S. BOTHMA AND SON TRANSPORT (PTY) LTD.

INTEGRATED WATER & WASTE MANAGEMENT PLAN (IWWMP) FOR THE

JUNE 2017

DWS REF. NO.: 16/2/7C223/C0155

S BOTHMA AND SON TRANSPORT (PTY) LTD

THE INTEGRATED WATER AND WASTE MANAGEMENT PLAN (IWWMP) FOR WATER USE LICENCE APPLICATION

DOCUMENT CONTROL

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REVISION AND AMENDMENTS

Date	No.	Description of Revision or Amendment
July 2017	0	Integrated Water and Waste Management Plan

EXECUTIVE SUMMARY

Project overview

S. Bothma and Son Transport (Pty) Ltd (the Applicant). undertakes a sand mining operation on the Remainder (Re) Portion of the Farm Boschbank 12, located near the town of Sasolburg in the Parys District Municipality area of the Free State Province. The operation is in possession of two Mining Rights (reference numbers: FS 30/5/1/2/2/ 161 (10014) MR and FS 30/5/1/2/2/239 MR) issued by the Department of Minerals Resources (DMR) under the provisions of the Minerals and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002). These Mining Rights are currently pending a Section 102 application for consolidation thereof. It is understood that the DWS, following a site inspection carried out on the Applicants property, identified that certain water use activities (as per Section 21 of the NWA) were being engaged on the site/ operations and consequently required a Water Use Licence (WUL). Geo Soil and Water (GSW), has been approached by the Applicant to assist in addressing the concerns raised by the DWS in their Notice and to compile and submit an application for a WUL.

The mine falls within the Upper Vaal Water Management Area (WMA), under the primary drainage region C and in sub-quaternary sub-catchment C22F.

Water Uses and Waste Streams

The water uses applicable to this Integrated Water and Waste Management Plan (IWWMP) and Water Use Licence Application (WULA) are the following:

- Section 21(a): Taking water from a water resource;
- Section 21(b): Storing water. This refers to the storage of clean / uncontaminated water;
- Section 21(c): Impeding or diverting the flow of water in a watercourse;
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

The main waste streams include domestic waste, hazardous waste and industrial waste.

IWWMP Report

The development of the IWWMP for this project was done in order to meet the water use authorisation requirements in terms of the National Water Act (NWA) (Act No. 36 of 1998). The IWWMP clearly defines the responsibility and accountability for the execution of water and waste management. It also identifies and plans for future water and waste management needs and requirements.

The IWWMP further outlines the management of water and waste on site, and serves to document the methods employed, and the management of water and waste related emergencies that may arise. The IWWMP also details the minimisation of costs related to the management of water and waste by

specifying how the efficiency of water and waste management systems are optimised, thereby minimising adverse environmental and social impacts related to water and waste management.

Public Participation Process

Interested and Affected Parties (I&AP's) identified were initially notified of the proposed WULA, and invited to register as an I&AP and submit any comments or concerns they may have. All registered I&AP's, including key stakeholders and landowners, have been notified of the availability of the IWWMP that has been placed out for public review. All issues and responses will be captured in the Public Participation Report and will be submitted to the DWS.

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GLOSSARY OF TERMS

Catchment:

The area from which any rainfall will drain into the watercourse or watercourses or part of the water course, through surface flow to a common point or common points.

Environment:

The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical, cultural and political aspects. 'Environment' is described as the surroundings within which humans exist and is made up of:

i. the land, water and atmosphere of the Earth;

ii. micro-organisms, plant and animal life;

iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and

iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Existing Lawful Water Use:

An existing lawful use means a water use which has taken place at any time during a period of two years immediately before the date of commencement of the National Water Act, 1998, (Act 36 of 1998) or which has been declared an existing lawful water use under section 33 and which was authorised by or under any law which was in force immediately before the date of commencement of the National Water Act (Act 36 of 1998).

Hydrological:

The study of movement, distribution and quality of surface water and groundwater.

Hydrogeological:

The study of distribution and movement of groundwater.

Mine risk:

Mines are classified into three risk categories namely, categories A, B and C according to the perceived severity of the potential impacts on the water resources due to mining activity.

Monitoring programme:

A programme for taking regular measurements of the quantity and/or quality of a water resource, waste or wastewater discharge at specified intervals and at specific locations to determine the chemical, physical and biological nature of the water resource, waste or waste water discharge.

Public Participation Process:

A process of involving the public in order to identify issues and concerns, and obtain feedback on options and impacts associated with a proposed project, programme or development. Public Participation Process in terms of NWA refers to: a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to specific matters.

Quaternary catchment:

A forth order catchment in a hierarchical classification system in which a Primary catchment is the major unit.

Reserve:

The quantity and quality of water required –

to satisfy basic human needs by securing a basic water supply, as prescribed under the Water Services Act, 1997 (Act 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

iv. to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the relevant water resource.

Tributaries:

A stream or river which flows directly into a larger river or stream.

Watercourse:

Includes:

i. a river or spring;

ii. a natural channel in which water flows regularly or intermittently;

iii. a wetland, lake or dam into which, or from which, water flows; and

iv. any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Water quality:

The physical, chemical, toxicological, biological (including microbiological) and aesthetic properties of water that determine sustained (1) healthy functioning of aquatic ecosystems and (2) fitness for use (e.g. domestic, recreational, agricultural, and industrial). Water quality is therefore reflected in (a) concentrations or loads of substances (either dissolved or suspended) or micro-organisms, (b) physic-chemical attributes (e.g. temperature) and (c) certain biological responses to those concentrations, loads or physic-chemical attributes.

Water use:

Water Use is defined broadly in Section 21 of the National Water Act, 1998 (Act 36 of 1998) and includes taking and storing water; activities which reduce stream flow; waste discharges and disposals; controlled activities (activities which impact detrimentally on a water resource); altering a water course; removing water found underground for certain purposes and recreation.

Water resource:

A water resource includes any watercourse, surface water, estuary or aquifer. Watercourses include rivers, springs, and natural perennial and non-perennial channels, wetlands, lakes, dams, or any collection identified as such by the Minister in the Government Gazette.

Water use license:

An authorisation from the DWS to a designated water user to use water. The authorisation will provide details on the time-frames and conditions for the designated water use.

ABBREVIATIONS

ABA		Acid-Base Accounting
AMD	:	Acid Mine Drainage
BBBEE	:	Broad-Based Black Economic Empowerment
CLF		Community Liaison Forum
CMA		Catchment Management Area
DEA	:	Department of Environmental Affairs
DMR	:	Department of Mineral Resources
DSTI		Daily Safe Task Instruction
DWA	:	Department of Water Affairs (formerly DWAF)
DWAF	:	Department of Water Affairs and Forestry
DWS	:	Department of Water and Sanitation (formerly DWA)
EA	:	Environmental Authorisation
EAP	:	Environmental Assessment Practitioner
ECO		Environmental Control Officer
EIA	:	Environmental Impact Assessment
EIMS	:	Environmental Impact Management Systems (Pty) Ltd.
EMP	:	Environmental Management Plan
EMPR	:	Environmental Management Programme
EMS	:	Environmental Management System
EO		SHE
GDP	:	Gross Domestic Product
HDPE	:	High-Density Polyethylene
HDSA	:	Historically Disadvantaged South African
HSEC	:	Health, Safety, Environmental and Community
I&AP	:	Interested and Affected Party
IEMPR		Integrated Environmental Management Programme
IRR	:	Issues and Response Report
ISO	:	International Organisation for Standardisation

IWULA	:	Integrated Water Use License Application
IWWMP:		Integrated Water and Waste Management Plan
LCT	:	Leachable Concentration Thresholds
LOM	:	Life of Mine
MAR	:	Mean Annual Runoff
MBS	:	Metres Below Surface
MPRDA:		Mineral and Petroleum Resources Development Act (Act 28 of 2002)
NEMA	:	National Environmental Management Act (Act No. 107 of 1998)
NEMWA;		National Environmental Management: Waste Act (Act No. 59 of 2008)
NFEPA	**:**	National Freshwater Ecosystem Priority Area
NHRA	:	National Heritage Resources Act (Act No.25 of 1999)
NIHL	:	Noise Induced Hearing Loss
NSBA	:	National Spatial Biodiversity Assessment
NWA	:	National Water Act (Act 36 of 1998)
PCD	:	Pollution Control Dam
PES	:	Present Ecological Status
PM_{10}	:	Particulate Matter with an aerodynamic diameter of less than 10μm
$PM_{2.5}$	"	Particulate Matter with an aerodynamic diameter of less than 2.5μm
PPP	:	Public Participation Process
PVC		Polyvinyl Chloride
%PTV	*:*	Pollution Tolerant Valves
RE		Remaining Extent
RO		Reverse Osmosis
ROM	:	Run of Mine
SABS		South African Bureau of Standards
SANS		South African National Standards
SASS	:	South African Scoring System
SAWQG		South African Water Quality Guidelines
SHE	:	Safety, Health and Environmental
SHEQ		Safety, Health, Environment and Quality

SLP	:	Social and Labour Plan
TC	:	Total Concentrations (TC)
TCT	:	Total Concentration Threshold
L/TIFR	:	Lost Time Injury Frequency Rates
WARMS:		Water Authorisation Registration and Management System
WUL:		Water Use Licence
WULA:		Water Use Licence Application
WMA:		Water Management Area
WML	:	Waste Management License
WMS:		Waste Management Strategy

1. INTRODUCTION

The Applicant is an existing sand surface mining operation (shovel and load) located on the Remainder Portion of the farm Boschbank 12, close to the Wonderfontein Road in the Sasolburg district. Geo Soil and Water (GSW) (Pty.) Ltd. was appointed by the Applicant to submit an IWWMP, as well as to compile and submit the WUL Application in terms of the NWA. The IWWMP and WULA have been requested by the Department of Water and Sanitation (DWS) as per the Notice of Intention to issue a Directive in terms of Section 53(1) of the NWA submitted to the Applicant, as well as the meeting held with the DWS on the 20th September 2016.

The Applicant undertakes a sand mining operation on the Remainder (Re) Portion of the Farm Boschbank 12, located near the town of Sasolburg in the Parys District Municipality area of the Free State Province. The operation is in possession of two Mining Rights (reference numbers: FS 30/5/1/2/2/ 161 (10014) MR and FS 30/5/1/2/2/239 MR) issued by the DMR under the provisions of the MPRDA. These Mining Rights are currently pending a Section 102 application for consolidation thereof. It is understood that the DWS, following a site inspection carried out on the Applicants property, identified that certain water use activities (as per Section 21 of the NWA) were being engaged on the site/ operations and consequently required a WUL. As discussed at the meeting GSW, has been approached by the Applicant to assist in addressing the concerns raised by the DWS in their Notice.

The mine falls within the Upper Vaal Water Management Area (WMA), under the primary drainage region C and in sub-quaternary sub-catchment C22F.

1.1. ACTIVITY BACKGROUND

The mining operation at Boschbank is opencast mining (shovel and load), as well as supporting core transportation business with onsite technical support.

The monitoring programme of the Applicant incorporates three environmental components, namely:

- Dust monitoring;
- Surface water monitoring; and
- Health and Safety.

The project area lies within the Upper Vaal Water Management Area, within the C224 quaternary catchment. See Table 1 for a summary of the background information

Table 1: Background information

Property Descriptions:	Re of the farm Boschbank 12
Nearest Towns:	Vanderbijlpark / Vereeniging and Sasolburg

Water Uses Authorised:	None.
Water Management Area:	Upper Vaal Water Management Area.
Quaternary Drainage Region:	C22F
Commodity:	Sand
Mining Method:	Opencast mining method
Estimated LoM:	10 years

In order to comply with national legislation, the Applicant has an authorisation in terms of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002, MPRDA);

The applicant submitted a request for verification of an existing water use under Section 35(1) of the National Water Act, (Act 36 of 1998), and declared the abstraction of water on property 12PA/0 as an existing water use in 2013. The DWS, following a site inspection carried out on the Applicants property, identified that certain water use activities (as per Section 21 of the NWA) were being engaged on the site/ operations and consequently required a WUL. This IWWMP has been compiled in support of the WUL Application and according to the Department of Water Affairs (DWA) Operational Guideline: Integrated Water and Waste Management Plan (First Edition, February 2010).

1.2. CONTACT DETAILS

The applicant is S. Bothma and Son Transport (Pty) Ltd. The relevant contact details are provided **Table 2** below:

Table 2: Applicant contact details

Name of Applicant:	S. Bothma and Son Transport (Pty) Ltd
Name of Mine:	S. Bothma and Son Transport (Pty) Ltd Sand Mine
Delegated responsible person:	Mr Johan Pretorius
Physical Address:	Farm Londondale 442 Sasolburg

Postal Address:	P.O. Box 287 Sasolburg 1947
Tel:	+27 16-970 2015
Fax:	+27 16-970 2059
Email:	bothma@botchmas.com

1.3. REGIONAL SETTING AND LOCATION OF ACTIVITY

The Bothma and Son Transport (Pty) Ltd project area includes portion Re. of the farm Boschbank (situated in the Sasolburg Local Municipality within the Fezile Dabi District Municipality District Municipality (Free State Province). The Mining Right is granted over one property (Table 3). Mining and water uses are relegated to Remainder (Re.) Portion of the farm Boschbank 12. The project area is situated approximately 5 km northwest of Sasolburg.

1.4. PROPERTY DESCRIPTION

The details of the relevant portion Re. of the property Boschbank 12 on which the project area is located is listed in **Table 3**. The location of the mine is indicated in Figure 1 below.

Table 3: Title deed information

Property Description	Title Deed	Owner Details	Applicants Right to Property
Remainder of the farm Boschbank 12	T19767/2005	A. M. Rossouw Eiendomme (Pty) Ltd	Owner

The co-ordinates of the centre of the site are indicated in **Table 4** below.

Table 4: Site Co-ordinates

Latitude	**26°47'39.67"S**
Longitude	27°47'46.55"E

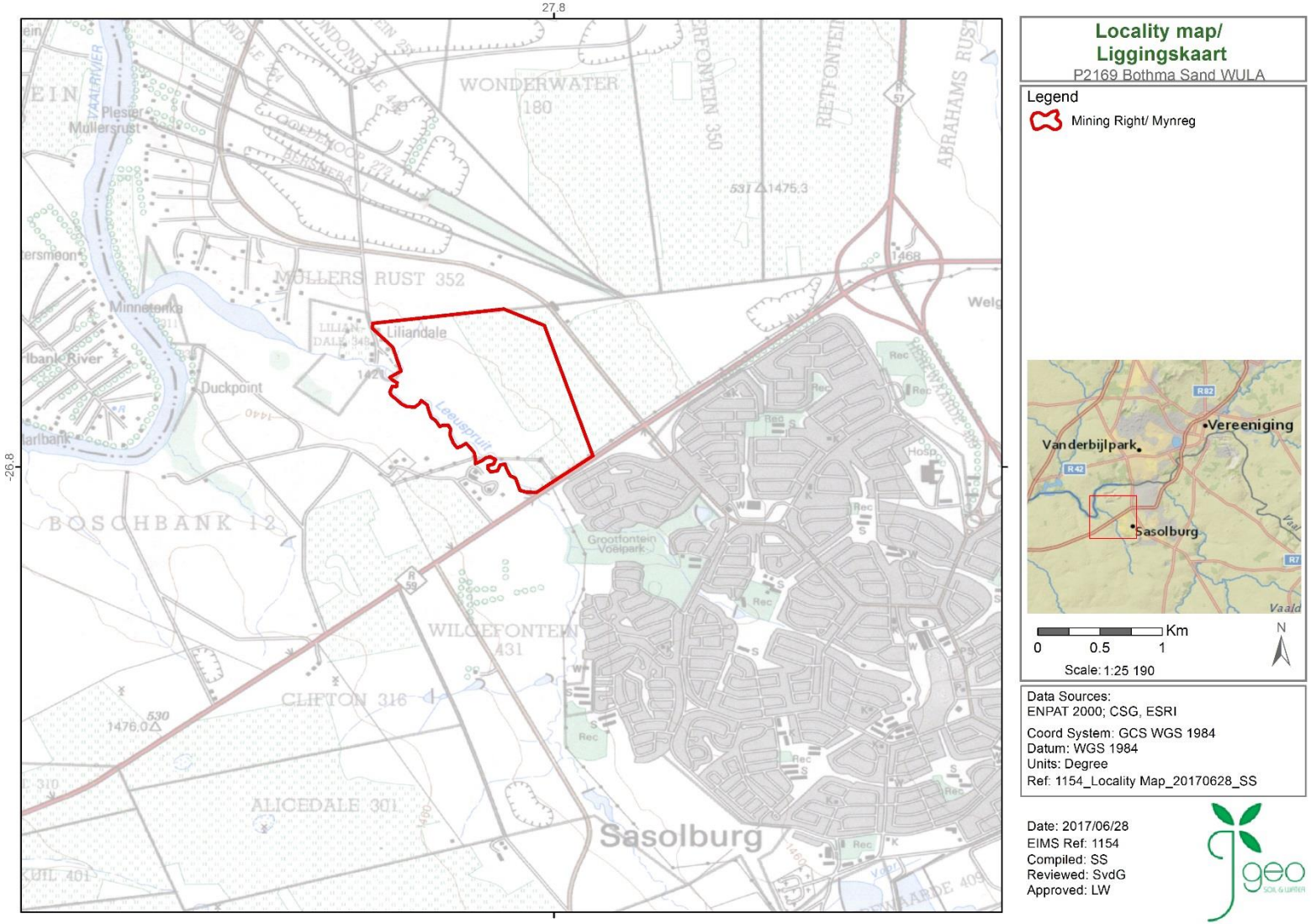


Figure 1: Locality map for the Applicant

1.5. PURPOSE OF IWWMP

Although the requirement for the compilation of an IWWMP was originally aimed at collating and rationalising the information submitted for Water Use Licence Applications (WULA) to the DWS, it has progressed beyond this purpose to:

- Provide the regulatory authorities with focused and structured information not only to meet their general information needs, but also to articulate the required management measures and actions to achieve the water and waste related performance on an on- going basis;
- Provide direction and guidance to the water user on water and waste management of any activity; and
- The IWWMP should be used in conjunction with other guidelines developed by DWS, such as the External Guideline on the Water Use Authorisation Process and the series of Best Practical Guidelines for water resource protection in the Industries and Mines. The Department and/or relevant Catchment Management Agencies (CMA) implement the integrated water resource management (IWRM) at source by means of an IWWMP.

The Department requires an IWWMP as a simple feasible, implementable plan for water users based upon site specific programmes, also taking into account the National Water Resource Strategy (NWRS), Catchment Management Strategy (CMS), Resource Quality Objectives (RQO's) and sensitivity of the receiving water resource, upstream and downstream cumulative impacts of water use activities, external water use authorisation guidelines, as well as water use specific supplementary information requirements. The most important component of the IWWMP development process is the formulation of various strategies, goals and objectives for the water use or waste management of an activity, in accordance with the set philosophies and policies. The policies must address the four key areas related to IWWMP development, namely process water, storm water, groundwater and waste. The purpose of an IWWMP is as follows:

- Compilation of a site specific, implementable, management plan addressing all the identified water use and waste management related aspects (e.g. process water balances, storm water management, groundwater management, water re-use and reclamation, water conservation and demand management, waste minimization and recycling) of the specific activity, in order to meet set goals and objectives, in accordance with Integrated Water Resources Management principles;
- Provision of management plan to guide a water user regarding the water and waste related measures which must be implemented on site in a progressive, structured manner in the short, medium and long term;
- Documentation of all the relevant information, as specified in this guideline, to enable the Department to make the decision regarding the authorisation of a water use;

- Clarification of the content of the IWWMP for DWS officials and the water users, as the various regional offices of DWS might have different interpretations regarding the content of an IWWMP;
- Standardisation of the format of the supporting documentation which the Department requires during submission of a WULA;
- Provision of guidance on the content of information required in an IWWMP as part of the water use authorisation process and level of detail that the Department requires to enable them to evaluate the supporting documentation to make a decision on authorisation water use;
- Ensuring that a consistent approach is adopted by the Department and the various Regional Offices and CMA's with regards to IWWMPs; and
- It is the responsibility of the water user to demonstrate to the Department that the selected management measures in the IWWMP action plan adhere to the "SMART" concept i.e.:

  S = sustainable;

  M = measurable;

  A = achievable;

  R = resources allocated; and

  T = timeframe specific.

It is a Departmental requirement that a water user needs to compile an IWWMP for any one of the following purposes:

- As the supporting technical documentation for any IWULA;
- When converting Existing Lawful Use (ELU) to licensed water use; and
- In order to comply with the conditions of an existing water use licence.

The implementation of the IWWMP is an interactive process whereas its performance is monitored on an annual basis. The assessment of the IWWMP document itself, as well as the submission of information relating to monitoring and auditing conducted in terms of it could lead to its shortcomings, which must be addressed in the annual update of the action plan of the IWWMP (Figure 2). This will ensure that the concept of continual improvement is applied throughout the life cycle of the activity (Operational Guideline: IWWMP dated February 2010 and GNR 267 dated March 2017).

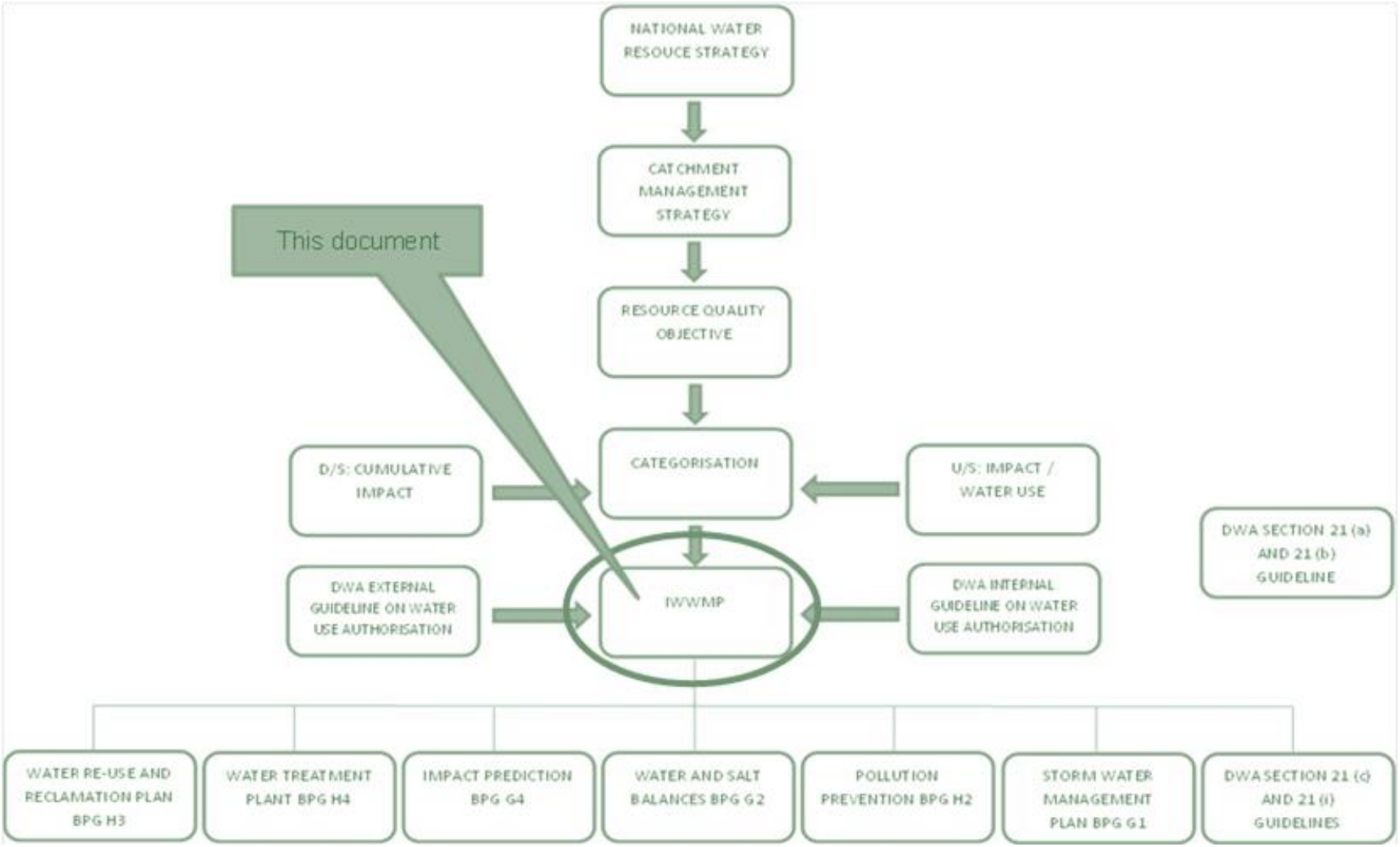


Figure 2: General IWWMP approach flow diagram

Table 5 provides a guide to the structure of this IWWMP, in relation to the requirements of the DWS Operational Guideline: Integrated Waste and Water Management Plan (2010) and GNR 267 (2017).

