern

Date	Name	Question/Issue Raised:	Answer:
16/03/2011	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.
16/03/2011	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.
24/10/2011	RM	Specialist studies with regard to water, heritage and others must be done.	This has been addressed in the EIA report.

Table 8.5: LEDET Issues of Concern

Date	Name	Question/Issue Raised:	Answer:
16/03/2011	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.
12/10/2011	MS	Proof, which will take into consideration the amendments of the Integrated Water Use License Application (IWULA), submitted to the Department of Water Affairs (DWA), must be provided.	This has been addressed in the EIA report.
12/10/2011	MS	Proof that a Waste Management License application in accordance to NEMWA has been submitted to the Department of Environmental Affairs (DEA) must be provided.	This has been addressed in the EIA report.
12/10/2011	MS	The surface water studies undertaken by Jones and Wagener Engineers must be incorporated in the EIR.	This has been addressed in the EIA report.
12/10/2011	MS	Feasible methods for managing the existing waste sludge produced at the Char Manufacturing Plant must be adequately addressed.	This has been addressed in the EIA report.
12/10/2011	MS	The existing waste management plan must be incorporated in the EIR and the EMP.	This has been addressed in the EIA report.

Date	Name	Question/Issue Raised:	Answer:
12/10/2011	MS	Alternatives for lining of the waste water dams must be identified and addressed and the best option recommended.	This has been addressed in the EIA report.
12/10/2011	MS	The groundwater specialist must recommend suitable measures to mitigate potential groundwater pollution from the stockpiles.	This has been addressed in the EIA report.
12/10/2011	MS	The water specialist study must recommend feasible measures of recycling of water in order to address water and salt balance.	This has been addressed in the EIA report.
12/10/2011	MS	The existing IWWM, as well as the Environmental Management Framework by Waterberg Local Municipality must be incorporated in the EIR.	This has been addressed in the EIA report.
12/10/2011	MS	The EIR must indicate the adequacy of the capacity of the pollution control dam to accommodate the proposed project.	This has been addressed in the EIA report.
12/10/2011	MS	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.	This has been addressed in the EIA report.
12/10/2011	MS	Proof of agreements that are in place regarding, for example the provision of water and electricity, must be provided.	This has been addressed in the EIA report.
11/10/2011	MS during telephonic conversation with V.Vorster	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.	This has been addressed in the EIA report.
11/10/2011	MS	General waste management must be reported on. This includes issues such as the availability of bins, the disposal of contaminated Personal Protective Equipment (PPE).	This has been addressed in the EIA report.
11/10/2011	MS	The management of extra sludge (hazardous waste) produced at the Char Manufacturing Plant must be elaborated on in the EIR.	This has been addressed in the EIA report.
22/9/2011	MS	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.	This has been addressed in the EIA report.

Table 8.6: DWA Issues of Concern

Date	Name	Question/Issue Raised:	Answer:
16/03/2011	Charles Linstrom – Exxaro (CL):	We will apply for a WUL Amendment 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.	
16/03/2011	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.

Date	Name	Question/Issue Raised:	Answer:
16/03/2011	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.
16/03/2011	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).
16/03/2011	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 existing Char Manufacturing Plant.
16/03/2011	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.
16/03/2011	MM	Will you factor in the water balance and salt balance?	CL: The water balance will dictate storm water constraints, thus we 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.
16/03/2011	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 8.7: Waterberg District Municipality Issues of Concern

Date	Name	Question/Issue Raised:	Answer:
17/03/2011	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.
17/03/2011	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.
17/03/2011	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.

Date	Name	Question/Issue Raised:	Answer:
			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.
17/03/2011	Edwynn Louw	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.

Table 8.8: Lephalale Local Municipality Issues of Concern

Date	Name	Question/Issue Raised:	Answer:
17/03/2011	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 to Filomaine Swanepoel at Grootegeluk mine, they have an IWWMP. Is it not a good idea to incorporate the new plants into the IWWMP?	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.

9. REFERENCES AND SPECIALIST STUDIES

9.1 References

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CONSULTANT'S EXPERIENCE
AND
DECLARATION OF INDEPENDENCE

Synergistics Environmental Services (Pty) Ltd is an independent environmental consultancy that was established in 2004. The company has extensive experience in environmental impact assessments; environmental management plans, programmes and systems; environmental auditing; environmental monitoring reporting; environmental performance assessments; closure and rehabilitation costing and planning; and development of environmental action plans.

Matthew Hemming is an Environmental Assessment Practitioner in South Africa has over 7 years' environmental management and assessment experience, specifically in the mining, waste and infrastructure development sectors.

The undersigned herewith declare that this report represents an independent, objective assessment of the environmental impacts associated with the proposed Char Manufacturing Plant Expansion Project:

	Name	Designation	Signature	Date
Prepared by:	Shelley Holt	Senior Environmental Consultant		
	Chiara D'Egidio	Environmental Consultant		
Reviewed by:	Matthew Hemming	Project Director		

APPLICANT'S DECLARATION AND UNDERTAKING

The undersigned herewith declare that the information presented this report is in accordance to the current plans of the company mining and undertake to comply with the mitigation and management measures as described in this report..

Signed: _____

Name: _____

Designation: _____

Dated: _____

9.2 Specialist Studies and Appendices