Table 5: Guide to the structure of the IWWMP

Guideline Item	Relevant IWWMP Section
Quantification of the Water Resource Problem	
Are the existing water quality data adequate to identify contaminants of concern?	Section 4.2 and Section 4.3
How well have the nature, extent and causes of the water management problems on site been identified?	Section 4.2, Section 4.3 and Section 5.6
To what extent has the analysis and characterization of the problems considered current thinking on water resource management?	Section 5
Are there any discernible trends?	Section 4 & Section 5
Targets, Indicators and Monitoring	
Does the IWWMP define medium and long-term goals towards sustainable management of water resources?	Section 6.3
Does the IWWMP make provision for the establishment of indicators of progress and set annual and medium term targets?	Section 6.4
Are these indicators and targets appropriate and consistent with the policies and strategies considered for implementation of the IWWMP?	Section 6.5, Section 6.6 and Section 6.7
Are the proposed monitoring, review and evaluation as well as auditing systems adequate and sustainable?	Section 6.6
Priority Actions	
Does the IWWMP describe clear priorities for action, relevant to the goals and targets, feasibility in terms of achieving targets, their	Section 6.5, Section 6.6

Guideline Item	Relevant IWWMP Section
estimated costs, available resources, institutional capacities and effectiveness?	
Does the water management strategy have an adequate and credible financial provisioning plan to support the implementation of the IWWMP?	Section 6.5
To what extent do the structural and sectoral goals and objectives as well as actions of the IWWMP address key performance areas of strategy, institutional matters and the sustainable management of the water resource?	Section 6.5, Section 6.6
Does the IWWMP address the components of section 27(1) of the NWA?	Section 7
Creating Awareness	
Does the IWWMP describe the participatory process used to identify water use and waste related aspects?	Section 5.7 and Section 5.8
Does the IWWMP summarise the major issues raised during the consultation process?	Section 5.8
To what extent have the matters raised impact on the content of the plan?	Section 5.6 and Section 5.7
Does the plan make provision for linkage with other initiatives in terms of water resource management?	Section 3.1, Section 5.2 & Section 7.2.3
Does the IWWMP make provision for continual involvement of stakeholders?	Section 5.5.3.

2. PROJECT DESCRIPTION

2.1. DESCRIPTION OF ACTIVITY

The project area is situated on Portion Re. of the farm Boschbank 12 approximately 5 km northwest of the town Sasolburg. Mining operations is done by means of quarrying strip mining method. The topsoil is being removed to a depth of approximately 0.5m or more and stockpiled separately on the side of

the proposed sand excavation areas. The sand will be removed by means of shovelling (front end loader and or excavator) and either loaded directly onto conventional trucks to be delivered to customers as is, or transported to the sand screening and washing plant to be washed and screened as per customer requirement, prior to loading and delivery to customer. Alluvial Sand will be mined to an approximate depth of 5m first bench. The benches will be sloped in such a manner not posing danger at a gradient of not more than 1:2 (26 degrees).

Concurrently with activities, the slopes of open mines shallower than 1.5 meters will be finished off to a gradient not steeper than 1:3 (18 degrees). All deeper areas will be finished at gradient not steeper than 1:2 (26 degrees). The residue of the sand washing process consists out of inert silt, which will be covered with sub soils and then top soiled and re-vegetated. The sand screening plants utilized is of portable nature and can be easily removed or re-located, currently taking place on the farm Boschbank 12. An average of approximately 15 780 m^3 to 40 000 m^3 each on the Mining Rights161 MR and 239 MR, respectively will be mined on monthly basis, depending on customer demand and supply ratio.

2.1.1. MINING METHOD

Mining operations at the sand mine are conducted by means of sand quarrying strip mining method that makes use of mechanical means of shovel (front end loader and excavator) and load (conventional truck) operations.

2.1.2. MINERAL DEPOSITS

Alluvial Sand is found on approximately 50 hectares (ha). The average depth of the sand is approximately 3.5 m on Portion Re. of the farm Boschbank 12.

2.1.3. MINED PRODUCTS

Alluvial sand will be mined and sold to the local building industry surrounding the mine, as well as to Gauteng and the bigger Free State region.

2.1.4. PLANNED LIFE OF MINE

The current life of mine is approximately 10 years after the renewal of the mining rights until 2024 and 2025 (currently pending a Section 102 Application for consolidation of the Mining Rights). The mining schedule is summarised in **Table 6** below and indicated in **Figure 3** below.

Table 6: Mining schedule for the project area

Mining Area	Schedule	Proposed footprint (ha)	Proposed excavation depth (mbs)
Area A	515.00	0.91	5.00
Area B	1030.00	1.52	5.00

Area C	1545.00	2.38	5.00
Area D	2060.00	5.90	5.00
Area E	2575.00	10.76	5.00
Area F	3090.00	11.00	5.00
Area G	3605.00	9.42	5.00

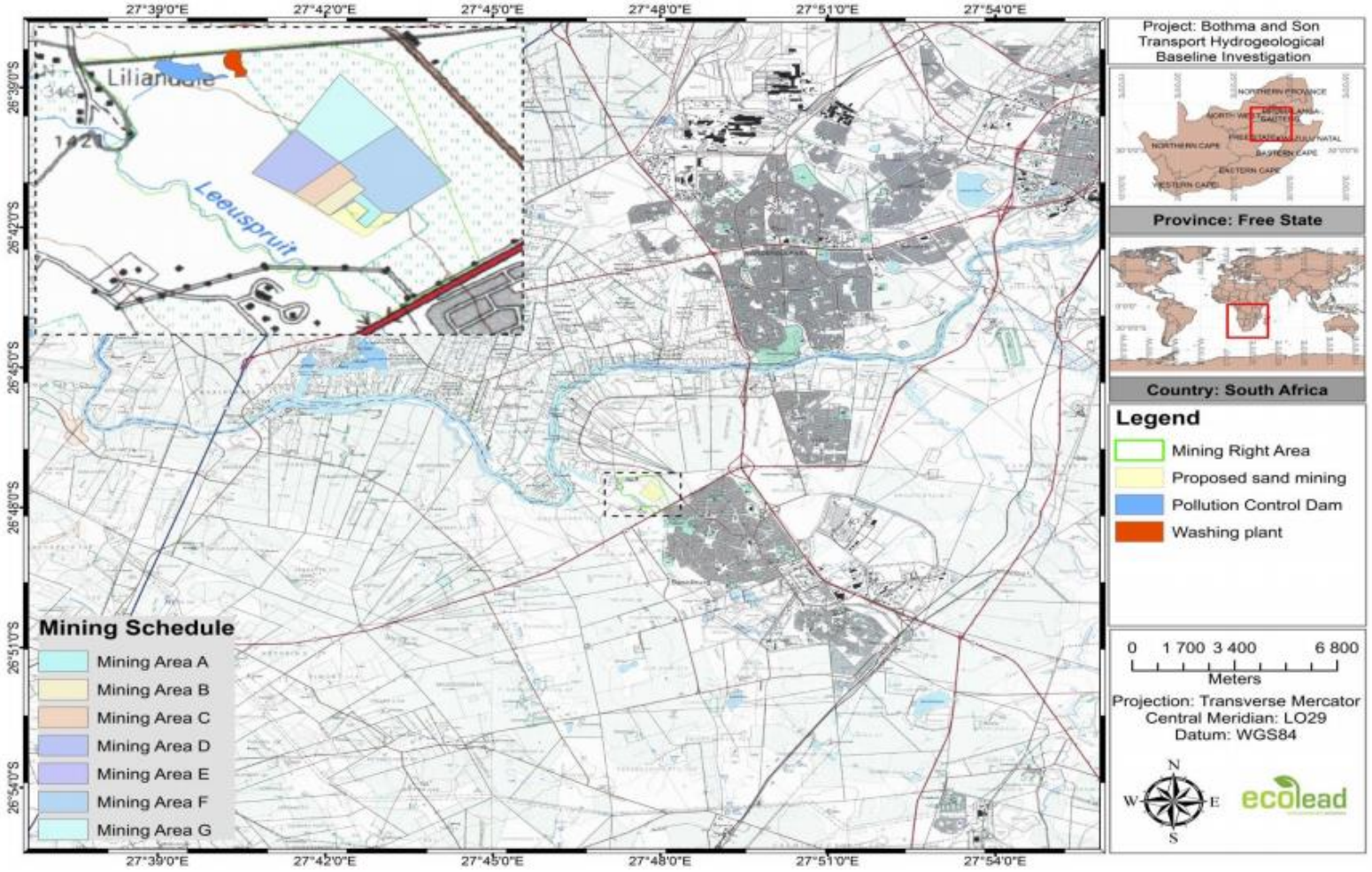


Figure 3: Site location and Mining Schedule

2.2. ACTIVITY LIFE DESCRIPTION

The operation is aimed at mining sand from a reserve of approximately 3 150 000 saleable tonnes of sand from an average depth of around 3.5 m, which is located in the Karoo Supergroup with shale, sandstone or mudstones of the Madsarinwe formation or the intrusive Karoo Suite dolerites. The sand is mined through opencast shovel and load. About 20% is sold as building sand out of the pit and 80% is put through the washing process plant and sold as plaster sand.

The Applicant has been mining sand for more than forty years and on this particular area since the late 1990's on the old mining right order as well as the new order mining right.

2.3. ACTIVITY INFRASTRUCTURE DESCRIPTION

The following section covers the on and off-site infrastructure for the Applicant located on Boschbank 12.

2.3.1. ACCESS ROADS

The Wonderfontein tarred road is used as an entrance to the mining area. No additional access roads will be required.

2.3.2. HAUL ROADS

There are existing mine roads within the mining area. No additional roads will be required. The location of haul roads will alter as the mining activities move from one area to the next.

Figure 4: Haul road and surrounding area

2.3.3. FENCING OF THE MINING AREA

A cattle fence has been established around the perimeter of the mining area.

2.3.4. BUILDINGS AND OTHER FACILITIES

No surface structures are situated within the proposed sand mining area. In the nearby surrounding vicinity there is a portable sand washing plant (refer to Figure 5), and a building contractor site. Mining infrastructure on the mine site consists out of portable chemical toilets as well as portable screening and washing plants. No permanent structures will be built.

Figure 5: Mobile washing and screening plant

Existing access roads are utilized and maintained. Existing power lines on mine sites or adjacent to mine sites will remain, as no new construction or relocation will take place.

All supporting infrastructure such as offices, mechanical workshops, refuelling facilities are situated at the main Bothma depot, which is located on a different site.

2.3.4.1. ELECTRICAL DISTRIBUTION

The power requirements for the Boschbank mine site is restricted to office and general lighting requirements and the restricted pumping of water. There are existing Eskom points on site that are currently used for the washing plant.

2.3.4.2. POTABLE WATER SUPPLY

Potable water consumption is estimated at 120 l/d per. Potable water is sourced from the local municipality with a road tanker.

2.3.4.3. POLLUTION CONTROL DAMS, CLEAN AND DIRTY WATER MANAGEMENT

The NWA (1998) requires that the dirty water originating from the mining operations is kept separate from the clean water systems outside and on top of the mining area.

Three Process and Settling Water dams occur onsite. The sand screening plant utilizes water out of the processing dam, which is filled with rain and surface water. The water is recycled to a settling dam after being utilized in the washing and screening process to be transferred to the process dam again. – refer to area map Boschbank 12 – mining reference FS 30/5/1/2/2/ 239 MR

2.3.5. REHABILITATION

Operational phase: Rehabilitation of the opencast mining area will be done concurrently with the opencast mining according to a stated mining sequence. The slopes of open mines shallower than 1.5 meters will be finished off to a gradient not steeper than 1:3 (18 degrees). All deeper areas will be finished at gradient not steeper than 1:2 (26 degrees). Materials, the residue of the sand washing process consisting out of inert silt will be placed back into the void in the sequence of the former strata i.e. topsoil on the surface, subsoil directly below the topsoil and all hard material (sandstone and shale) in the bottom of the void. The total disturbed area should be free draining. On completion of surface reinstatement, the area will be revegetated with suitable pasture grass species. The sand screening plants utilized is of portable nature and can be easily removed or re-located, currently taking place on the farm Boschbank 12.

Rehabilitation and closure phases: Supporting activities in the rehabilitation process: Such as levelling, sloping and contouring as well as administering of fertilizer and re-vegetation.

2.4. KEY WATER USES AND WASTE STREAMS

2.4.1. KEY WATER USES

The Water Uses, as defined in Section 21 of the NWA (1998) that take place or are proposed at Bothma and Son are described in detail in Section 3. However, several key Water Uses have been identified in **Error! Reference source not found.** below, in compliance with the format requirements for the IWWMP as stipulated by the DWS in their Operational Guideline for the compilation of IWWMPs (2010) and GNR 267 (2017).

Table 7: Water uses to be authorised

No	Proposed Development	Water Use (Section 21)	Purpose	Authorised quantity/capacity	Co-ordinates	Property Affected
1	Abstracting water from the Leeuwspruit	(a)	Sand processing. Meter installed.	± 22 500 m^3 per month	S26°47"36.6" E27°47"18.8"	Portion Re. of Boschbank 12
2	Spring water dam/ excavation,	(b)	Storing water from spring to prevent water from flowing through operations.	-	S26°47"25.9" E27°47"42.6"	Portion Re. of Boschbank 12
3	Mining infrastructure (including access roads) situated within 500m from watercourse and/ wetlands	(c) & (i)	Transporting of sand and workers on mine	-	S26°47"25.9" E27°47"42.6"	Portion Re. of Boschbank 12
4	Pollution Control Dam (Dam 1)	(c) & (i)	Storing of dirty water.	-	S26°47"23.2" E27°47"27.0"	Portion Re. of Boschbank 12

No	Proposed Development	Water Use (Section 21)	Purpose	Authorised quantity/capacity	Co-ordinates	Property Affected
5	Settlement Dam (Dam 2)	(c) & (i)	Settling of silt	-	S26°47"28.3" E27°47"25.6"	Portion Re. of Boschbank 12
6	Settlement Dam (Dam 3)	(c) & (i)	Settling of silt	-	S26°47"30.9" E27°47"20.4"	Portion Re. of Boschbank 12
7	Dirty Water Containment Facility (Option 2)	(c) & (i)	Containing dirty storm water	-	Facility a: S26°47"40.5" E27°47"33.8" Facility b: S26°47"46.5" E27°47"40.0"	Portion Re. of Boschbank 12
8	Dirty Water Containment Facility (Option 1)	(c) & (i)	Containing dirty storm water	-	S26°47"25.6" E27°47"37.9"	Portion Re. of Boschbank 12
9	Site Office Infrastructure	(c) & (i)	Some administrative work for mine	-	S26°47"23.5" E27°47"37.1"	Portion Re. of Boschbank 12

No	Proposed Development	Water Use (Section 21)	Purpose	Authorised quantity/capacity	Co-ordinates	Property Affected
10	Mining operations within wetlands.	(c) & (i)	Sand mining in seep and associated wetlands	-	S26°47"40.0" E27°47"30.0" and S26°47"52.5" E27°47"42.8" (Central points of the mining areas)	Portion Re. of Boschbank 12
11	Sump	(c) & (i)	Collection of dirty water	Unnamed pan and associated wetland	S26°47"32.7" E27°47"20.2"	Portion Re. of Boschbank 12
12	Silt traps	(c) & (i)	Collection of silt		Silt trap 1: S26°47"52.7" E27°47"50.1" Silt trap 2: S26°47"44.7" E27°47"37.0"	Portion Re. of Boschbank 12

No	Proposed Development	Water Use (Section 21)	Purpose	Authorised quantity/capacity	Co-ordinates	Property Affected
					Silt trap 3: S26°47"48.6" E27°47"42.4" Silt trap 4: S26°47"40.0" E27°47"32.4" Silt trap 5: S26°47"40.8" E27°47"35.4"	
13	Excavation Dam	(c) & (i)	Seepage from a local spring is collecting in a clean water dam		S26°47"23.7" E27°47"44.2"	Portion Re. of Boschbank 12
14	Pollution Control Dam (Dam 1)	(g)	Storing of dirty water		4 Corner Points: S26°47"25.4" E27°47"32.9" S26°47"26.0" E27°47"33.1"	Portion Re. of Boschbank 12

No	Proposed Development	Water Use (Section 21)	Purpose	Authorised quantity/capacity	Co-ordinates	Property Affected
					S26°47"24.7" E27°47"25.1" S26°47"22.6" E27°47"23.7"	
15	Settlement Dam 2 (Dam 2)	(g)	For settling of silt from processing plant	-	4 Corner Points: S26°47"26.5" E27°47"31.9" S26°47"28.6" E27°47"31.7" S26°47"30.9" E27°47"24.8" S26°47"28.2" E27°47"22.2"	Portion Re. of Boschbank 12
16	Settlement Dam 3 (Dam 3)	(g)	For settling of silt from processing plant	-	4 Corner Points: S26°47"01.2" E27°46"53.2" S26°47"30.7" E27°47"23.1"	Portion Re. of Boschbank 12

No	Proposed Development	Water Use (Section 21)	Purpose	Authorised quantity/capacity	Co-ordinates	Property Affected
					S26°47"33.4" E27°47"21.1" S26°47"30.2" E27°47"19.2"	
17	Dust Suppression	(g)	Suppression of dust	-	Whole Mine	Portion Re. of Boschbank 12
18	Sump	(g)	Collection of dirty water	-	Central point: S26°47"32.7" E27°47"20.2"	Portion Re. of Boschbank 12
19	Dirty Water Containment Facility 1	(g)	Containment of dirty storm water through the mining area	-	Central point: S26°47"48.9" E27°47"44.0"	Portion Re. of Boschbank 12
20	Dirty Water Containment Facility 2	(g)	Containment of dirty storm water through the mining area	-	Central point: S26°47"40.5" E27°47"33.8" And	Portion Re. of Boschbank 12

No	Proposed Development	Water Use (Section 21)	Purpose	Authorised quantity/capacity	Co-ordinates	Property Affected
					S26°47"46.5" E27°47"40.0"	

2.4.2. WASTE STREAMS

Sanitation will be in the form of portable chemical toilets provided and serviced by reputable supplier. Bins are provided on site for domestic waste, which is then disposed of at the local Metsimaholo waste disposal site and proof, in the form of disposal slips, is kept.

No moveable equipment maintenance or re-fuelling will take place on the mine area itself, the main depot is equipped with full maintenance workshop, as well as diesel refuelling station properly with concrete slabs and workshop pits to prevent spillage.

However, in the event of accidental spillage it will be handled in accordance with ISO 9001:2015 documented procedure Emergency Response. The Applicant has a service level agreement in place with a 24 hour spill response reputable supplier in Vereeniging, namely IFRT spill response, who will attend to any major spillages. In the event of minor spillage on site, the containment process is implemented, whereby saw dust is used to absorb the majority of the spill thereafter contaminated soil will be removed, bagged and disposed of by reputable supplier. Soil will be then treated with lime and top soiled.

TABLE 8: MINE WASTE STREAMS

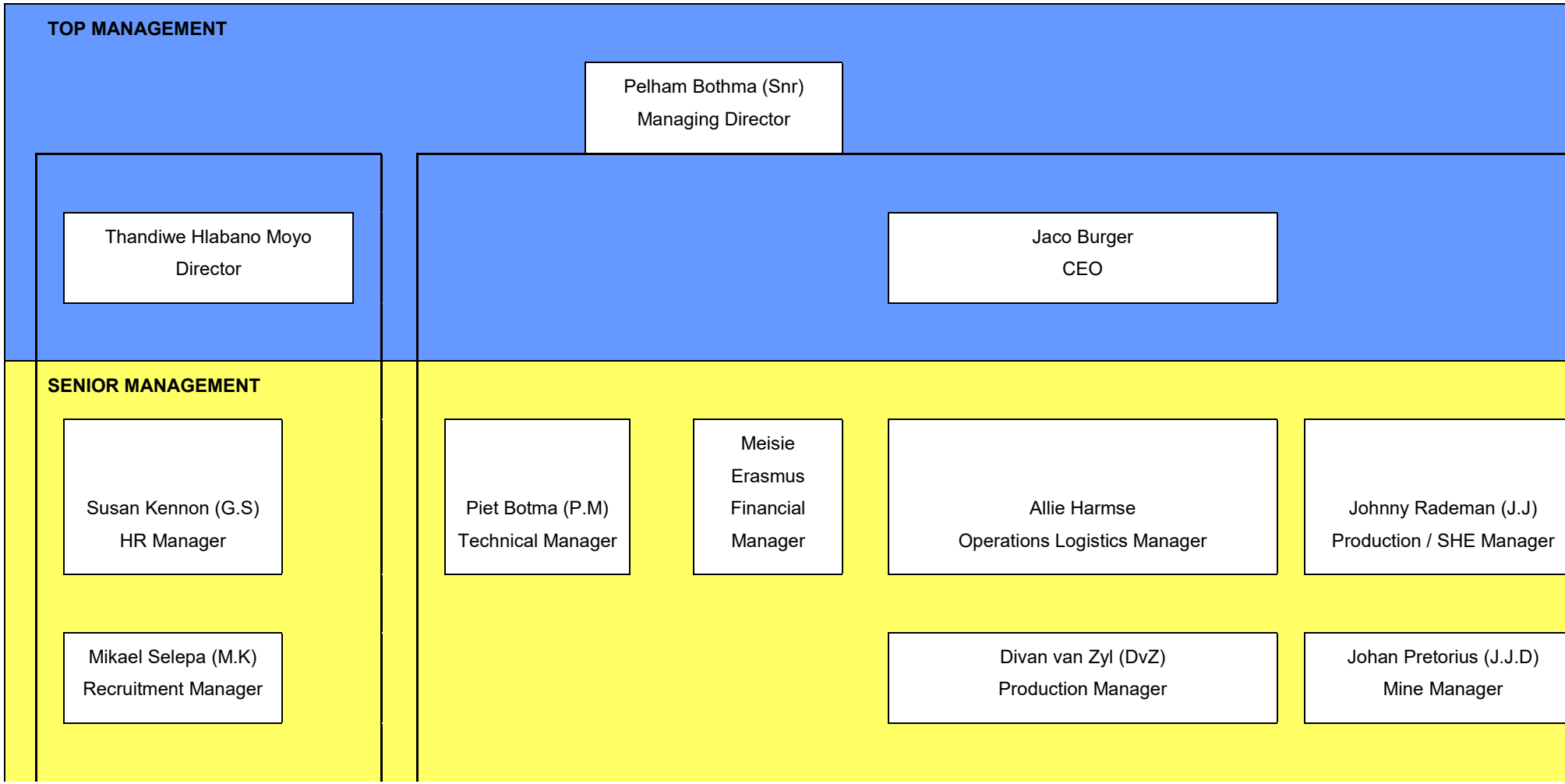
Waste type	Examples	Origin	Disposal
Non-hazardous waste			
Domestic waste	Paper, empty cans, glass, steel, plastic containers, food remains	Offices	All generated waste is transported and disposed of at the landfill site currently operated by the local municipality.
Industrial waste	Metals, rubber, tyres, conveyor sheets, piping and tubing (plastic, metal and rubber).	Operational Maintenance	Scrap steel is released to licensed scrap processors in accordance with NNR requirements. Rubber and PVC are disposed of via licenses
Hazardous waste			

Waste type	Examples	Origin	Disposal
Hydrocarbon containing waste	Chemicals, oils, greases, degreasers, lubricants, contaminated rags.	Office area	Chemicals, oils and greases are recycled via recognised recyclers.
Silt	Desilting of settlement dams.	Mining area	The silt needs to be analysed in order to determine if it is suitable for rehabilitation. Alternatively, it should be disposed of at a licensed site.

2.5. ORGANISATIONAL STRUCTURE OF ACTIVITY / COMPANY

Figure 6 below provides an illustration of the Applicant's organisational structure. Refer to Section 5.5 for a detailed description of the Applicant's organisational structure.

WORKFORCE PROFILE



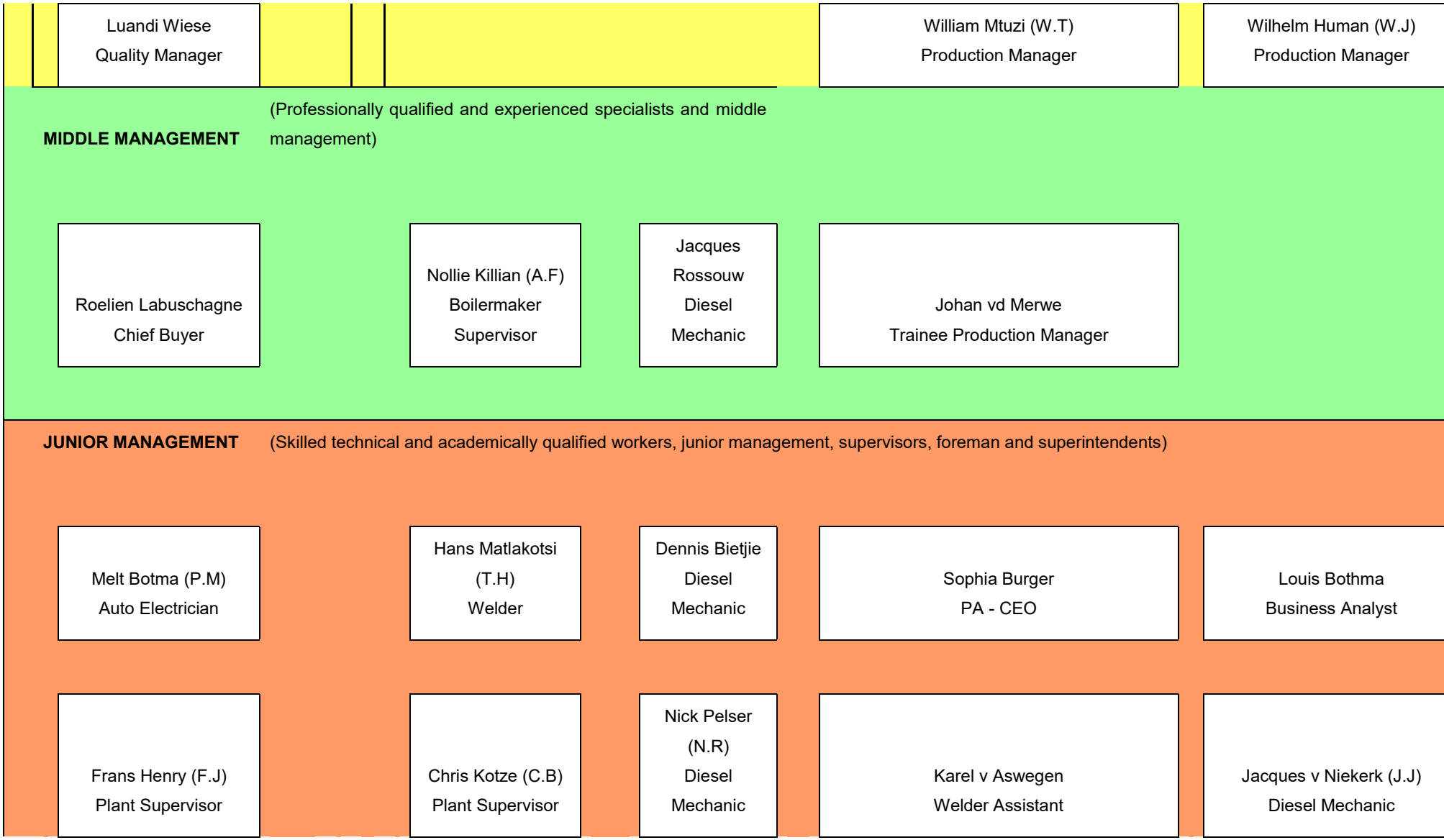

Luandi Wiese
Quality Manager
William Mtuzi (W.T)
Production Manager
Wilhelm Human (W.J)
Production Manager
MIDDLE MANAGEMENT
(Professionally qualified and experienced specialists and middle management)
Roelien Labuschagne
Chief Buyer
Nollie Killian (A.F)
Boilermaker
Supervisor
Jacques
Rossouw
Diesel
Mechanic
Johan vd Merwe
Trainee Production Manager
JUNIOR MANAGEMENT
(Skilled technical and academically qualified workers, junior management, supervisors, foreman and superintendents)
Melt Botma (P.M)
Auto Electrician
Hans Matlakotsi
(T.H)
Welder
Dennis Bietjie
Diesel
Mechanic
Sophia Burger
PA - CEO
Louis Bothma
Business Analyst
Frans Henry (F.J)
Plant Supervisor
Chris Kotze (C.B)
Plant Supervisor
Nick Pelser
(N.R)
Diesel
Mechanic
Karel v Aswegen
Welder Assistant
Jacques v Niekerk (J.J)
Diesel Mechanic

Figure 6: The organisational structure of the Applicant

2.6. BUSINESS AND CORPORATE POLICIES RELATED TO THE ENVIRONMENT

The Applicant. has various authorized implemented policies in place, including the Safety, Health and Environmental (SHE) Policy (Policy 8), which indicates the commitment to employees, the environment and resources.

The purpose of the SHE policy is to provide a guideline to ensure that responsibility to health, safety and the environment is adhered to al all times and as far as possible. To ensure that the Applicant's objectives on SHE is met, the mine focuses on:

- Striving to conduct its operations in a manner that minimises adverse environmental impacts and protects the health and safety of the employees and the public;
- The company recognises and responds to community concerns regarding the chemical usage and other related product in the operation of business;
- The company strives towards sustainable development and is committed to the continual improvement of its safety, health and environment;
- The company integrates health, safety, behavioural-based safety and environmental considerations in its planning for new products and processes;
- The company will report all the relevant information regarding chemicals that are hazards in terms of safety, health and environment to the relevant authorities;
- The company will give advice to customers and other affected parties on the safe use, transportation and storage of its products as well as the safe disposal of its residues and containers;
- The company will increase it's knowledge by conducting and/or supporting necessary research towards health, safety and environmental issues and effects of it's products to be transported, processes and waste material;
- The company co-operates with customers, authorities and affected parties to resolve problems created by the handling and disposal of chemical substances considered to be hazardous;
- The company promoted the principles and practises of Responsible Care by sharing its experiences and offering assistance to others who produce, handle, use, transport or dispose of chemicals;
- The company encourages its employees to activley participate and commit themselves to the SHE programmes, training and related aspects of the company; and
- The company encourages its employees in taking responsibility for themselves and other in furthering the SHE goals of the company.

3. REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

Section 21 of the NWA, defines several types of activities as Water Uses. Those activities undertaken by the Applicant that constitute a Water Use that are applicable to this IWWMP include:

- Section 21(a): Taking water from a water resource;
- Section 21(b): Storing water. This refers to the storage of clean / uncontaminated water;
- Section 21(c): Impeding or diverting the flow of water in a watercourse;
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

None of the water uses are licensed under Chapter 4 of the NWA (1998). Information on the new and existing water uses not yet authorised is provided below to inform decision making.

3.1. SUMMARY OF ALL WATER USES

The NWA gives effect to the rights enshrined in the Constitution of the RSA with regards to water resource management. The purpose of the Act is to provide for the protection, usage, development, conservation, management and control of the country's water resources in an integrated manner.

The NWA provides the legal basis upon which to develop tools and means to affect the said activities. One of these tools is the authorisation of the water uses as defined in Chapter 4 of the NWA. Section 21 of the NWA lists 11 water uses which can only be legitimately undertaken through the water use authorisation issued by DWS.

The Applicant has a Section 21(a) Water Use registered in terms of the NWA for Londondale 264 PA: Portion 2 (DWS reference number: 27/2/1/C22K/1-13941), which is not part of this WULA. However, for Portion Re. of the farm Boschbank 12, the Applicant does not have any registered water uses.

3.2. EXISTING WATER USES

The NWA makes provision for Section 21 Water Uses that could be considered to be Existing Lawful Water Uses, if they comply with the requirements of Section 32 of the NWA (1998), although the declaration of any Water Uses as Existing Lawful Water Uses is still at the discretion of the DWS.

Section 32(1) of the NWA (1998), defines an Existing Lawful Water Use as follows:

"An existing lawful water use means a water use -

(a) which has taken place at any time during a period of two years immediately before the date of commencement of this Act and which;

(i) was authorised by or under any law which was in force immediately before the date of commencement of this Act;

(ii) is a stream flow reduction activity contemplated in section 36(1); or

(iii) is a controlled activity contemplated in section 37(1).”

or

(b) which has been declared an existing lawful water use under section 33.”

The landowner, AM Rossouw (Eiendomme) Beperk, registration 2002/012161/07, Title Deed T19767/2005, has a registered water permit, reference 10003863, on the farm Boschbank 12, as well as the Remainder of the farm Boschbank total of 665.5621 ha for agricultural purposes. This is an existing lawful water use located on Portion Re. of the farm Boschbank 12.

3.3. RELEVANT EXEMPTIONS

In terms of Section 22(1) of the NWA a person may only use water:

(a) without a licence

i. if that water use is permissible under Schedule 1 of the NWA;

ii. if that water use is permissible as a continuation of an existing lawful use; or

iii. if that water use is permissible in terms of a general authorisation issued under Section 39.

(b) if the water use is authorised by a licence under the NWA; or

(c) if the responsible authority, namely the Chief Director: Regulation in DWA, has dispensed with a licence requirement.

GN 704 and Regulation 77 of the NWA (Act 36 of 1998) place restrictions on the mining activities for the protection of water resources. Of relevance to the Applicant is the restrictions placed on locality (Section 4), which states:

“No person in control of a mine or activity may –

(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor;

(b) except in relation to a matter contemplated in regulation 10, carry on any underground or opencast mining, prospecting or any other operation or activity under or within the l:50 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is the greatest;

(c) place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or

(d) use any area or locate any sanitary convenience, fuel depots, reservoir or depots for any substance which causes or is likely to cause pollution of a water resource within the 1:50 year flood-line of any watercourse or estuary."

The wetland and geohydrologist specialists have delineated the wetlands and watercourses associated with the study area. The proposed mining, as well as the temporary infrastructure lies within watercourses and is, therefore, located in the "no-go" area in terms of section 4(b) of GN 704. Therefore, an exemption will be required from the requirements of Sections 4 of GN 704 as per Section 3 of GN 704 for the mining of wetlands and watercourses for the Applicant located on Portion Re of the farm Boschbank 12.

3.4. GENERALLY AUTHORISED WATER USES

In terms of Section 22(1) of the NWA a person may use water without a licence if that water use is permissible in terms of a General Authorisation (GA) issued under Section 39 of the Act.

An assessment was done of the General Authorisations under the NWA, namely:

- General Authorisation No. 970, dated 15 April 2016 in terms of Sections 21(a) and (b) water uses,
- General Authorisation No. 655, dated 6 September 2013 in terms of Sections 21 (e), (f) (g), (h) and (j) water uses;
- General Authorisation No. 509, dated 26 August 2016 in terms of Sections 21 (c) and (i) water uses; and
- General Authorisation No. 1198, dated 18 December 2009 in terms of Sections 21(c) and (i) for the purpose of rehabilitating a wetland for conservation purposes.

The conclusion was that there are no water uses associated with the Applicant that could be considered as General Authorisations.

3.5. NEW WATER USES TO BE LICENCED

All the new and proposed water uses at the Applicant's project area are located on Portion Re. of the farm Boschbank 12 are included in **Error! Reference source not found.**: Summary of Water Uses above and indicated in Figure 7 below. The completed Water Use Licence Forms will be submitted to the DWS simultaneously with the submission of this IWWMP. A summary of the mine's new and proposed Water Uses for ease of reference is indicated below:

3.5.1. SECTION 21 (A) – TAKING WATER FROM A WATER RESOURCE

Water is abstracted from the Leeuspruit for the purpose of the processing of sand on the mine. The water is pumped from the Leeuspruit River to the S Bothma Dam 1 to ensure that enough water is

available in the dam for washing. Approximately, 22 500 m^3 of water is abstracted from the Leeuspruit per month.

3.5.2. SECTION 21(B) – STORING WATER

A natural spring occurs on the north-eastern corner of the property. The water naturally gravitates and is channelled underneath the haul road to flow into an old excavation. The water from the spring is not used for any activities on the mine. Approximate flow rate measured at 1 litre per second (l/s), which is stored in the excavation dam to prevent water from flowing through the mining operations.

3.5.3. SECTION 21(C) – IMPEDING OR DIVERTING THE FLOW OF WATER IN A WATERCOURSE AND SECTION 21 (I) – ALTERING THE BEDS, BANKS, COURSE OR CHARACTERISTICS OF A WATER COURSE

Mining infrastructure (including access roads) and operations fall within 500 m of wetlands and as such trigger the requirement for a Section 21 (c) and (i) water use according to the DWS's current interpretation of the regulations. Seepage from the local spring is being stored in the excavation dam, therefore, impeding the flow of the water and altering the characteristics of the watercourse.

3.5.4. SECTION 21(G) – DISPOSING OF WASTE IN A MANNER WHICH MAY DETRIMENTAALY IMPACT ON A WATER RESOURCE

The PCD (Dam 1), the two Settlement Dams (Dam 2 and 3), the sump, dust suppression and the proposed new dirty water containment structures (indicated in the storm water management plan), will trigger this water use. The sediment from the settling dam water is used for rehabilitation. This may be a source of contamination within the catchment.

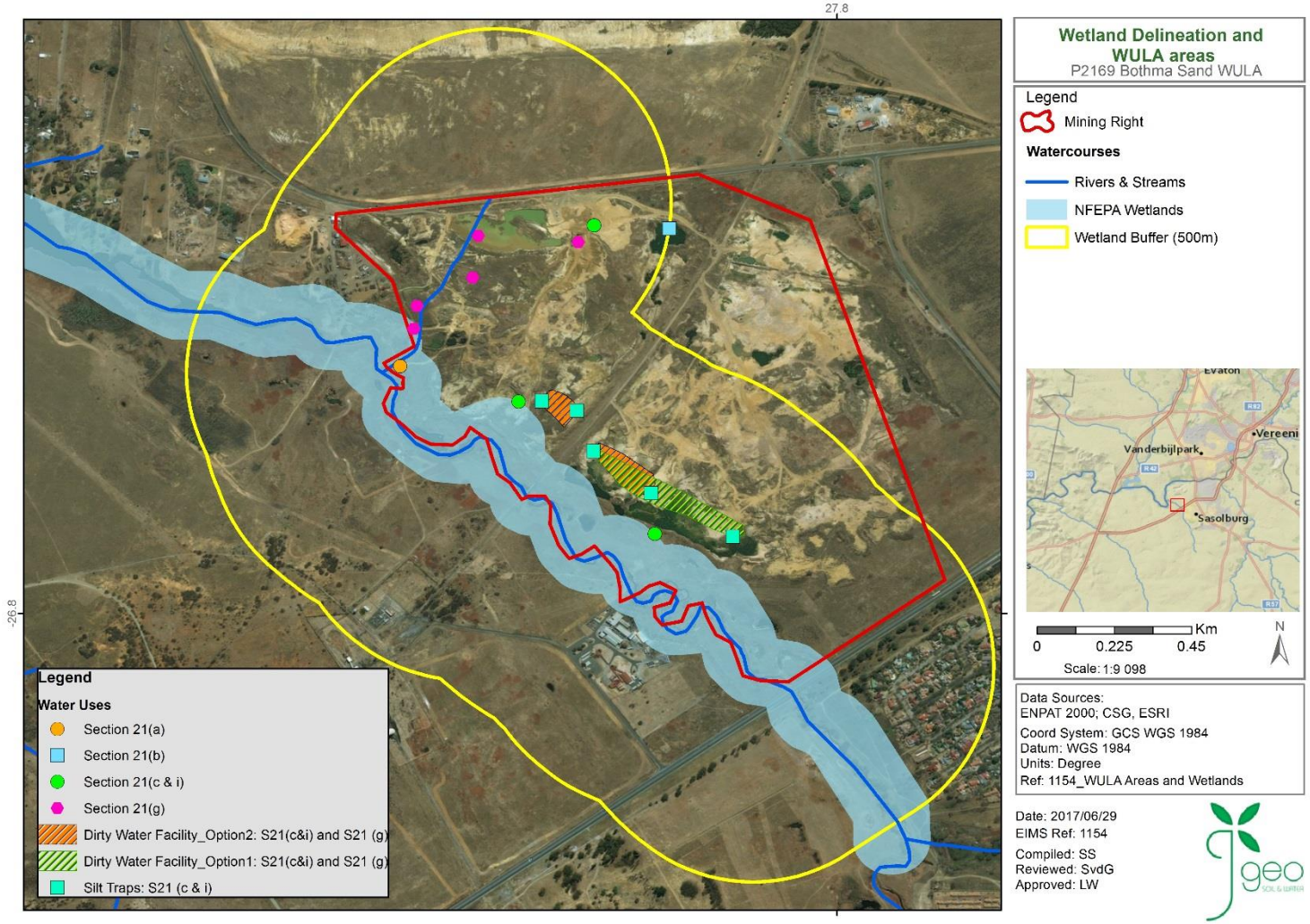


Figure 7: Section 21 Water Uses and the surface water features

3.6. WASTE MANAGEMENT ACTIVITIES (NEMWA)

Waste is regulated under the National Environmental Management Waste Act (NEMWA) (Act No. 59 of 2008). NEMWA defines "waste" as the following: “any substance, whether or not that substance can be reduced, reused, recycled and recovered:

(a) That is surplus, unwanted, rejected, discarded, abandoned or disposed of;

(b) That is surplus, unwanted, rejected, discarded, abandoned or disposed of;

(c) Which the generator has no further use of for (the purposes of production);

(d) That must be treated or disposed of; or

(e) 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;” for.

3.7. WASTE RELATED AUTHORISATIONS

No waste related authorisations are held by the Applicant located on Portion Re. of Boschbank 12 for non-mining waste related activities. Domestic waste generated on-site will be transported for disposal at their registered disposal site.

3.8. OTHER AUTHORISATIONS AND REGULATIONS

The operation is in possession of two Mining Rights (reference numbers: FS 30/5/1/2/2/ 161 (10014) MR and FS 30/5/1/2/2/239 MR) issued by the DMR under the provisions of the MPRDA. These Mining Rights are currently pending a Section 102 application for consolidation thereof. The Applicant conducts annual performance audits on the EMPs compliance (refer to Appendix G). This WULA is applicable to Portion Re. of the farm Boschbank 12.

Table 9: The current mining right approved lifetimes

Area description:	Mining right reference:	Expiry Date:	Status:
The remainder of the farm Boschbank 12	FS: 30/5/1/2/2 161 MR	25.02.2014	Extension of Mining Rights has been requested and granted by DMR.
The farm Boschbank 12	FS: 30/5/1/2/2 239 MR	14.07.2015	

4. PRESENT ENVIRONMENTAL SITUATION

4.1. CLIMATE

The project area is situated on the Highveld in the northern most extent of the Free State Province, which borders the Gauteng Province to the north. The area is located on the escarpment, at an average altitude of1440 metres above sea level (masl). The winters are generally dry and cold with frost and intermittent light rain. The summers are mild with most of the rainfall, frequently in the form of thundershowers, occurring during the summer. The area is also collectively known as the Vaal Triangle, with many industries in the area.

4.1.1. TEMPERATURE

The temperature data for the Leitrum meteorological monitoring station was obtained from Sasol, located to the south of the project area in Sasolburg. The annual maximum, minimum and mean temperatures for Leitrumare given as 24.7°C, 10.5°C and17.1°C, respectively, based on the 2010 record. Average daily maximum temperatures range from28.5°C in October to 19°C in July, with daily minimum ranging from17°C in January to 1°C in June (Table 10).

TABLE 10: MAXIMUM, MINIMUM AND MEAN MONTHLY TEMPERATURES FOR LEITRUM (2010)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum (°C)	25	28	27	24	22	20	19	23	28	28	26	27
Minimum (°C)	17	16	15	12	7	1	3	4	10	12	14	16
Mean(°C)	20	21	20	17	14	10	10	13	18	20	20	21

4.1.2. WIND

The prevailing wind direction is north-easterly and north-westerly. Winds are generally light to moderate except during thunderstorms when the northerly and north-north westerly winds predominate. In Table 11 the average monthly wind velocity and maximum wind velocity for each month of the year are given, as measured over the period March 1993 to January 2011 at Vereeniging.

TABLE 11: MONTHLY MEAN AND MAXIMUM HOURLY WIND VELOCITY OVER THE PERIOD MARCH 1993 TO JANUARY 2011 AS MEASURED AT VEREENIGING (0438784)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Speed (km/h)	2.9	2.6	2.4	2.4	2.3	2.5	2.6	3.0	3.4	3.7	3.5	3.5
Maximum Speed (km/h)	11.2	10.1	9.1	18.8	12.9	20.0	22.5	17.8	13.9	14.6	13.4	12.0

4.1.3. POTENTIAL EVAPORATION

Monthly Symons Pan (S-Pan) evaporation was calculated from the WR 90 study and is indicated in Table 12 below. The site is located in evaporation zone 11A. Natural open water monthly lake evaporation was calculated by multiplying the monthly S-Pan evaporation with monthly pan factors for open water evaporation provided in the WR 90 study. Evaporation is highest over the summer months.

TABLE 12: AVERAGE MONTHLY S-PAN EVAPORATION

Months	Symons Pan Evaporation (mm)	Lake Evaporation Factor	Lake Evaporation (mm)
January	199	0.84	167
February	160	0.88	141
March	146	0.88	128
April	106	0.88	94
May	81	0.87	70
June	61	0.85	52
July	69	0.83	57
August	99	0.81	81
September	140	0.81	113
October	178	0.81	144
November	185	0.82	152
December	201	0.83	167
Total	**1625**	**Not Applicable**	**1366**

4.1.4. RAINFALL

The mine falls within a summer rainfall area. The majority of the rainfall occurs from October through to April (Figure 8). with rainfall mainly occurring as sudden downpours and thunderstorms. The highest 24-hour rainfall recorded between 1953 and 2000 at the Sasolburg rainfall station (closest rainfall station to site) was 118.8 mm, which occurred in October 1959 (Kuntz, 2004). The Mean Annual Precipitation (MAP) adopted for the site is 639 mm (Smithers and Schulze, 2002) The summer months

experience on average 10 to 14 rain days month, with only 1 to 2 rain days occurring within the winter months. The annual average number of rain days is given as 88 based on the long-term record.

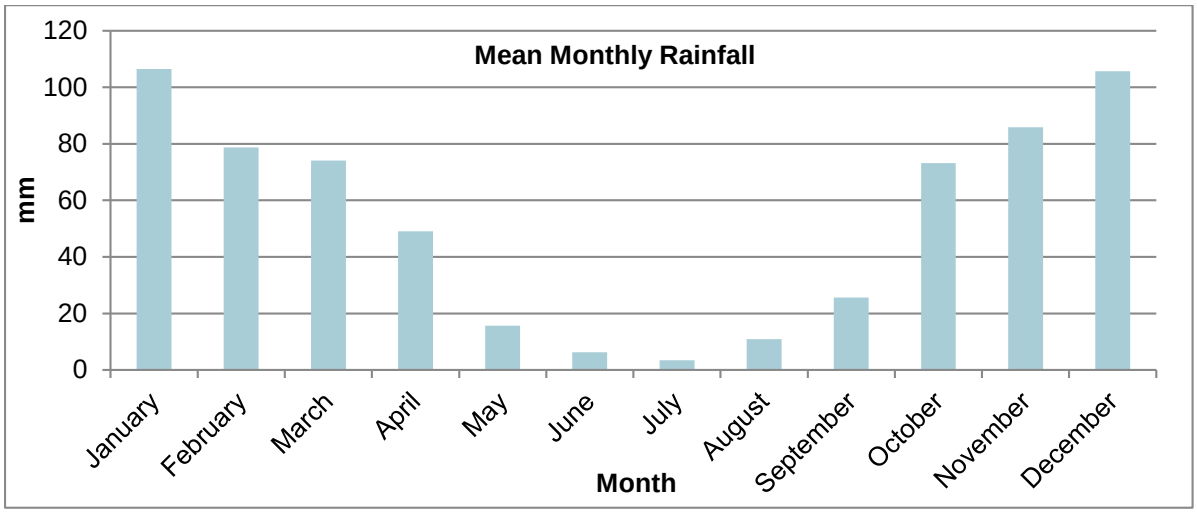


FIGURE 8: MEAN MONTHLY RAINFALL FOR THE SASOLBURG RAINFALL STATION (0438588_W)

4.2. SURFACE WATER AND HYDROPEDOLOGY

4.2.1. WATER MANAGEMENT AREA

The project area lies within the quaternary catchment C22K, within the Upper Vaal Water Management Area (WMA8). The Upper Vaal WMA is a pivotal WMA in the country lying within the eastern interior of South Africa. It is situated in a sem-arid part of the country with a mean annual precipitation of 600 – 800 mm. Large quantities of water are retransferred into the area from the two neighbouring areas, as well as water sourced from the Upper Orange River via Lesotho. Similarly, large quantities of water are transferred out to three other WMAs, which are dependent on water from the Upper Vaal WMA to meet their requirements.

4.2.2. WETLAND ASSESSMENT

A wetland assessment was conducted by The Biodiversity Company in February 2017 (refer to Appendix B). The objective of the wetland study was to:

- Characterise the current state of the local river systems;
- To delineate and assess the wetlands within 500m of the project area;
- To conduct a risk assessment for the proposed development; and
- To prescribe mitigation measures and provide recommendations for identified risks.

The results of the wetland study are discussed below.

4.2.2.1. *IN SITU* WATER QUALITY

In situ water quality analysis was conducted in the Leeuspruit River, (LR1 is a reach of the Leeuspruit River located upstream from the mine. The site is characterized by slow flowing waters over muddy substrate with marginal and aquatic vegetation as the dominant biotope. The results are indicated in Table 13 below.

TABLE 13: IN SITU WATER QUALITY OF THE LEEUSPRUIT RIVER

Site	pH	Conductivity (µS/cm)	Dissolved Oxygen (DO) /mg/l	DO Saturation (%)	Temperature (°C)
TWQR*	**6.5-9.0**	**<700**	**>5.00**	**80-120**	**5-30**
LR1	8.3	866	9.32	131.60	26.20

*Levels exceeding recommended guideline levels are indicated in red

Most fresh waters are usually relatively well buffered and more or less neutral, with a pH range from 6.5 to 8.5, and most are slightly alkaline due to the presence of bicarbonates of the alkali and alkaline earth metals (Barbour et al, 1996). The pH target for fish health is ranges between 6.5 and 9.0. As can be seen from the above. The pH value Leeuspruit River fell within the recommended guideline levels and did not have a limiting effect on local aquatic biota at the time of the survey.

Electrical conductivity (EC) is a measure of the ability of water to conduct an electrical current. This ability is a result of the presence in water of ions such as carbonate, bicarbonate, chloride, sulphate, nitrate, sodium, potassium, calcium and magnesium, all of which carry an electrical charge. The EC levels in the Leeuspruit River exceeded recommended guideline levels and was possibly a limiting factor of aquatic biota at the time of the survey. Possible input of ions may stem from a combination of the nearby ash dump, Sasolburg residential area, Waste Water Treatment Works (WWTW) and mining area located a short way upstream.

The maintenance of adequate Dissolved Oxygen (DO) is critical for the survival of aquatic biota as it is required for the respiration of all aerobic organisms (DWS, 1996). Therefore, DO concentration provides a useful measure of the health of an ecosystem (DWS, 1996). The median guideline for DO for the protection of freshwater fish, determined by a variety of fish faunas is >4 - 5 mg/ℓ (Doudoroff & Shumway, 1970 and DWS, 1996). Exposure to DO concentrations below 2 mg/l will lead to death of most fish (UNESCO, 1996). Percentage saturation (% sat) is the amount of oxygen (O2) in a litre of water relative to the total amount of oxygen that the water can hold at that temperature. DO levels fluctuate seasonally and diurnally over a 24-hour period and vary with water temperature and altitude (DWS, 1996). The South African Water Quality Guidelines (1996), state that the target water quality range (TWQR) for DO to protect aquatic biota through most life stages is 80% - 120% of saturation, and that saturation levels below 40% would be lethal. During the survey DO levels in the Leeuspruit

River were above the minimum prescribed limits, with the DO saturation exceeding the upper limit. The recorded DO levels would have had a limiting factor on the local aquatic biota provided the elevated levels above 120% persist. Elevated levels result in DO supersaturation which may lead to Gas Bubble Disease in fish.

The water temperature plays an important role in aquatic ecosystems by affecting the rates of chemical reactions and, therefore, also the metabolic rates of organisms (DWS, 1996). Temperature affects the rate of development, reproductive periods and emergence time of organisms (DWS, 2005b). Temperature varies with season and the life cycles of many aquatic macroinvertebrates are cued to temperature (DWS, 2005b). During the survey water temperatures in the Leeuspruit River was within recommended guideline levels and was not expected to have a negative effect on the aquatic ecosystem.

4.2.2.2. WETLAND CLASSIFICATION AND DELINEATION

The Leeuspruit on the south-western boundary is classified as National Freshwater Ecosystem Priority Areas (NFEPA) wetland, namely a floodplain system. The system is not an ecological priority area and is considered to be a riverine system in a largely to seriously modified state (Figure 9).

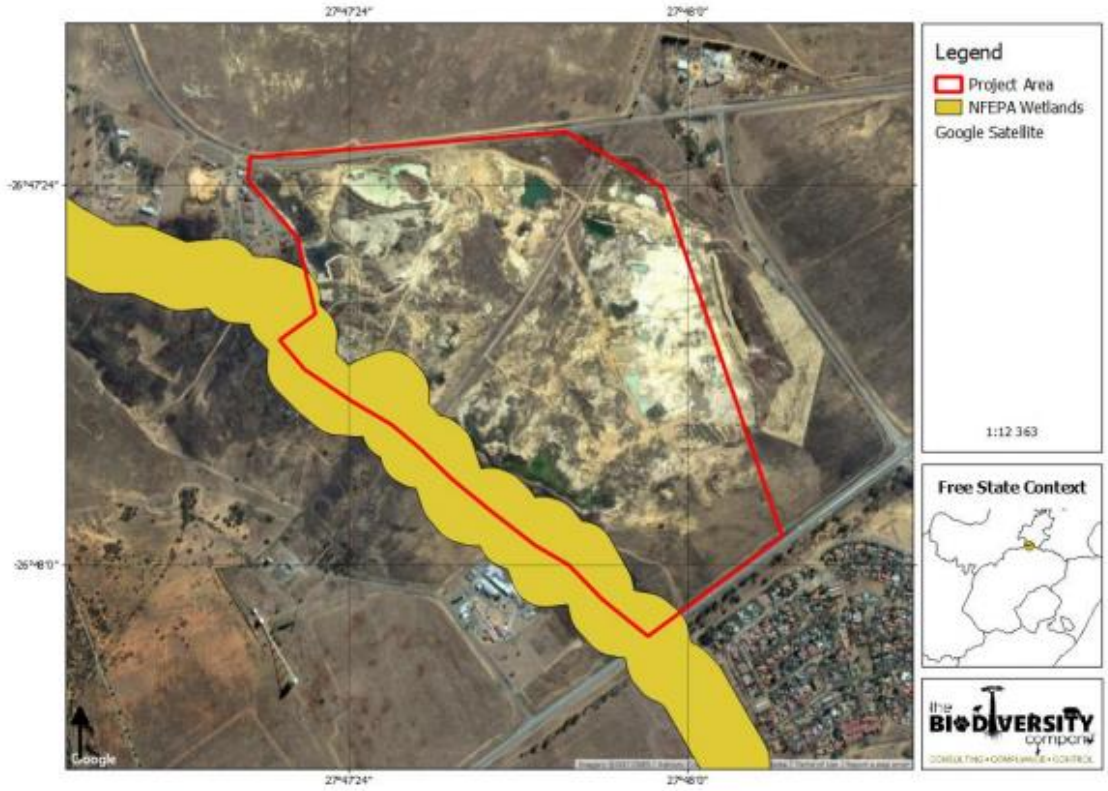


Figure 9: The NFEPA wetland within 500m of the project area

Three (3) hydrogeomorphic (HGM) units were identified within the 500m project assessment boundary, namely:

- Floodplain (HGM 1);

- Channelled Valley Bottom (HGM2); and
- Seepage 1(HGM3)1.

These are indicated in Figure 10 below and classified in **Table 14** below.

Figure 10: Wetland units identified within the project area

Table 14: Wetland classification as per SANBI guideline (Ollis, Snaddon, Job, & Mbona, 2013)

Unit	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregions/	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
HGM 1	Inland	Highveld	Dry Highveld Grassland	Plain	Floodplain	Floodplain Flat	N/A
HGM 2	Inland	Highveld	Dry Highveld Grassland	Valley floor	Channelled Valley bottom	N/A	N/A

HGM 3	Inland	Highveld	Dry Highveld Grassland	Slope	Seep	N/A	N/A

4.2.2.3. WETLAND- PRESENT ECOLOGICAL STATUS (PES) DETERMINATION

The PES results are described in the sections below with Table 15 showing the combined results. The valley bottom and seepage wetlands have been mined and the worst-case scenario has been assigned for these areas. As a result of this, an ecological status and functioning assessment was only conducted for the floodplain system.

TABLE 15: THE PES RESULTS FOR THE WETLANDS

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM1	29	D: Largely Modified	4.5	C: Largely modified	3.8	C: Largely modified	3.7
Overall PES Score		4.1		**Overall PES Class**		D: Largely modified	
HGM 2	2	F: Critically Modified	10	F: Critically Modified	10	F: Critically Modified	10
Overall PES Score		10		**Overall PES Class**			
HGM 3	115	F: Critically Modified	10	F: Critically Modified	10	F: Critically Modified	10
Overall PES Score		10		**Overall PES Class**		F: Critically Modified	

The overall PES score for the floodplain (HGM1) was that of a D (Largely Modified). The hydrological component of the HGM unit was categorised as a D (Largely Modified). The wetland has been altered by the infilling of small portions at road crossings. The catchment is within an urban area and the impervious areas have altered the hydrology of the catchment.

The geomorphology of the wetland was categorised as a C (Moderately Modified). The geomorphological health has been impacted on by the altered hydrological conditions, and also the encroachment of developments into the system.

The vegetation component was categorised as a C (Moderately Modified). The vegetation component was affected by the alien vegetation in places, however, large areas were dominated by natural vegetation.

4.2.2.4. WETLAND ECO SERVICES: FUNCTIONAL ASSESSMENT

The Ecosystem services provided by the HGM units present at the site were assessed (where possible) and rated. Ecosystem services could not be assessed for the valley bottom and seepage wetland as these areas have been mined. Table 16 below provide the ecoservice rating of likely extent to which a benefit is being supplied, while

Table 17 summarise the eco-services provided by HGM 1.

TABLE 16: ECOSERVICES RATING OF LIKELY EXTENT TO WHICH A BENEFIT IS BEING SUPPLIED

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

TABLE 17: THE ECOSERVICES BEING PROVIDED BY THE WETLAND HGM1

Wetland Unit					HGM 1
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		2,5
			Streamflow regulation		1,7
			Water Quality enhancement benefits	Sediment trapping	1,6
				Phosphate assimulation	1,4
				Nitrate assimulation	1,3
				Toxicant assimulation	2,0
				Erosion control	2,4
			Carbon storage		1,7
	Direct Benefits	Biodiversity maintanance			0,8
		Provisioning benefits	Provisioning of water for human use		1,1
			Provisioning of harvestable resources		0,8
			Provisioning of cultivated foods		0,4
		Cultural benefits	Cultural heritage		0,0
			Tourism and recreation		0,7
			Education and research		0,8
Overall					19,1
Average					1,3

4.2.2.5. ECOLOGICAL IMPORTANCE AND SENSITIVITY

The EIS assessment was applied to the HGM1 unit to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in Table 18 below.

TABLE 18: THE EIS RESULTS FOR THE PROJECT AREA

Wetland Importance and Sensitivity	
HGM 1	
	Importance
Ecological Importance & Sensitivity	1, 8
Hydrological / Functional Importance	1, 8
Direct Human Benefits	0,6

HGM 1 showed Moderate (C) level of importance for the Ecological Integrity & Sensitivity as well as for the Hydrological Importance. The Direct Human benefits were rated to be marginally important with a (D) rating.

4.2.2.6. SUMMARY OF FINDINGS

The system associated with the Applicant's mining operation is in a seriously modified state. This is due to the modifications to instream habitat, wetland and riparian zone continuity, flow modifications and large potential impacts on physico-chemical conditions (water quality). Eight species of fish are expected to occur within the catchment, with none being of conservation importance. During the assessment, a single exotic and highly invasive fish species was recorded. According to the 2017 baseline survey, the Leeuspruit River reach associated with project area is in a seriously modified state. Water quality was in a modified state, with elevated DO saturation levels and elevated conductivity levels observed. These parameters should be monitored as elevated levels will potentially have a limiting effect on local aquatic biota. Both the biotic integrity and fish assemblages were seriously modified as a result of poor water quality and limited habitat that served as limiting factors within the Leeuspruit River.

4.2.3. HYDROPEDOLOGY

According to the wetland specialist (Appendix B), hydropedology aims to address two fundamental questions (Lin, 2012):

1. How do soil architecture and the associated distribution of soils over the landscape exert a first-order control on hydrologic processes (and related biogeochemical dynamics and ecological functions)?

2. How do hydrologic processes (and the associated transport of energy and mass) influence soil genesis, evolution, variability, and function across space and time?

According to Lin (2012) the successful management and use of land, and also effective point scaling from point observations to landscape processes is an in situ understanding of flow and transport processes in natural soils. The focus of pedology has shifted from classification and inventory, to now understanding and quantifying variable processes upon which the water cycle and ecosystems depend (Lin et al., 2005, 2006b).

4.2.3.1 GEOLOGY AND SOILS

According to the 1:250 000 geological map, superficial formations comprises mainly of mudrock, rhythmite, siltstone and fine- to coarse-grained sandstone of the Vryheid formation and Ecca Group. The different lithofacies are generally arranged in upward-coarsening deltaic cycles (up to 80m thick in the southeast). Fining-upward fluvial cycles are typically sheet-like in geometry, although some form valley-fill deposits. They comprise coarse-grained to pebbly, immature sandstones - with an abrupt upward transition into fine-grained sediments and coal seams. The Vryheid Formation is underlain by basement rocks comprising diamictites of the Dwyka Group and unidentified volcanic rocks. Surficial alluvial bodies, as well as unconsolidated quaternary deposits formed during the Quaternary Period and are noted all along the riparian zones of drainages traversing the project area.

The geology of the project area is constituted of shale of Ecca shale and sandstone, with many dolerite sills. Sporadic occurrence of Basement Complex granite in the west. Occasional small pans occur. According to the land type database (Land Type Survey Staff, 1972 - 2006) the development falls within the Dc7 and Ca1 land types. It is expected that, the dominant soils in the crest and midslope positions will be soils of the Longlands, Kroonstad, Valsrivier, Bonheim and Swartland forms. The soil that dominated the footslopes and the valley bottoms are Kroonstad, Longlands, and Rensburg soil form.

4.2.3.2 SOILS AND HYDROLOGICAL HILLSLOPE CLASSES

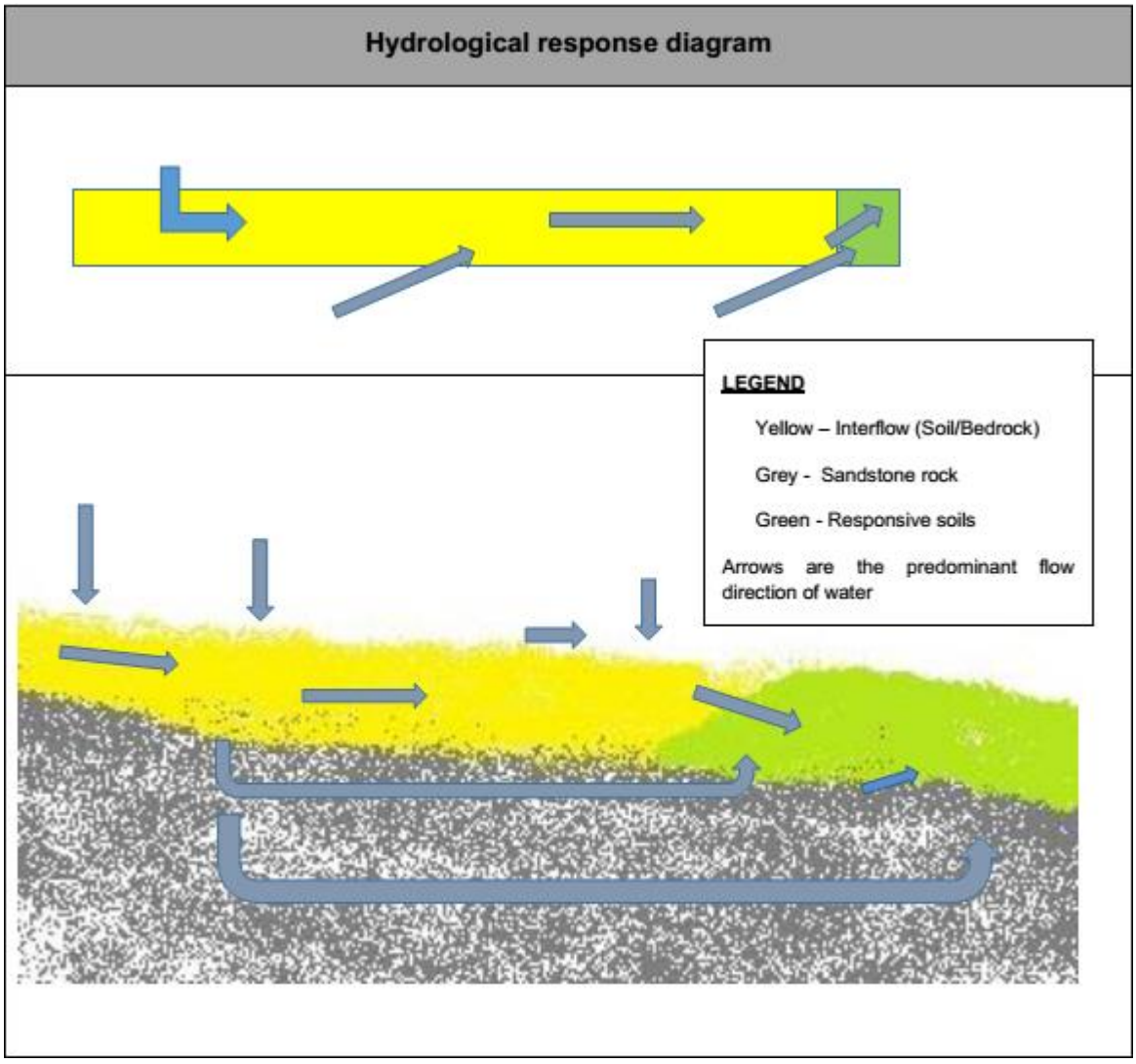
The soils seen by the wetland specialist on site indicated that the area is dominated by Ehorizon soils such as, Longlands and Kroonstad. Longlands soils form the cornerstone of the hillslope seepage wetlands. The dominant flow path in these soils are laterally downslope through the soil, leaching these soils. These soils are interflow soils and play a significant part in the subsurface feed to the wetlands. By mining these soils large quantities of flow could be cut-off or contaminated. The valley bottom areas show a steady accumulation of clays and a decreased slope which causes the formation of permanent wetland features. These are the areas where the Katspruit soil forms dominate. Based on the limited soils data for the site the project area is assumed to have Longlands, Westleigh, and Kroonstad soils in the midslopes positions and Katspruit soils in the valley bottom positions as shown in Figure 11 below.

Figure 11: Assumed soil forms for the project area

The hydrological soil classes are shown in Figure 12 below along with the selected transect. The dominant flow path in these transects are as shown in Table 19. The crest to midslope positions are dominated by Interflow soils. Water moves through the interflow portion which consists of sandy leached Longlands soils. The flow is lateral and then recharges the stream/rivers. The wetlands are fed largely by these interflow portions and they are crucial to the wetlands health.

Figure 12: The hydrological soil types for the project area

Table 19: Hydrological hillslope classification and dominant flow paths for the transect at the mine



4.2.4. SURFACE WATER HYDROLOGY

4.2.4.1. OVERVIEW

The Leeuspruit forms the western boundary of the mine boundary. The Vaal River is situated to the south and west of the mining area, but further than 500m from the active mining area. A natural spring occurs in the northern corner of the mining boundary (refer to Figure 13 below). The project area lies within the C22K quaternary catchment (refer to Figure 14 below)

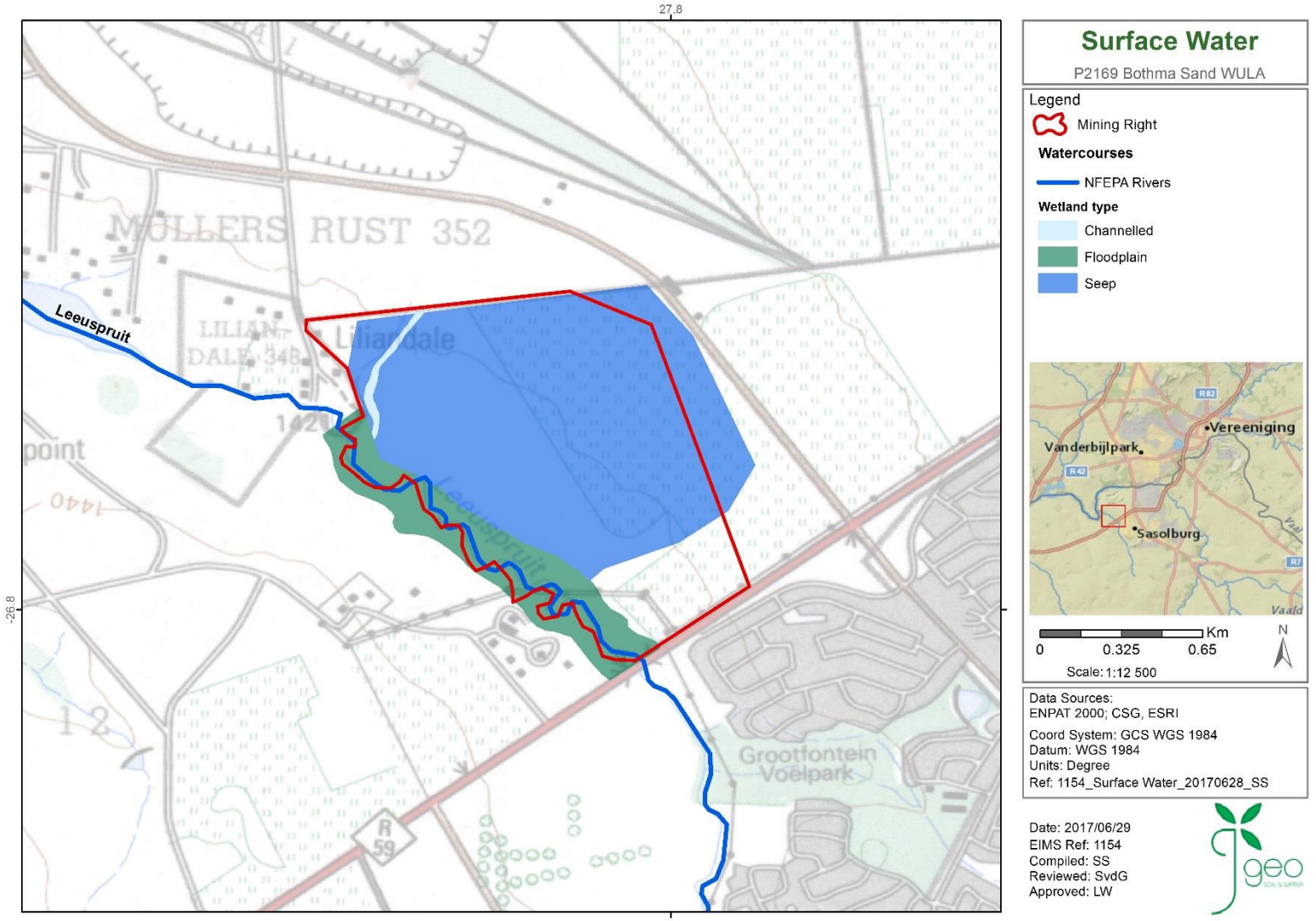


Figure 13: Surface water features in and around the mining right boundary

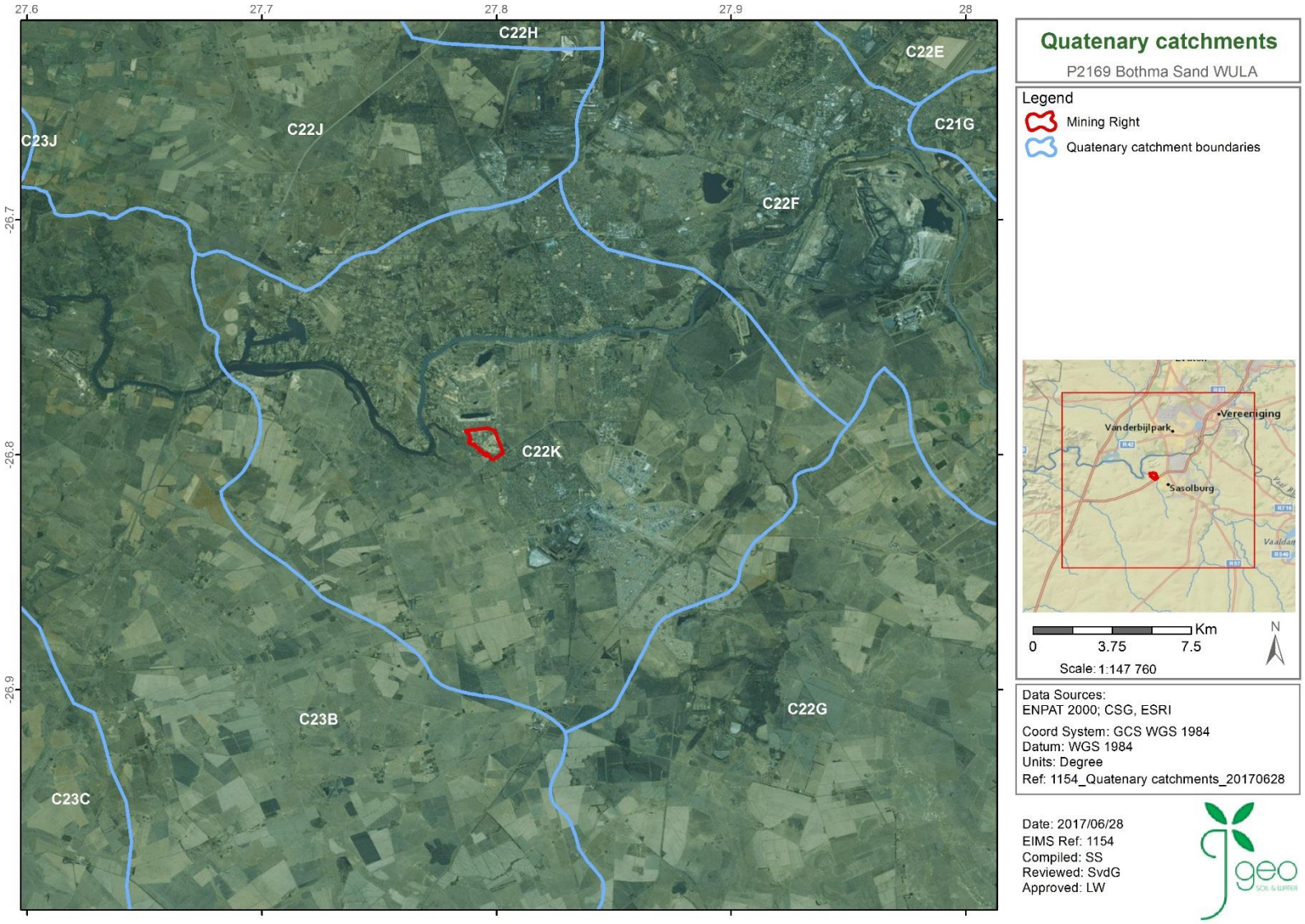


Figure 14: Quaternary catchment for the project

4.2.4.2. WATER QUALITY

During June 2016, on-site surface water features in the project area were also sampled and include the four (4) dams, namely the Pollution Control Dam (S. Bothma Dam 1), Settling Dam 2 (S. Bothma Dam 2), Settling Dam 3 (S. Bothma Dam 3), and the excavation dam (S. Bothma Dam 5), a sump as well as an upstream sampling point of the Leeuspruit. Hydrocensus sampling locality, SW01, coincide with sampling locality S Bothma Dam 5 and SW05 correspond to S Bothma Dam 1. Figure 15 presents a spatial distribution map of visited geosites, including surface water features. Information relevant to the surface water features is summarised in Table 20.

The water quality of the surface water features is summarized in **Table 21** below. Locality, SW06, is the most downstream sample of the Leeuspruit and indicates no signs of external impacts, while the upstream sampling locality, SW02, confirm an impacted and modified surface water system. Sulphate and sodium concentrations are slightly elevated and above limits with elevated ammonium concentrations suggesting possible upstream anthropogenic activities. The alkaline environment observed may explain elevated concentrations of heavy metals i.e. aluminum (Al), causing cations to form hydroxides and go into solution. Sampling locality, Bothma Spruit, represents the furthest upstream sampling point of the Leeuspruit and indicates only marginally elevated levels of iron (Fe). Thus, it is inferred that the impact observed at SW02 must originate from an external contamination up-gradient from this sampling locality.

In general, water quality of the on-site surface water features is good with no chemical determinants exceeding SANS 214:2015 limits at S Bothma Dam 1 (existing pollution control dam (PCD)) and S Bothma Dam 5. Slightly elevated levels of sulphate is observed at sampling localities S Bothma Dam 2 and S Bothma Dam 3, however, concentrations are still below the SANS 241:2015 acute health limits of 500 mg/L. Slightly elevated levels of iron (Fe) were also observed at sampling localities S Bothma Dam 3, S Bothma Sump as well as S Bothma Spruit. It should be mentioned that, although the SANS 241:2015 aesthetic limit of 0.3 mg/L is exceeded, samples analysed are still below the health limit of 2.0 mg/L.

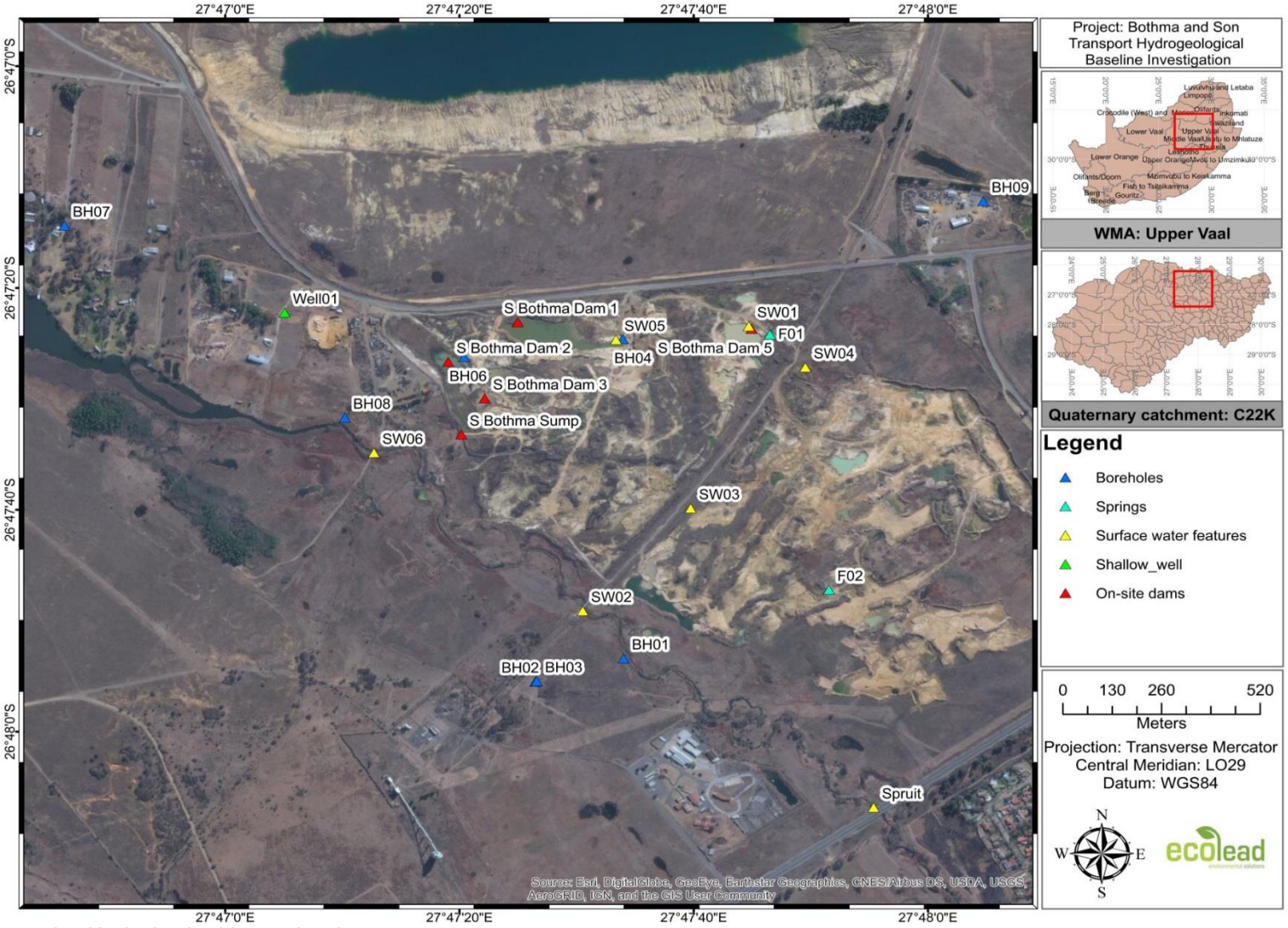


Figure 15: Hydrological investigation

Table 20: On-site Surface Water features

Site ID	Latitude	Longitude	Site	Water application	Water level (mbs)	Remarks
S Bothma Dam 1	-26.789740	27.790270	Dam	Mining	n/a	Operational pollution control dam (PCD).
S Bothma Dam 2	-26.790736	27.788619	Dam	Mining	n/a	On-site surface water feature.
S Bothma Dam 3	-26.791650	27.789485	Dam	Mining	n/a	On-site surface water feature.
S Bothma Dam 5	-26.789907	27.795815	Dam	Mining	n/a	On-site surface water feature.
S Bothma Sump	-26.792554	27.788931	Dam	Mining	n/a	On-site surface water feature.
Spruit	-26.801892	27.798709	River	Livestock	n/a	Most upstream point of Leeuspruit.
SW01	-26.789840	27.795750	Dam	Mining	n/a	Dam is fed by fountain discharge. Same sampling locality as S Bothma Dam 5.
SW02	-26.796970	27.791810	River	Unknown	n/a	
SW03	-26.794400	27.794370	Dam	Unknown	n/a	Worked out diggings.
SW04	-26.790870	27.797090	Dam	Unknown	n/a	
SW05	-26.790180	27.792600	Dam	Mining	n/a	Wash plant water use pumped from river. Same sampling locality as S Bothma Dam 1.
SW06	-26.793010	27.786860	River	Unknown	n/a	Upstream sampling locality.
F01	-26.790050	27.796250	Spring	Unknown	n/a	Approximate flow measured @ 2.5 L/s.
F02	-26.796440	27.797650	Spring	Unknown	n/a	Approximate flow measured @ 2.0 L/s.

Table 21: Dam sampling run (2016) water quality evaluated according to SANS 241:2015

Determinant	Unit	Risk	SANS 241:2015 limits	S Bothma Dam 1	S Bothma Dam 2	S Bothma Dam 3	S Bothma Dam 5	S Bothma Sump	S Bothma Spruit
Physical and aesthetic determinants									
pH	**-**	**Operational**	**≥5.0 ≤ 9.5**	7.4	7.3	7.5	8.3	7.5	7.8
EC	**mS/m**	**Aesthetic**	**≤170.0**	99.0	98.0	101.0	61.0	99.0	102.0
Macro determinants									
Total Alkalinity	**CaCO3/l**	**-**	**-**	73.0	45.0	61.0	85.0	107.0	99.0
Cl	**mg/l**	**Aesthetic**	**≤300.0**	102.0	104.0	105.0	49.0	104.0	60.0
SO4	**mg/l**	**Aesthetic/Acute health**	**≤ 250.0 ≤ 500.0**	235.0	**253.0**	**350.0**	102.0	166.0	168.0
PO_4	**mg/l**	**-**	**-**	0.0	0.0	0.0	0.0	0.0	0.1
Na	**mg/l**	**Aesthetic**	**≤200.0**	125.0	107.0	113.0	35.0	126.0	143.0
Ca	**mg/l**	**-**	**-**	48.0	47.0	46.0	45.0	60.0	60.0
Mg	**mg/l**	**-**	**-**	16.0	20.0	18.0	27.0	7.6	6.2
Micro determinants									
Al	**mg/l**	**Operational**	**0.3**	0.2	0.2	**1.0**	0.03	**0.4**	0.02
Fe	**mg/l**	**Aesthetic/Acute health**	**0.3 ≤ 2.0**	0.1	0.1	**0.4**	0.02	**0.4**	**0.4**
Mn	**mg/l**	**Aesthetic/Acute health**	**0.1 ≤ 0.4**	0.1	0.1	0.1	0.002	0.002	0.1

4.2.4.3. MEAN ANNUAL RUNOFF (MAR) AND DRAINAGE

The mean annual runoff (MAR) is estimated to be 9.11 mcm (million cubic metres) per annum (WR 2012). Local surface water drainage occurs via the Leeuspruit, which flows in a south-east-north-western direction towards to Vaal River approximately 3 km to the northwest. From here the Vaal River flows in a general westerly direction where is form a confluence with the Rietspruit approximately 10 km downstream. The Vaal dam is situated approximately 35 km west of the study area.

4.2.5. RESOURCE CLASS AND RIVER HEALTH

The Resource class essentially describes the desired condition of the resource, along with the degree to which it can be utilized. These classes range from minimally used to heavily used. The Management class facilitates the balance between protection and use of the water resource and defined by taking into consideration the social, economic and ecological landscape.

The Vaal River downstream of Vaal Dam to the outlet of C23J (Integrated Unit of Analysis (IUA) UM) includes the urban areas of Vereeniging, Vanderbijlpark, Sasolburg and Parys. In the reach between Vaal Dam and the Vaal Barrage the three main tributaries (Suikerbosrand, Klip and Rietspruit rivers) discharge into the Vaal Barrage, each conveying significant volumes of treated waste water and mine discharge water. Management of the flow entering this reach is from Vaal Dam and is influenced by the water users in and downstream of the Vaal Barrage, the urban return flows and mine dewatering discharges as well as the releases form Vaal Dam to maintain the TDS concentration at 600 mg/l (DWA, 2012).

Two Ecological Water Requirement (EWR) sites were defined in this IUA, one with a C Ecological Categories (EC) and the other a C/D EC state, both with a HIGH Environmental Importance (EI) providing motivation that the Recommended Ecological Category (REC) should be an improvement of the Present Ecological Status (PES). However, the assessment of this scenario as part of the Reserve study indicated that the implications of this improvement have significant impacts on the economy. The operational scenario accepted for the purpose of defining the Reserve was therefore to maintain the PES. The scenarios evaluated during this study still do not achieve the REC and for that reason the PES was used in the catchment configuration for this integrated unit of analysis (IUA) (DWA, 2012).

4.3. GROUND WATER

The following section describes the geohydrology of the area and discusses the possible impacts of the mine on ground water resources through the use of conceptual models (Ecolead, 2017) (Refer to Appendix C). A hydrocensus user survey was conducted in January 2017, during which relevant hydrogeological baseline information was recorded and samples collected for water quality analysis. Geosites logged include nine (9) boreholes, of which the majority comprised the Sigma Mine monitoring boreholes (include an artesian borehole), six (6) surface water localities, two (2) spring localities as well as a shallow dug well. The location of the geosites are indicated in Figure 13 above and the information of these site is indicated in Table 22 below.

Table 22: Geosite information: hydrocensus user survey

Site ID	Latitude	Longitude	Site	Water application	Water level (mbs)	Remarks
F01	-26.790050	27.796250	Spring	Unknown	n/a	Approximate flow measured @ 2.5 L/s.
F02	-26.796440	27.797650	Spring	Unknown	n/a	Approximate flow measured @ 2.0 L/s.
BH01	-26.798160	27.792780	Borehole	Monitoring	0.00	Artesian borehole.
BH02	-26.798740	27.790690	Borehole	Monitoring	0.19	Sigma Mine.
BH03	-26.798730	27.790720	Borehole	Monitoring	0.36	Sigma Mine.
BH04	-26.790160	27.792760	Borehole	Monitoring	11.24	Sigma Mine.
BH05	-26.790440	27.789740	Borehole	Monitoring	8.12	Sigma Mine.
BH06	-26.790610	27.789000	Borehole	Monitoring	7.04	Sigma Mine.
BH07	-26.787320	27.779520	Borehole	Domestic	8.04	Owner: P Mostert; 083 634 3333. Automatic float switch. 2x 5000 l Tanks.
BH08	-26.792130	27.786170	Borehole	n/a	0.00	Owner: Terblanche Transport. Artesian borehole.
BH09	-26.786710	27.801310	Borehole	Domestic	3.13	Owner: Loots; 082 653 4841. Borehole has been standing without pumping for a while now.
Well01	-26.789500	27.784740	Shallow well	Domestic/livestock	2.37	C.Bruwer; 076 973 2927.

4.3.1. AQUIFER DESCRIPTION

Two main hydrostratigraphic units/aquifer systems can be inferred in the saturated (vadose) zone, namely:

- Shallow quaternary and recent types of sediments (perched, unconfined) are characteristically a primary porosity aquifer. These aquifers are formed by the alluvial material along the riparian zone of local drainages and are limited to a zone of variable width and depth. Characteristics of riverbed sand aquifers can be summarised (Driscoll, 1986) as coarse gravels and sands are more typical of alluvial deposits. However, flood plains consist mainly of fine silt; and
- A shallow, weathered zone aquifer occurring in the transitional soil and weathered bedrock can be classified as a double porosity aquifer. This aquifer is generally unconfined with phreatic water levels. Usually this aquifer is most susceptible to impacts from contaminant sources. Yields in the weathered zone is generally low (0.02 – 0.14 L/s), because of its insignificant thickness (Van Tonder. et al, 2007).

Since 1999, an ash filling project was undertaken throughout the area to stabilise historically mined-out underground workings, however, due to the shallow nature of the sand quarrying and the presence of a sub-surface dolerite sill, it is assumed that there is very little to no hydraulic interaction between the deep basement and shallow weathered aquifer within the study area.

4.3.1.1. DEPTH TO GROUNDWATER LEVEL

The thickness of the unsaturated zone was determined by subtracting the undisturbed static water levels from the topography. The unsaturated zone within the study area is in the order of between 0 mbs (spring discharge) to ~ 11 mbs (this is based on groundwater level measured at the surveyed borehole). According to literature studies groundwater is generally not deeper than 15 m (Wessels 2013). The mining area is blanketed to a varied depth of more than 10 m aeolian and alluvial sand.

4.3.1.2. GROUNDWATER QUALITY

The results of the groundwater water quality that were conducted in January 2017 are indicated in **Table 23** (hydrocensus sampling localities) below. Parameters exceeding the stipulated SANS 241:2015 thresholds are highlighted in red (acute health), whereas yellow highlighted cells indicate parameters above aesthetic limits.

Table 23: Hydroccensus user survey geosite water quality evaluation according to SANS 241:2015 standards

Determinant	Unit	Risk	SANS 241:2015 limits	BH03	BH08	BH09	SW02	SW06	F02
Physical and aesthetic determinants									
pH	**-**	**Operational**	**≥5.0 ≤ 9.5**	8.20	8.10	8.10	**10.10**	8.20	8.10
EC	**mS/m**	**Aesthetic**	**≤170.0**	**452.00**	129.00	15.20	152.00	99.90	28.70
Total Hardness	**mg/l**	**-**	**-**	333.00	171.00	48.00	29.00	112.00	116.00
Macro determinants									
Total Alkalinity	**CaCO3/l**	**-**	**-**	900.00	320.00	60.00	132.00	81.00	96.00
Cl	**mg/l**	**Aesthetic**	**≤300.0**	96.00	78.00	4.00	185.00	107.00	15.00
SO_4	**mg/l**	**Aesthetic/Acute health**	**≤ 250.0 ≤ 500.0**	**1676.00**	181.00	<2.00	**291.00**	206.00	41.00
F	**mg/l**	**Acute health**	**≤1.5**	1.20	1.20	<0.20	0.40	0.80	0.20
NO_3-N	**mg/l**	**Acute health**	**≤11.0**	0.10	0.10	0.20	<0.10	3.00	<0.10
PO_4	**mg/l**	**-**	**-**	<0.10	<0.10	<0.10	<0.10	0.20	<0.10
NH_4	**mg/l**	**Aesthetic**	**≤1.5**	**2.80**	0.50	0.30	**6.40**	0.10	0.10
Na	**mg/l**	**Aesthetic**	**≤200.0**	**916.00**	147.00	7.00	**236.00**	102.00	8.00
K	**mg/l**	**-**	**-**	8.90	3.70	0.60	18.40	18.50	1.50
Ca	**mg/l**	**-**	**-**	8.00	14.00	11.00	10.00	30.00	25.00
Mg	**mg/l**	**-**	**-**	76.00	33.00	5.00	<1.00	9.00	13.00
Micro determinants									
Al	**mg/l**	**Operational**	**0.3**	<0.10	<0.10	<0.10	**2.14**	0.13	<0.10
Fe	**mg/l**	**Aesthetic/Acute health**	**0.3 ≤ 2.0**	0.03	0.03	0.05	<0.025	0.11	<0.025
Mn	**mg/l**	**Aesthetic/Acute health**	**0.1 ≤ 0.4**	**0.12**	<0.025	<0.025	<0.025	<0.025	<0.025

4.4. GROUNDWATER MODEL PREDICTIONS

The below scenarios were modelled for the purposes of management and decision making:

- Scenario 01 (base-case): Pre-mining steady state calibration and sensitivity analysis;
- Scenario 02: Mine dewatering (10 years LoM operational phase);
- Scenario 03: Contaminant transport (10 years LoM operational phase); and
- Scenario 04: Post-operational phase.

4.4.1. SCENARIO 01 (BASE-CASE): PRE-MINING STEADY STATE CALIBRATION AND SENSITIVITY ANALYSIS

A steady state groundwater flow model was developed to simulate equilibrium conditions, i.e. pre-mining conditions, which will be used as initial hydrogeological conditions for transient simulations. Due to the model limitations and data uncertainty, it is virtually impossible to accurately calibrate the model and this model should rather be viewed as a qualified model. The model was standardised by applying the American Society for Testing Materials (ASTM) guidelines (1993), as well as methods presented in Anderson and Woesner (1992) and Spitz and Moreno (1996) case studies. Under steady state conditions, the groundwater flow equation is reduced to exclude storativity. Groundwater levels of gathered observation boreholes were simulated by varying aquifer parameters (hydraulic conductivity and recharge) until an acceptable fit between the measured and simulated hydraulic heads was obtained. Figure 16 indicates the steady state hydraulic head contours and flow directions in conjunction with calibration curves. Observed groundwater levels were plotted against measured water levels and a correlation of 0.98 was obtained.

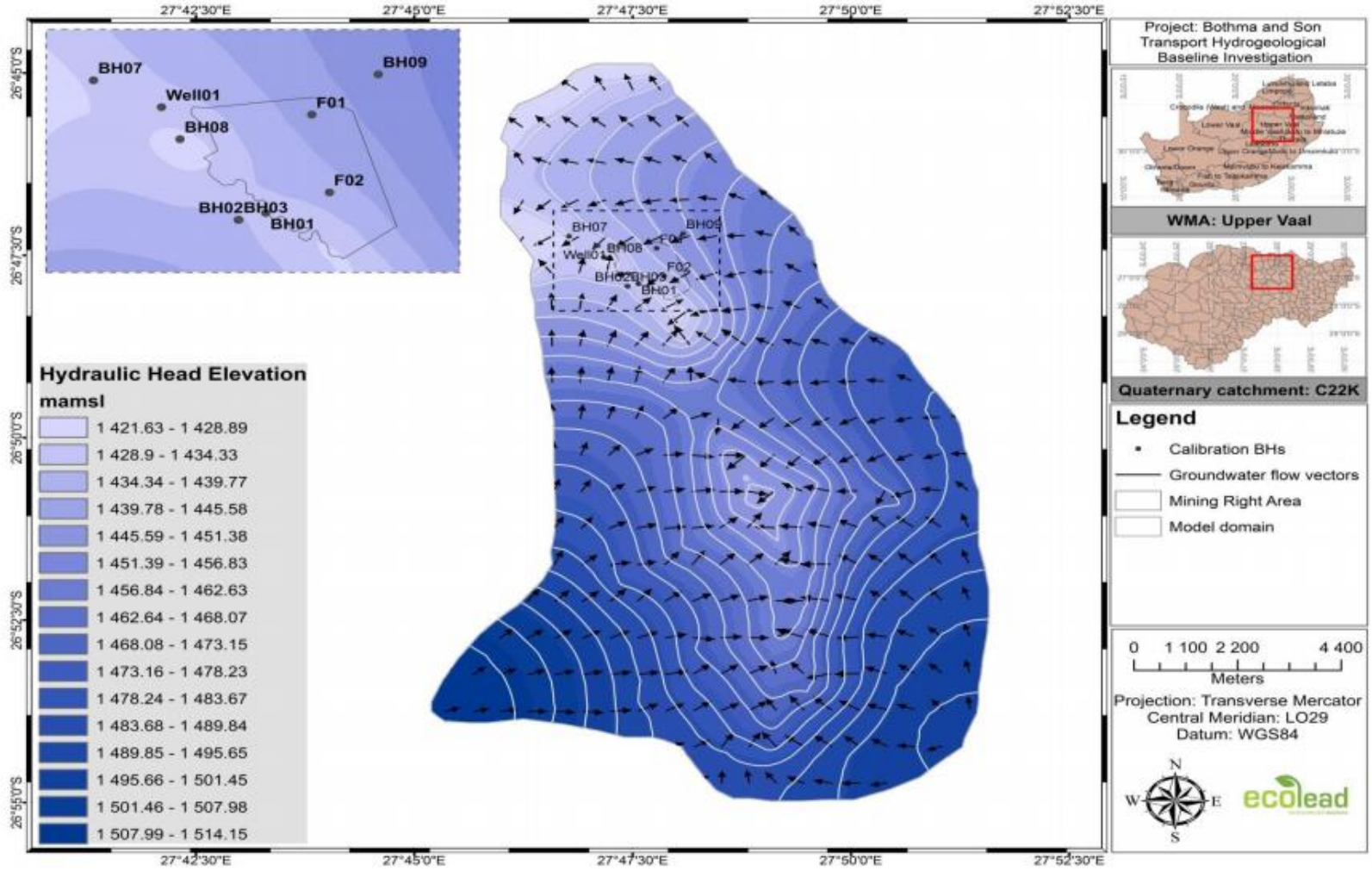


Figure 16: Model calibration: Steady state hydraulic heads and groundwater flow direction

4.4.2. SCENARIO 02 (MINE DEWATERING – 10 YEARS OF LOM)

The groundwater balance during the 10 year LoM period within the modelled catchment, is summarised in **Table 24** below. It is evident that the groundwater cone of depression formed due to the hydraulic stress of mine dewatering decreases spring flow (with no spring flow occurring for this period at locality (F02). Baseflow discharge to the Leespruit section decreases with approximately 5.0 % of steady state baseflow for the duration of the mining operation. Average mine dewatering is estimated at 260 m^3/d averaged out over the total mining period. Figure 17 to Figure 23 reflect the estimated zone of influence or capture zone corresponding to each mining area. It should be noted that the capture zone is relatively small and symmetric and, except for spring locality F02, at no stage during the mining period does the zone of influence seem to reach any of the hydrocensus geosites recorded.

Table 24: Catchment water balance: Scenario 02- Mine dewatering 10 year LoM

Scenario 2: Mine dewatering – (10 years LOM)			
Parameter	**Inflow (m^3/d)**	**Outflow (m^3/d)**	**Balance (m^3/d)**
Recharge (m^3/d)	7130.00	0.00	7130.00
Abstraction (m^3/d)	0.00	864.00	-864.00
Baseflow and Spring flow (m^3/d)	0.00	5983.00	-5983.00
Mine dewatering (m^3/d)	0.00	260.00	-260.00
Imbalance ignoring internal transfer (m^3/d)	0.00	37.20	-23.00
Total (m^3/d)	7130	7144	0.00

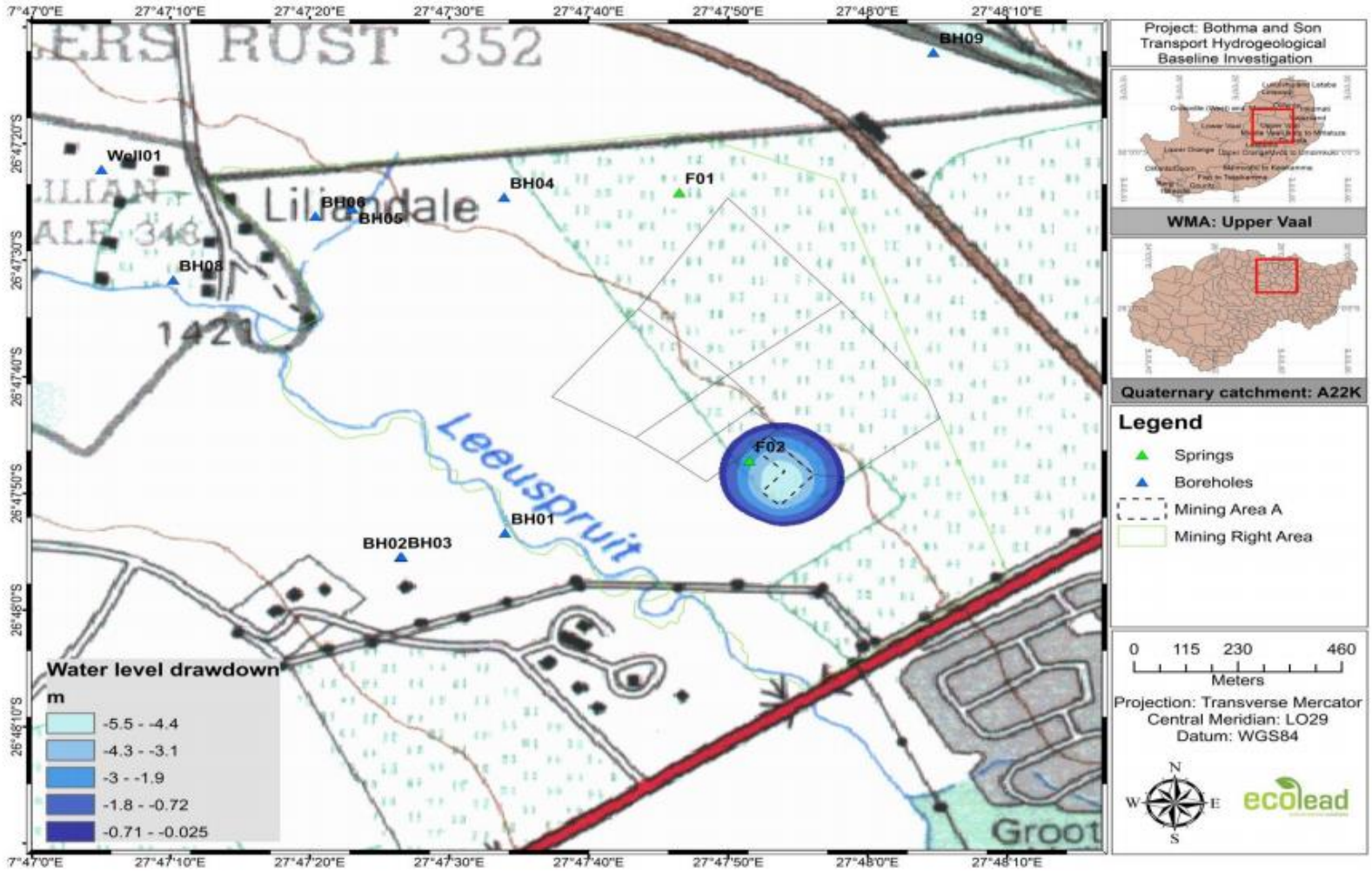


Figure 17: Water level drawdown and zone of influence: Mining Area A

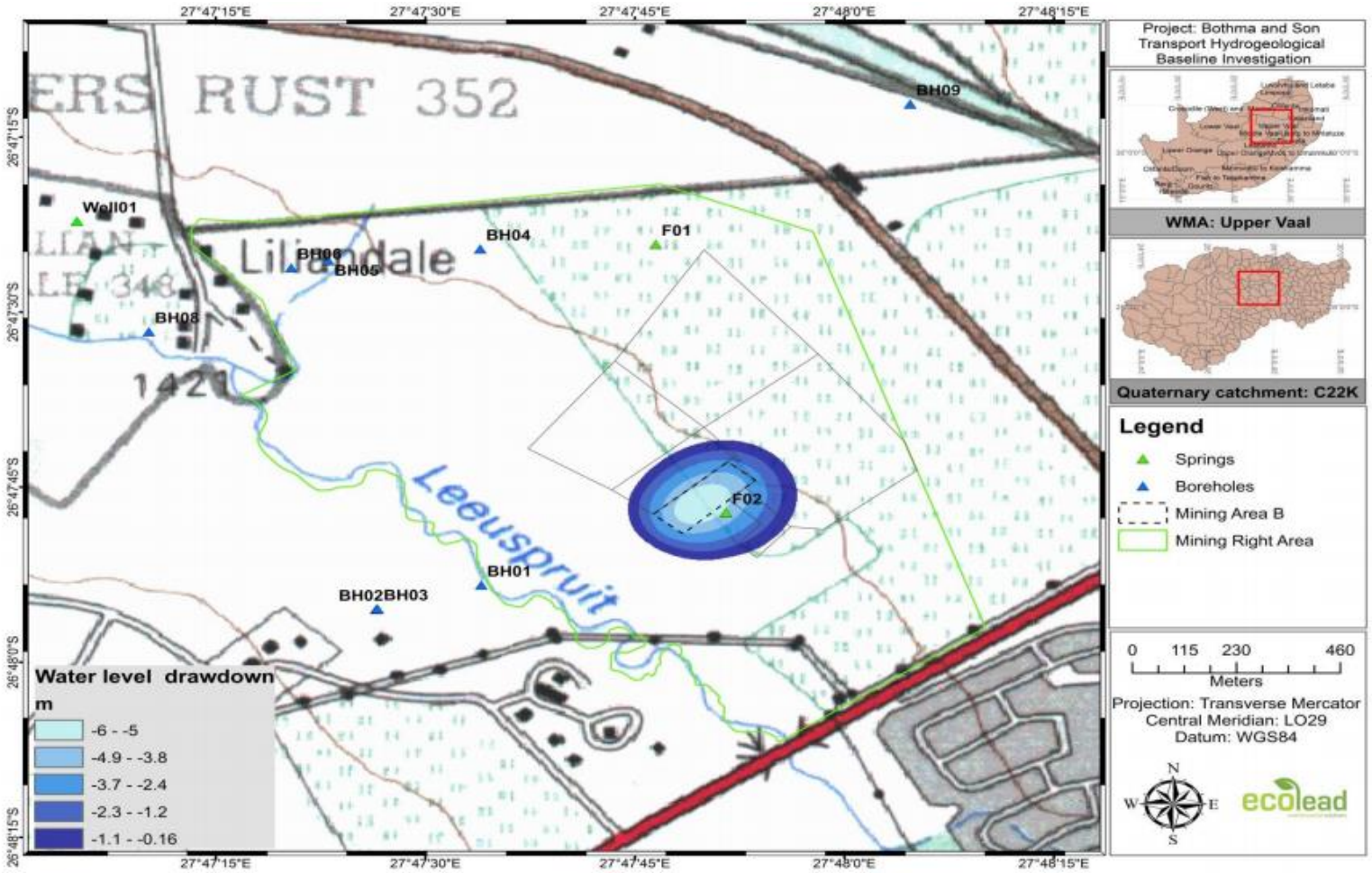


Figure 18: Water level drawdown and zone of influence: Mining Area B

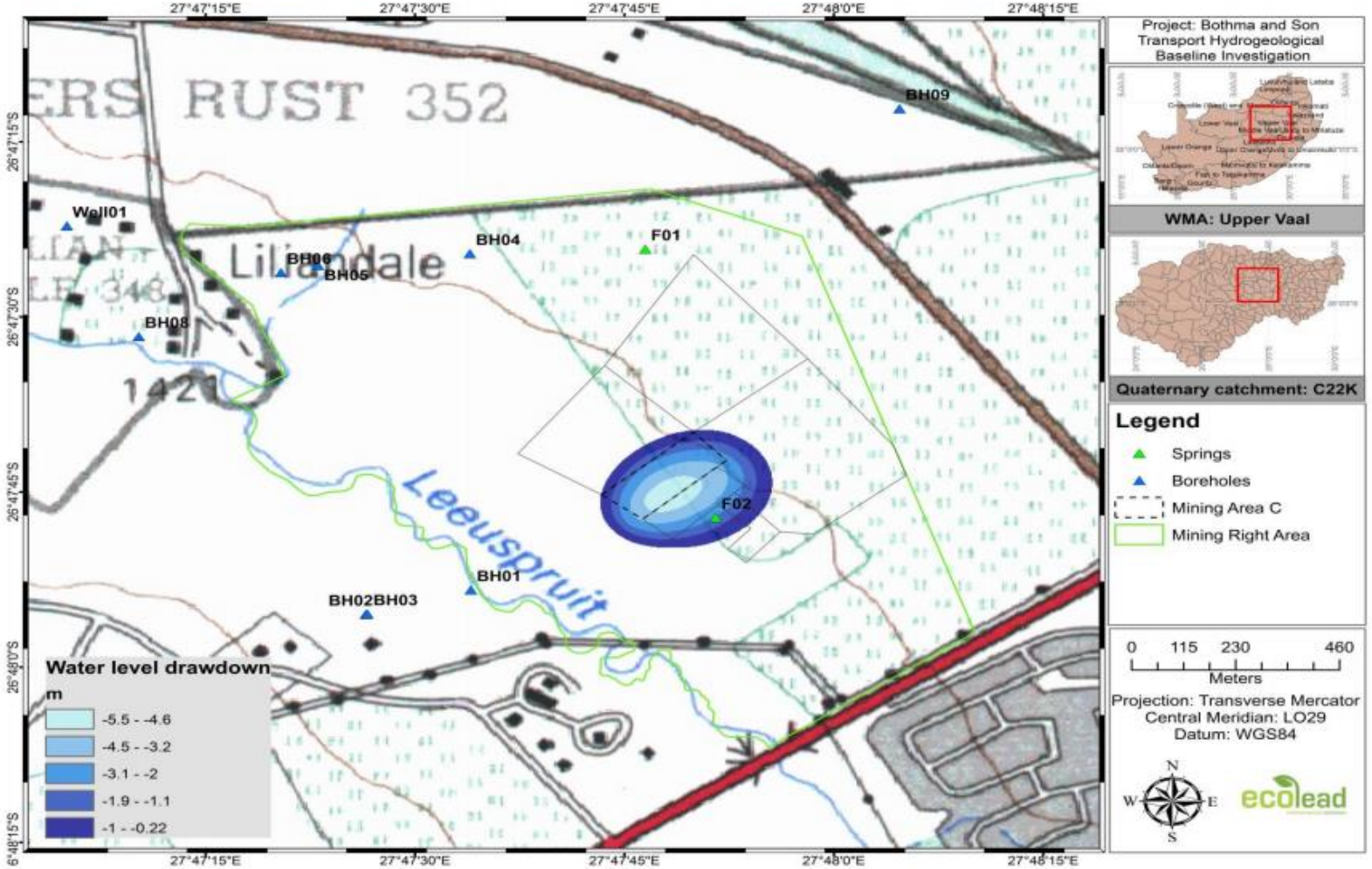


Figure 19: Water level drawdown and zone of influence: Mining Area C

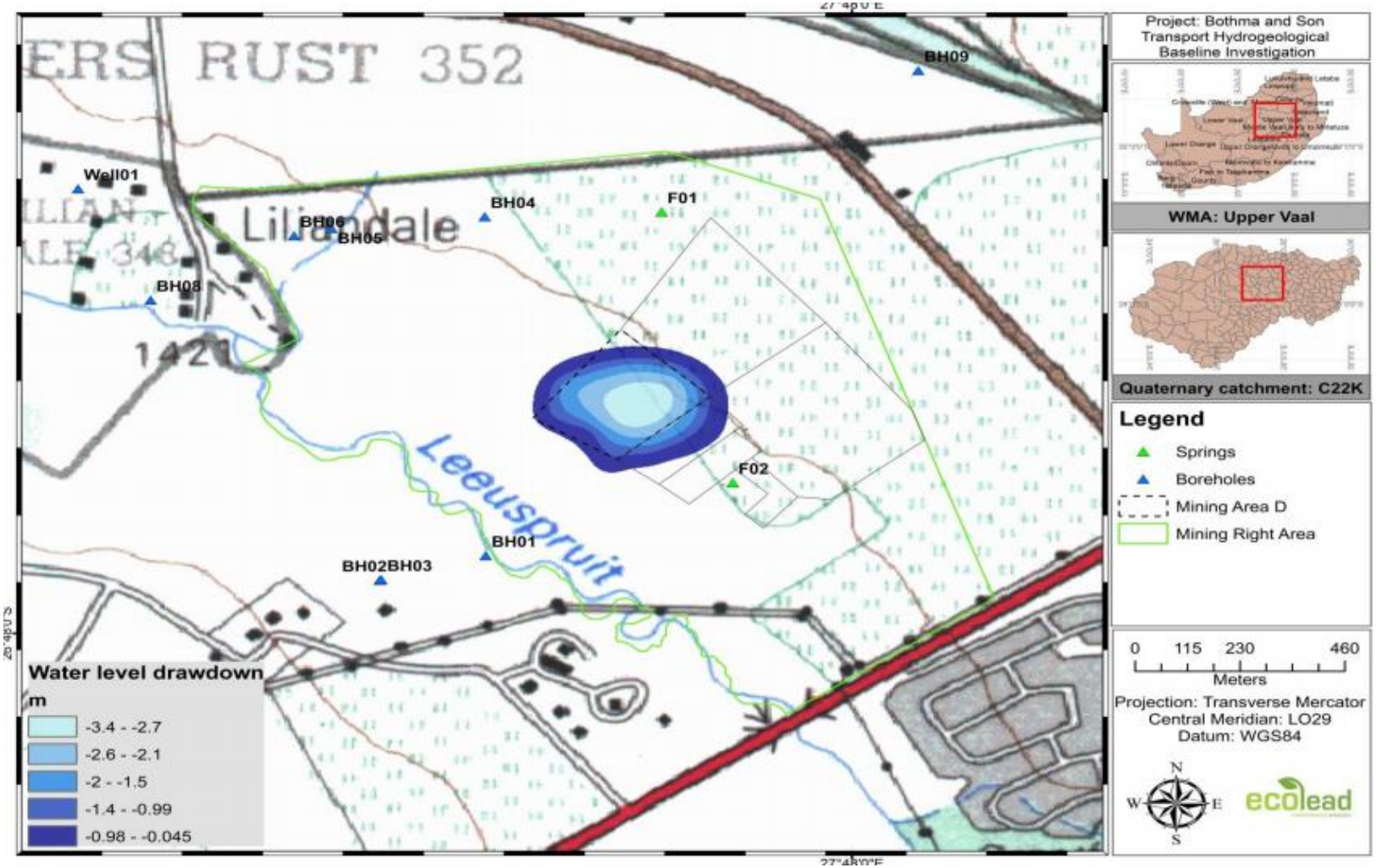


Figure 20: Water level drawdown and zone of influence: Mining Area D

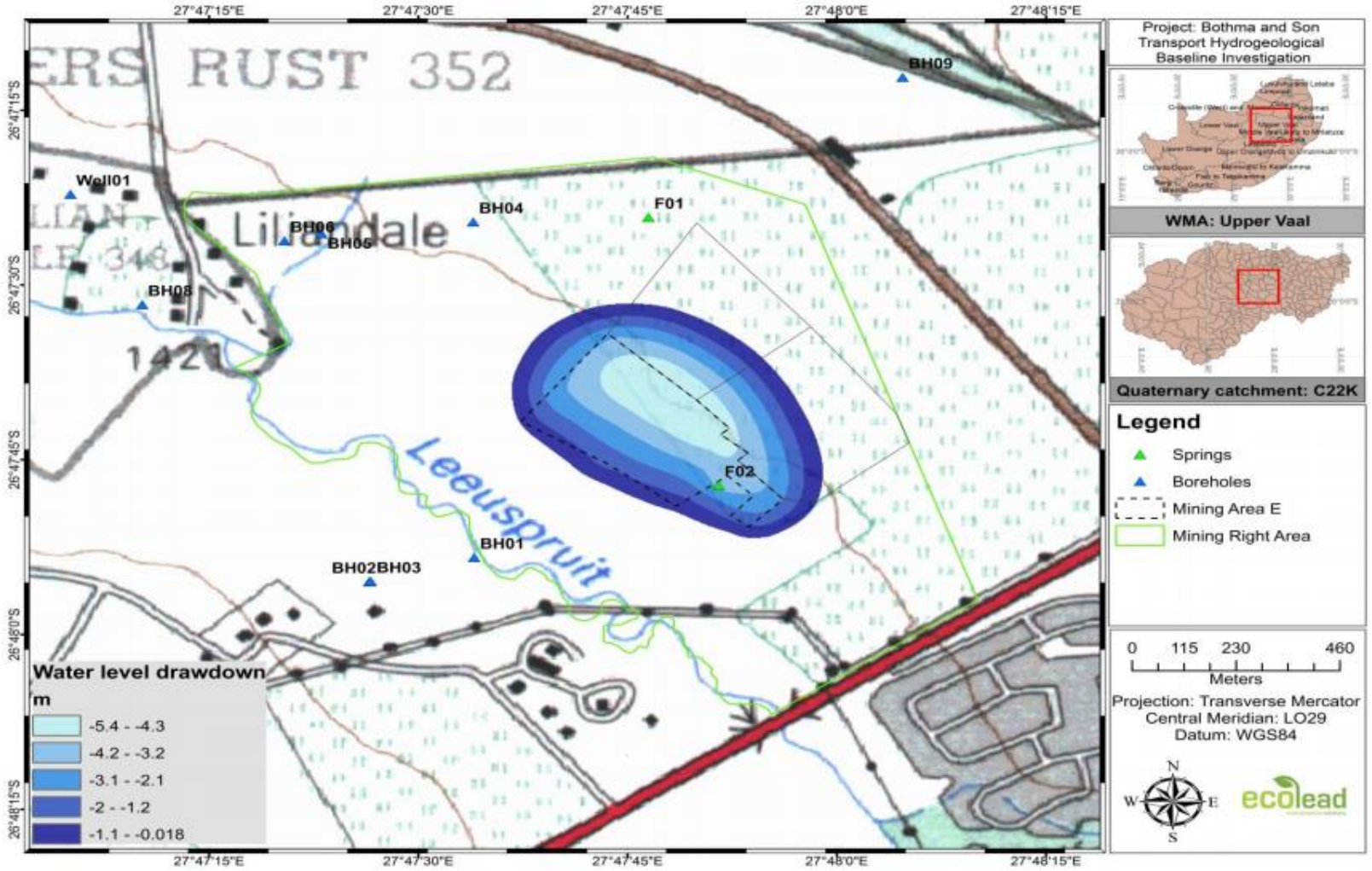


Figure 21: Water level drawdown and zone of influence: Mining Area E

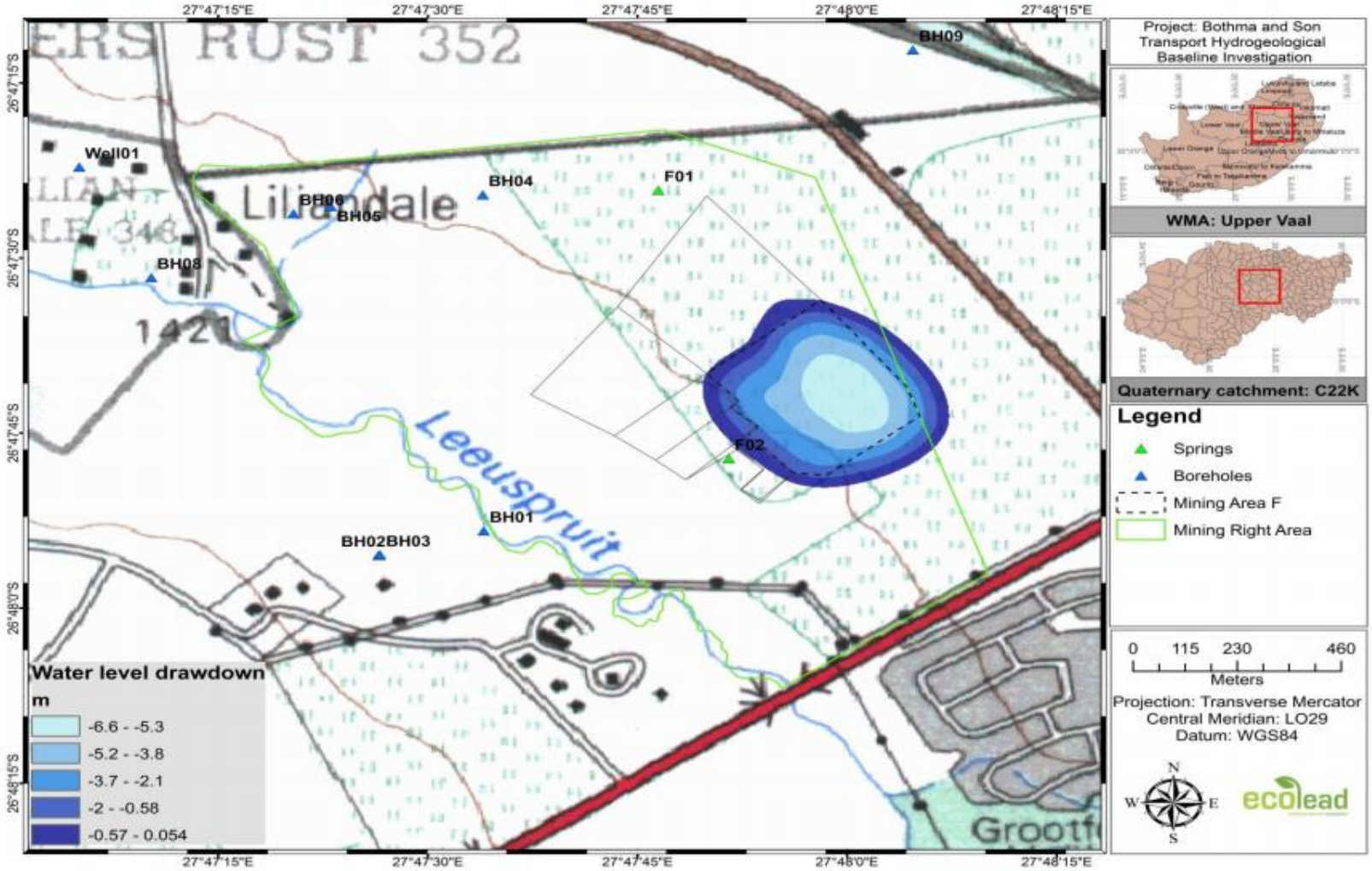


Figure 22: Water level drawdown and zone of influence: Mining Area F

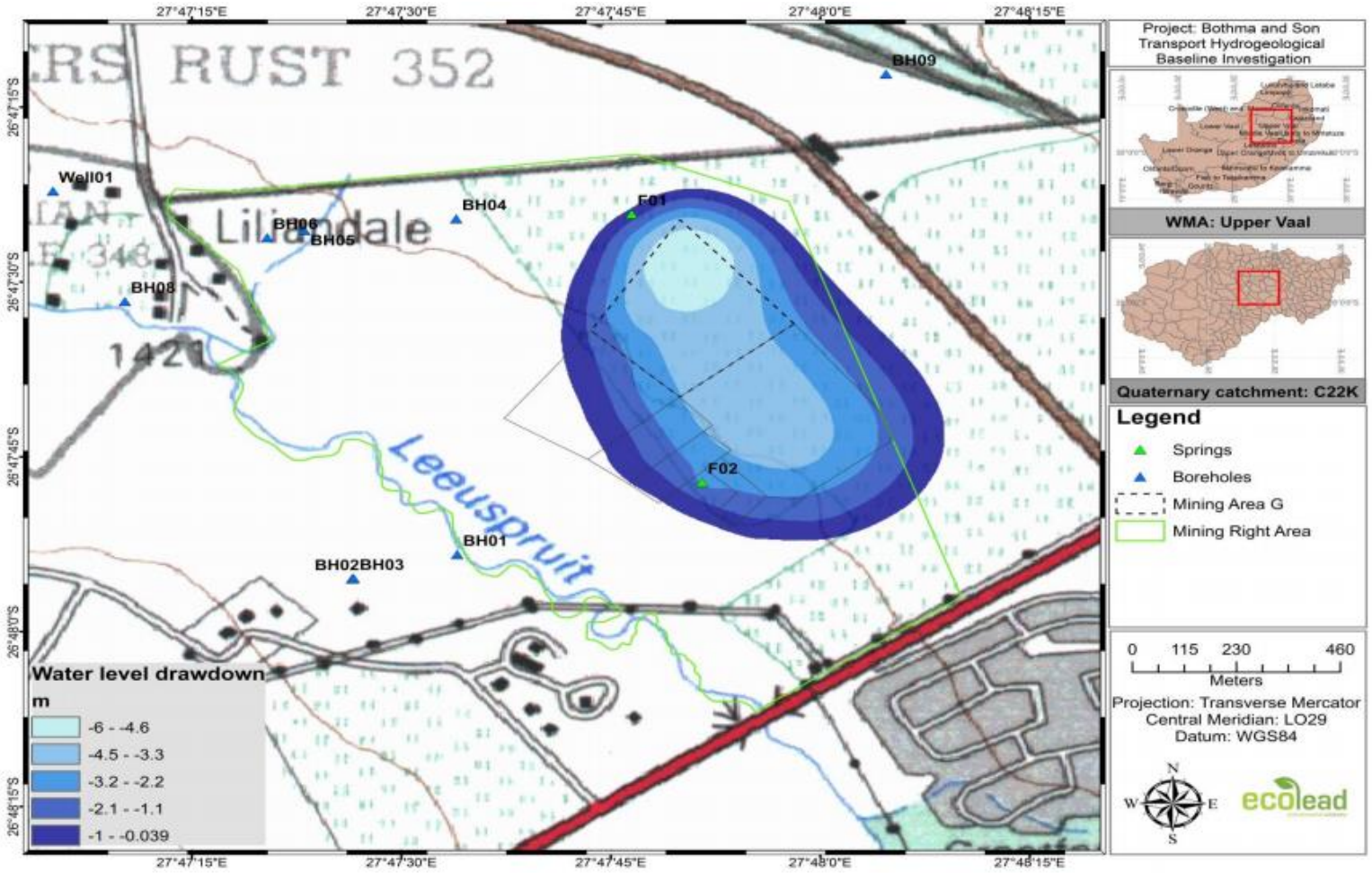


Figure 23: Water level drawdown and zone of influence: Mining Area G

4.4.3. SCENARIO 03 (CONTAMINANT TRANSPORT – 10 YEARS LOM)

The only on-site facility that poses a potential threat to groundwater pollution (i.e. contact water storage) is the pollution control dam (PCD). Although all data evaluated does not indicate above limit concentrations, in isolated surface water features, sulphate was slightly elevated and also above background values (~ 80 – 100 mg/l). Accordingly, sulphate was used as proxy from contaminant migration associated with the mine workings. In order to be conservative, a source concentration in the order of 230 – 250 mg/l was assigned as mass-transport boundary condition and simulated. Figure 25 shows the modelled pollution plume migration with time. It can be noted that the plume migration is limited reaching an approximate down-gradient distance of 100 m while stretching to 200 m for the full LOM simulation.

4.4.4. SCENARIO 04 (MINE POST CLOSURE)

Due to the impact on spring locality, F02, the baseline hydraulic head value of this receptor were used to determine the effects of mine post closure and also duration of recovery periods. Figure 24 indicates the LoM and post-closure impact of hydraulic stresses on locality F02. It is expected that the maximum drawdown at this point will be ~8 m with the recovery period taking approximately 6 years from seizing of mining activities.

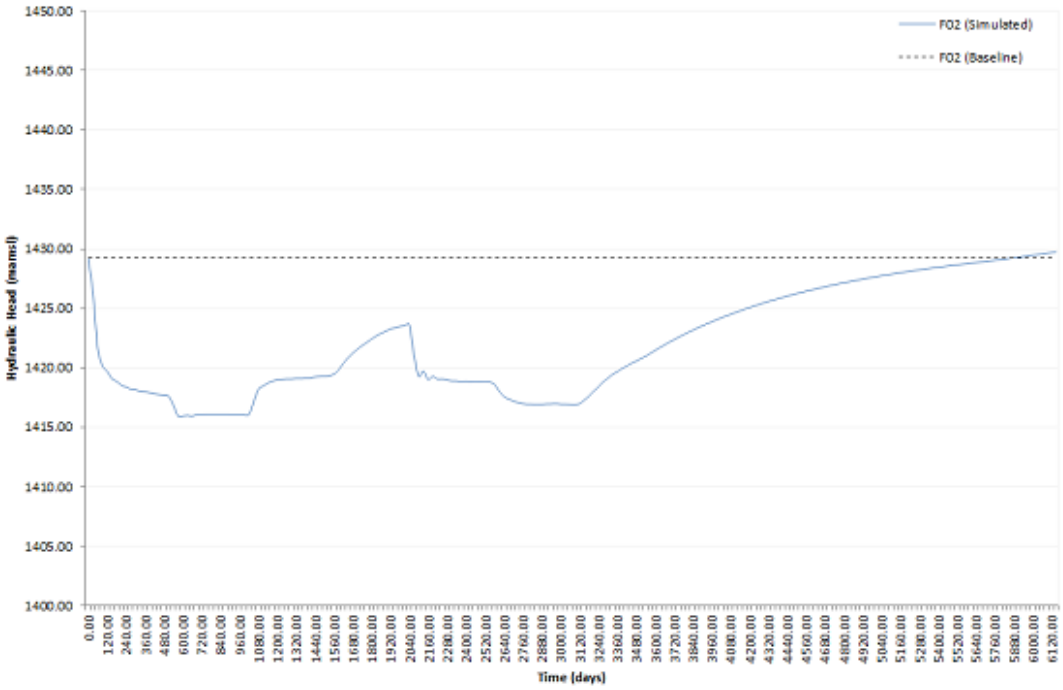


Figure 24: Mine post-closure evaluation: Time series hydraulic head elevation (F02)

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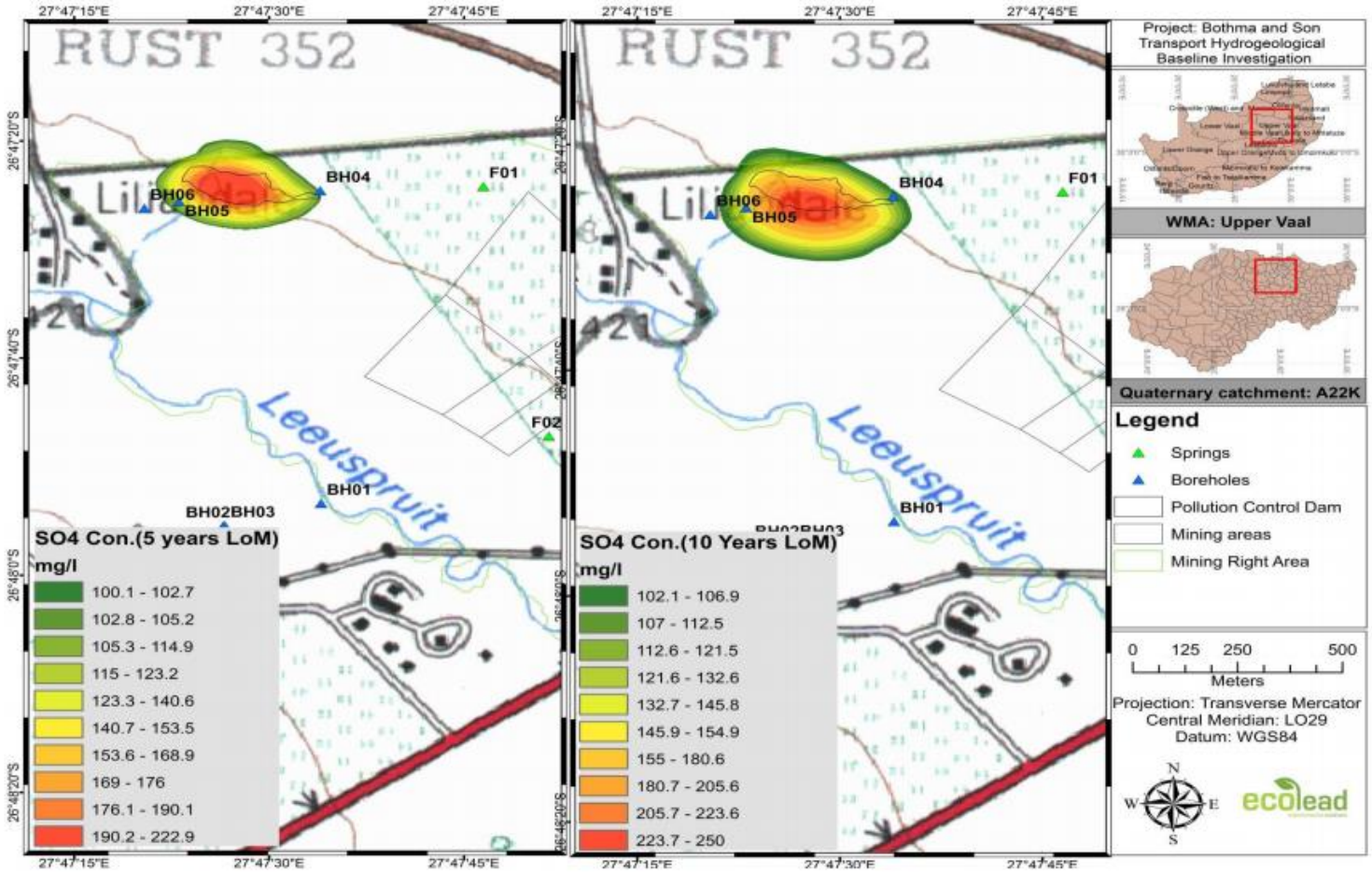

Figure 25: Sulphate migration after five and ten years LOM

4.4.4.1. RECOMMENDATIONS

The following recommendations are proposed following the groundwater investigation:

1. It is recommended that groundwater and surface water monitoring as outlined in this report be conducted on a monthly and quarterly basis to serve as an early warning and detection system for the impact on environmental receptors and contaminant migration from the site;
2. Further to this it recommended that groundwater and surface water quality be evaluated against SANS 241:2015 water quality standards with analysis of chemical variables as set out in this report. Laboratory analysis should be conducted at a SANAS accredited laboratory;
3. Water monitoring results be evaluated and reviewed on a bi-annual basis by a registered hydrogeologist for interpretation and trend analysis;
4. The numerical groundwater flow model should be updated at least every three to five years incorporating time-series monitoring data to be used to validate aquifer hydraulic parameters and other assumption based input; and
5. It is also recommended that the hydrocensus user survey be updated in conjunction with the groundwater flow model update and that geosites be re-visited in order to incorporate newly gathered data into the model development.

4.5. SOCIO-ECONOMIC ENVIRONMENT

The Metsimaholo Local Municipality is one of the local municipalities that falls under the Fezile Dabi District Municipality in the Free State province. There is an estimated population of 149,350 residents in the Metsimaholo Local Municipality.

There are 45 757 households in the Metsimaholo Local Municipality, with an average household size of 3,1 persons per household. Of these households, 22,1% have access to piped water inside the yard, whereas 71,7% have access to piped water inside their dwelling. Only 0,9% of the households do not have access to piped water (http://www.statssa.gov.za/?page_id=993&id=metsimaholo-municipality, accessed 9 February 2017).

4.5.1. ECONOMIC ACTIVITIES

Heavy industry and mining dominates the regional economy. Steel manufacturing and beneficiation industries are dominant in the region and chemical industries are dominant in Sasolburg. Arcelor-Mittal (steel), Eskom and Anglo Operations (power and supporting coal industries, Rand Water (regional water schemes), Sasol Chemical, Natref Petroleum Refinery and a number of other industrial developments, mostly involved in steel products and by-products form the employers in the Vereeniging-Sasolburg-Vanderbijylpark area. The Vaal River is a tourist attraction with venues such as the Emerald Casino and the Vaal Racecourse, generating several employment opportunities for the local population. However, the manufacturing industry is the predominant employer (IDP, 2015 -2016).

4.5.2. EMPLOYMENT

According to Stats South Africa, 40% of the economically active population of Metsimaholo Local Municipality is employed and unemployment stands at 23%. A relatively high proportion of the local population regards itself as economically non-active (not actively looking for employment). Figure 26 below indicates the average household income with the highest percentage of the population earning between R19 000 and R38 000 a year.

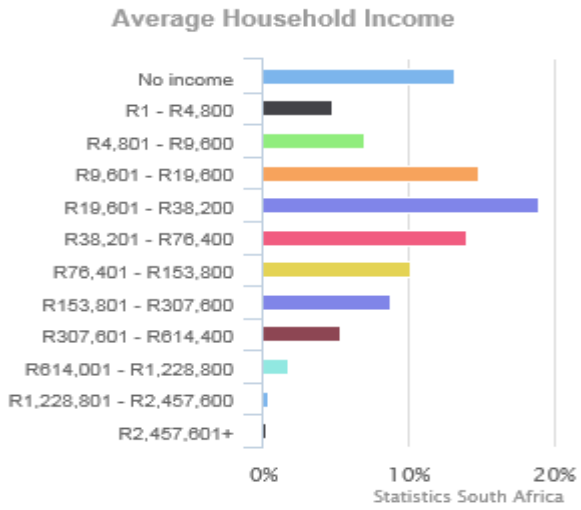

Figure 26: Average household income

5. ANALYSIS AND CHARACTERISATION OF ACTIVITY

This section contains an analyses or characterisation of all the water use and waste management aspects of an activity. This will provide an overview of four key areas, namely process water, storm water, groundwater and waste.

5.1. SITE DELINEATION FOR CHARACTERISATION

The Applicant's mine lies north of the town of Sasolburg on the Remainder (Re) Portion of the Farm Boschbank 12, located near the town of Sasolburg in the Parys District Municipality area of the Free State Province. The site is accessible by an existing access road off the Wonderfontein Road. The centre of the site is located at the following geographic coordinates: 26°47'37.51"S and 27°47'44.63"E (refer to Figure 1 above).

5.2. WATER AND WASTE MANAGEMENT

5.2.1. POTABLE WATER SUPPLY

Potable water for drinking is collected from the local municipality with road tanker for the offices, weighbridge and mine area. No potable water treatment takes place.

5.2.2. PROCESS WATER

Sand screening and washing takes place on the Remainder portion of the farm Boschbank 12 , where the sand screening and washing takes places. Water is abstracted from the Leeuspruit and pumped to the Pollution Control Dam (PCD) (Dam 1). From the PCD the water is pumped to the wash plant. After washing and screening the sand, the water is pumped back to the settlement dams (Dam 2 and Dam 3). Once the sediments have settled, the water is recycled and pumped back to the PCD for re-use.

Pollution preventive measures are being implemented to ensure that water will not be polluted such as no refuelling and servicing of equipment (front end loaders, excavator of truck units) on site.

5.2.3. WATER CONSERVATION AND DEMAND MANAGEMENT (WCDM)

The water is undertaken, managed and controlled in such a way to ensure that pollution of the water resources is minimised and avoided. Social and economic development will be facilitated, which will ensure that the use of the water resource will be of benefit to the local communities. Goods and services are being sourced from local businesses as far as possible, to enhance the economic benefits of the mine. A general overview of the WCDM to be developed is provided below.

5.2.3.1. DOMESTIC WATER CONSERVATION

The following aspects have been addressed as part of reducing water demand:

- The impact that the mine has on the groundwater adjacent to pits will be managed by monitoring boreholes;
- Samples from boreholes analysed to determine water quality exceedances and trends;
- Develop a management plan to deal with groundwater quality;
- Implement water conservation measures; and
- Ensure that no leakages occur in water pipelines.

5.2.4. DOMESTIC WASTE STREAMS

Domestic waste generated is collected and stored in waste bins placed on site. The domestic waste is disposed of at the local registered Metsimaholo dump site.

5.2.5. HAZARDOUS WASTE STREAMS

Pollution preventive measures are being implemented to ensure that water will not be polluted, such as no refuelling and servicing of equipment (front end loaders and excavator of truck units) on the mining site. All moveable equipment maintenance and re-fuelling takes place at the Applicant's main depot, which is not part of this WULA. The main depot is equipped with a maintenance workshop, as well as a diesel refuelling station that is properly bunded and workshop pits to prevent spillage. All used oil is contained and sold to BME who recycles the oil. Contaminated cloth and filters are disposed of in general waste skip and disposed of at Holfontein.

5.3. WATER AND SALT BALANCE

Water accounting uses a water balance approach to quantify the amount of water entering a system (through precipitation and groundwater flows) and the amount leaving a system (through evaporation, surface water flows, sewage, product water loss and groundwater flows). A water and salt balance will need to be compiled for the Applicant in order to ensure that sustainable water resource management forms part of the mine's integrated water management principles and involves the development of an integrated approach of water accounting that more accurately reflects the reality of water use on the mine.

5.4. STORM WATER (CLEAN AND DIRTY WATER SYSTEMS)

A conceptual stormwater management plan has been developed by Digby Wells (Refer to Appendix E). Mining operations have the potential to impact on the natural water quality of an area in the following ways:

- Bulk earthworks which will strip vegetation and expose top soils and sub-soils. Storm water flows will contribute to erosion thereby increasing levels of Suspended Solids (SS) within local watercourses and water features;

- Earthworks and mineral processing operations may expose elements naturally occurring within soils and geology to storm water, mobilising them into local watercourses and water features;
- Storage and usage of process specific chemicals and vehicular related pollutants which, if not properly managed properly, may be washed by storm water into local watercourses and water features; and
- Discharge of polluted or improperly treated storm water, process water and sewage water into local watercourses or water features may occur.

A negative impact on the baseline water quality by mining operations will likely affect local aquatic ecosystems, and/or local population who use the water for drinking, washing, irrigating or livestock watering. In addition to the above, storm water may pose a risk of flooding to a proposed development, if not managed correctly.

The aim of the conceptual Storm Water Management Plan is to mitigate the above impacts by fulfilling the requirements of the NWA, as well as the GN 704 requirements. GN 704 was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources.

The five main conditions of GN704 applicable to the Applicant are:

- **Condition 4**: which defines the area in which, mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam, reservoir together with any associated structure or any other facility should be situated outside the 1:100 year flood-line. Any underground or opencast mining, prospecting or any other operation or activity should be situated or undertaken outside of the 1:50 year flood-line. Where the floodline is less than 100 metres away from the watercourse, then a minimum watercourse buffer distance of 100 metres is required for infrastructure and activities;
- **Condition 5**: which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource;
- **Condition 6:** which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level;
- **Condition 7**: which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable; and

- **Condition 10:** which describes the requirements for operations involving extraction of material from the channel of a watercourse. Measures should be taken to prevent impacts on the stability of the watercourse, prevent scour and erosion resulting from operations, prevent damage to in-stream habitat through erosion, sedimentation, alteration of vegetation and flow characteristics, construct treatment facilities to treat water before returning it to the watercourse, and implement control measures to prevent pollution by oil, grease, fuel and chemicals.

5.5. OPERATIONAL MANAGEMENT

Management of operational risk is a key consideration for mines operating within the social and economic context of South Africa. Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk. Operational risks and impacts RE managed through the implementation of the Safety, Health, Environment and Quality (SHEQ) system.

5.5.1. ORGANISATIONAL STRUCTURE

The organizational structure for the Applicant is presented **Error! Reference source not found.** above and the below sections includes a discussion of resources and competencies, as well as the internal and external communication processes that are implemented by the Applicant.

5.5.2. RESOURCES AND COMPETENCIES

The success of Environmental Management is dependent upon the commitment of the organization, at all levels, to environmental excellence. Commitment to the structured and effective Environmental Management Plans (EMPs) will benefit both the organization business success and the community in which it operates. This commitment requires that the organization provide the necessary resources for employee training, reference material and reporting procedures. Senior executives and line managers shall be held responsible and accountable for the health and safety of personnel while on duty as well as the environmental impacts caused by mining activities.

The Applicant values its employees as a valuable asset and as such has embarked on extensive training of employees on the mining area to equip each individual with knowledge to perform their duties in a safe and productive manner. Furthermore, a portable skills training programme has been implemented to equip individuals with knowledge to be able to work in alternative fields other than mining. The competence of the workforce will be ensured through selection, training and awareness in health safety and environmental matters. Continual evaluation measures (toolbox talks, site inspection, pre-use inspection, scheduled maintenance to name a view) to ensure performance outcome on social, health and well-being, as well as improved environmental management through the lifespan of the

operations. Regular reviews on measurement take place with monthly safety meetings during which time decision are taken on aspects identified that need to be addressed.

The management of and the responsibility for the EMP rests with the appointed Mine Manager on an operational level and the Technical Manager on the maintenance side. The Mine Manager in conjunction with the CEO of the company will be responsible for:

- The implementation of the EMP;
- Following the annual EMP audit reports, the required actions on identified aspects are addressed;
- Community liaison to update communities on changes to the project design, potential impacts and health and safety aspects;
- Correct document and record control;
- Preservation of indigenous vegetation and eradication of weeds as per the approved EMP;
- Implementation of external environmental audits, and
- Operational area management will take place per mine area, including EMP reporting and inspection.

5.5.3. INTERNAL AND EXTERNAL COMMUNICATION

Public Participation Process (PPP) is a requirement of several pieces of South African Legislation. The aim of public participation is to ensure that all relevant interested and affected parties (I&AP's) are meaningfully notified, consulted and their opinions considered during the course of the project. The methodology applied to the PPP, must be one of openness, transparency and collaboration between the EAP and I&AP's. All documentation pertaining to the IWWMP will be made available to the public for comment in accordance with the relevant regulations.

5.5.4. TRAINING AND AWARENESS RAISING

Training and environmental awareness is an integral part of environmental management of a mine. Active SHE awareness conducted with toolbox talks, monthly SHE meeting chaired by Director in conjunction with Mine Manager, as well as SHE Manager to actively drive all SHE aspects on continuous basis.

The mine must ensure that all relevant employees are trained and capable of carrying out their duties in an environmentally responsible and compliant manner, and are capable of complying with the relevant environmental requirements. To obtain buy-in from staff, individual employees need to be involved in:

- Identifying the relevant risk;
- Understanding the nature of risks;
- Devising risk controls; and
- Given incentive to implement the controls in terms of legal obligations.

The mine shall ensure that adequate environmental training takes place. All employees shall have been given an induction presentation on environmental awareness. Where possible, the presentation needs to be conducted in the language of the employees. All training must be formally recorded and attendance registers retained. The environmental training will, as a minimum, include the following:

- General background and definition to the environment;
- The importance of compliance with all environmental policies;
- The environmental impacts, actual or potential, of their work activities;
- Compliance with mitigation measures proposed for sensitive areas;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving compliance with the environmental policy and procedures and with the requirement of the mine 's environmental management systems, including emergency preparedness and response requirements;
- The potential consequences (legal and/or other) of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying out their work activities; and
- All operational risks must be identified and processes established to mitigate such risk, proactively. Thus the mine needs to inform the employees of any environmental risks that may result from their work, and how these risks must be dealt with in order to avoid pollution and/or degradation of the environment.

In the case of permanent staff required during the operational phase of the project, the mine / contractor shall provide evidence that such induction courses have been presented. In the case of new staff (including contract labour) the contractor / mine shall keep a record of adequate environmental induction training.

5.6. MONITORING AND CONTROL

Monitoring regimes, will allow the Applicant to update and refine proposed mitigation measures in order to further reduce the impact on the receiving water resources

5.6.1. SURFACE WATER MONITORING

Surface water monitoring will take place on mine sites in order to measure if there is any impact on the surface water that may have been as a result of mining activities and may have detrimental effect on the environment.

Monitoring objectives are as follows:

- Identification of any pollution on site, then also the origin and extent of pollution;
- Impacts of identified pollution on the receiving water environment;

- Documentation of incident and improvement measures taken for prevention (Database); and
- Ensure that actions taken do comply with set legislative requirements

It is recommended that surface water samples will be taken on a monthly basis, and the spring flow measurement be conducted on a quarterly basis (Refer to Hydrogeological Assessment attached in Appendix C). The following parameters are recommended for surface water monitoring with reference to baseline sampling done:

- pH, Electrical Conductivity (EC), total dissolved solids (TDS), total suspended solids (TSS); Chemical Oxygen Demand (COD); Alkalinity (PAlk), Calcium (Ca), Magnesium (Mg), Potassium (K), Chloride (Cl), Sulphate (SO_4,); Fluoride (F), , 'Nitrate (NO_3), Sodium (Na); Manganese (Mn), Iron (Fe) and Aluminium (Al).

5.6.2. GROUNDWATER MONITORING

Groundwater monitoring should include quality analysis and water level monitoring and should be conducted on a quarterly basis. The monitoring objectives for groundwater are:

- To provide reliable groundwater data that can be used for management purposes;
- The early detection of changes in groundwater quality and quantity;
- To provide an on-going performance record on the efficiency of the Water Management Plan;
- To obtain information that can be used to redirect and refocus the Water Management Plan; and;
- To determine compliance with environmental laws, standards and the WUL and other environmental authorisations.

The following parameters are recommended for ground water monitoring with reference to baseline sampling done:

- pH, EC,TDS, TSS; COD; Alkalinity (PAlk), Ca, Mg, K, Cl, SO_4; F, NO_3, Na; Mn, Fe and Al.

5.6.3. BIOMONITORING

The purpose of aquatic biomonitoring is aimed at assessing the ecological integrity of wetlands and rivers at the time of sampling in relation to the pre-mining condition. The data contained in the aquatic ecology specialist report, serves as a baseline for future biomonitoring and the sample sites listed in. At present, no biomonitoring is being conducted onsite. The Applicant will be responsible for the development and implementation of an aquatic bio-monitoring plan. Biological monitoring should be conducted by accredited personnel and laboratories.

Table 25: Biological monitoring

Parameter	Frequency	Sampling Location
Bio-toxicity (Definitive) – Algal Growth Potential, *Vibrio*, *Daphnia*, Guppy	Quarterly	Up- and downstream of discharge points

Parameter	Frequency	Sampling Location
South African Scoring System (SASS5) including Integrated Habitat Assessment (IHI) version 2	Bi-annually	Up- and downstream of discharge points
Algae (algal biomass, taxonomic composition and diatom indices)	Quarterly	Up- and downstream of discharge points

5.6.4. DUST MONITORING

Monthly dust monitoring is currently undertaken by Nature Bound. Fallout dust are dust particles with an aerodynamic diameter greater than 20 µm. These particles are often too heavy to remain in suspension in the air and fall out of the air within a relatively short distance, hence the name “fallout dust”. Dust particles in this range are commonly referred to as a nuisance.

Nuisance dust can reduce visibility and soil buildings and materials, which can cause damage and an increase in cost due to the need for washing, cleaning and repainting. Plants can be affected by dust fallout through reduced light transmission, which affects photosynthesis and can result in decreased growth. Fallout dust can also collect in watercourses, causing sedimentation and a reduction in the water quality, and can also affect aquatic life through the impact on riverine habitat and fish gill clogging.

5.6.5. WASTE MONITORING

The Applicant will develop and implement a waste management plan which complies with the principles of the NEMWA and provides a mechanism for the effective management of waste throughout the LoM. This plan has ensured that the appropriate management of all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste, etc. The objectives of a waste monitoring programme are to identify and sufficiently manage waste related impacts through:

- avoiding and minimising waste;
- reducing and recycling waste; and
- the prevention of pollution.

Solid waste must be monitored in accordance with the waste management conditions detailed below:

- The Applicant shall develop and maintain a hazardous substance register for all hazardous materials that shall be kept on site. Material Safety Data Sheets (MSDS) must be available on site at the point of use and readily accessible for all hazardous substances stored;
- All plant and equipment must be inspected regularly (daily) to ensure that it is in good working condition, clean, and free from leaks of oil, petrol, diesel, hydraulic fluid and contaminating compounds;
- Daily inspections shall be carried out to ensure such spill prevention measures are in place and remain effective;

- The Applicant shall maintain a waste register which shall be used to track all waste removed from site. Proof of appropriate waste disposal shall be kept on file at the site for auditing purposes;
- The Contractor (or reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. Chemical toilets shall be emptied/serviced frequently to avoid offensive odours (at least weekly). Toilets must be kept in a clean, neat and hygienic condition. Chemical toilets shall be cleaned and emptied before the contractor's long weekends or public holidays; and
- Disposal of sewage from chemical toilets shall be in a safe and responsible manner and at an approved facility specifically for that purpose. Proof of sewage removal and disposal shall be kept on file for auditing purposes.

Hazardous / Chemical Waste is also be monitored on daily basis. However, the risk has been addressed with the decision taken not to service and maintain equipment on the mine site. The Applicant understands and is aware that unscheduled breakdowns may occur on the mining site, as well as external entities collecting sand, which will be monitored and cleanup action taken in accordance with acceptable environmental practice.

The sediments that are removed from desilting of the dams needs to be analysed in order to determine whether or not these are suitable for rehabilitation purposes. Once the Applicant has received an analysis of the sediments, they either need to be disposed of correctly or the correct fertilizers need to be applied to these sediments to make them suitable for rehabilitation purposes.

5.6.6. STORM WATER STRUCTURES

Storm water structures (channels, silt traps, dirty water containment facilities and energy dissipaters) should be monitored every year in September before the rainy season begins for any blockages or breaches. They should further be monitored immediately after every storm event during the rainy season. Should blockages or breaches occur, immediate action should be undertaken to remove debris and / or repair breaches. Monitoring should be undertaken by the onsite Environmental Control Officer (ECO) or maintenance manager. Inspections should be recorded and should include the following:

- Date of inspection;
- Rainfall amount received;
- Photographs of blockages and / or breaches witnessed;
- What action were taken to fix issues and amount of time taken to address issues; and
- Photographs post action taken.

The inspection reports should be presented to the DWS.

5.6.6.1. STORM WATER MANAGEMENT DESIGN

Two options have been considered for the Storm Water Management Plan (SWMP) and are described below.

Option 1

Option 1 includes a clean water diversion channel that extends around the entire upslope and sides of the boundary of the site (Figure 28). Clean water will flow from the north-eastern most point of the site, which has the highest elevation, and will flow either north-west or south-east, downslope and discharge into the Leeuspruit floodplain on either side of the site. The clean water channels will not require any lining, but should be vegetated with grass to prevent erosion. Energy dissipaters are recommended at the outlets of clean water channels where they discharge in to the Leeuspruit floodplain to prevent erosion. It is proposed that they consist of a collection of rocks as indicated in Figure 27.

Figure 27: Proposed Energy Dissipater

Dirty water generated on the site, will runoff downslope towards the Leeuspruit, and be captured by dirty water channels running along the bottom boundary, which will convey water to a silt trap before discharging into a dirty water containment facility located at a low point. Water from the dirty water containment facility can be pumped for use in the plant. Depending on the outcome of future water quality monitoring, the dirty water channels and containment facility may not need to be lined. A separation berm, with material obtained from the clean and / or dirty water channels, should be established to further separate clean and dirty water areas.

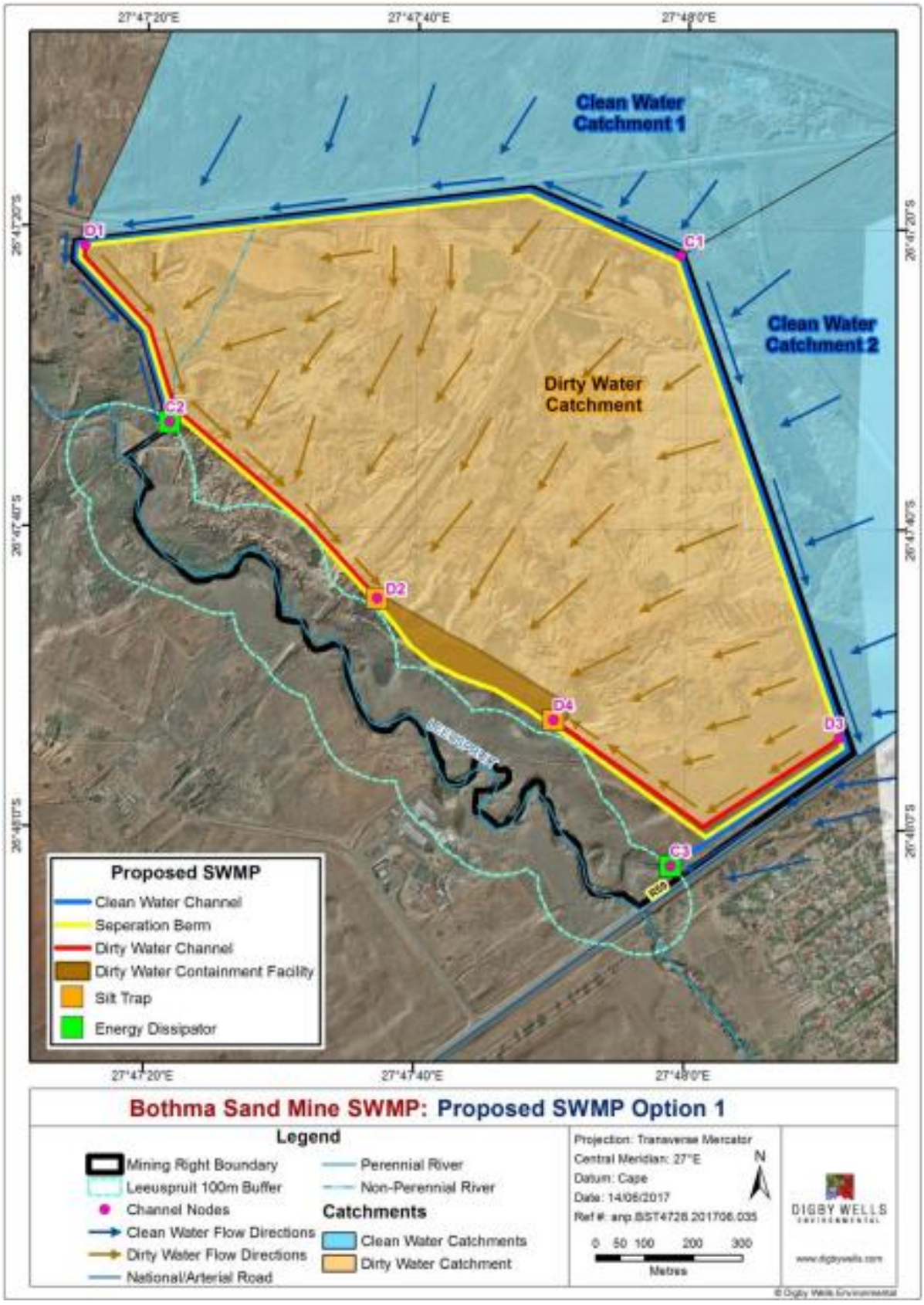

Figure 28: Proposed SWMP Option 1: Proposed SWMP Option 1

Option 2

Option 2 includes splitting the site into two dirty water areas that each report to their own dirty water containment facility (Figure 29). This allows for no disruption to the old Sasol conveyor servitude that runs through the centre of the site. Similarly to Option 1, upslope clean water will be diverted by channels that will discharge clean water into the floodplain of the Leeuspruit. Energy dissipaters are recommended where the clean water channels discharge into the Leeuspruit floodplain to prevent erosion. Dirty water will be captured by dirty water channels that will convey water to silt traps before discharging into two dirty water containment facilities. Water from the dirty water containment facilities can be pumped for use at the Plant.

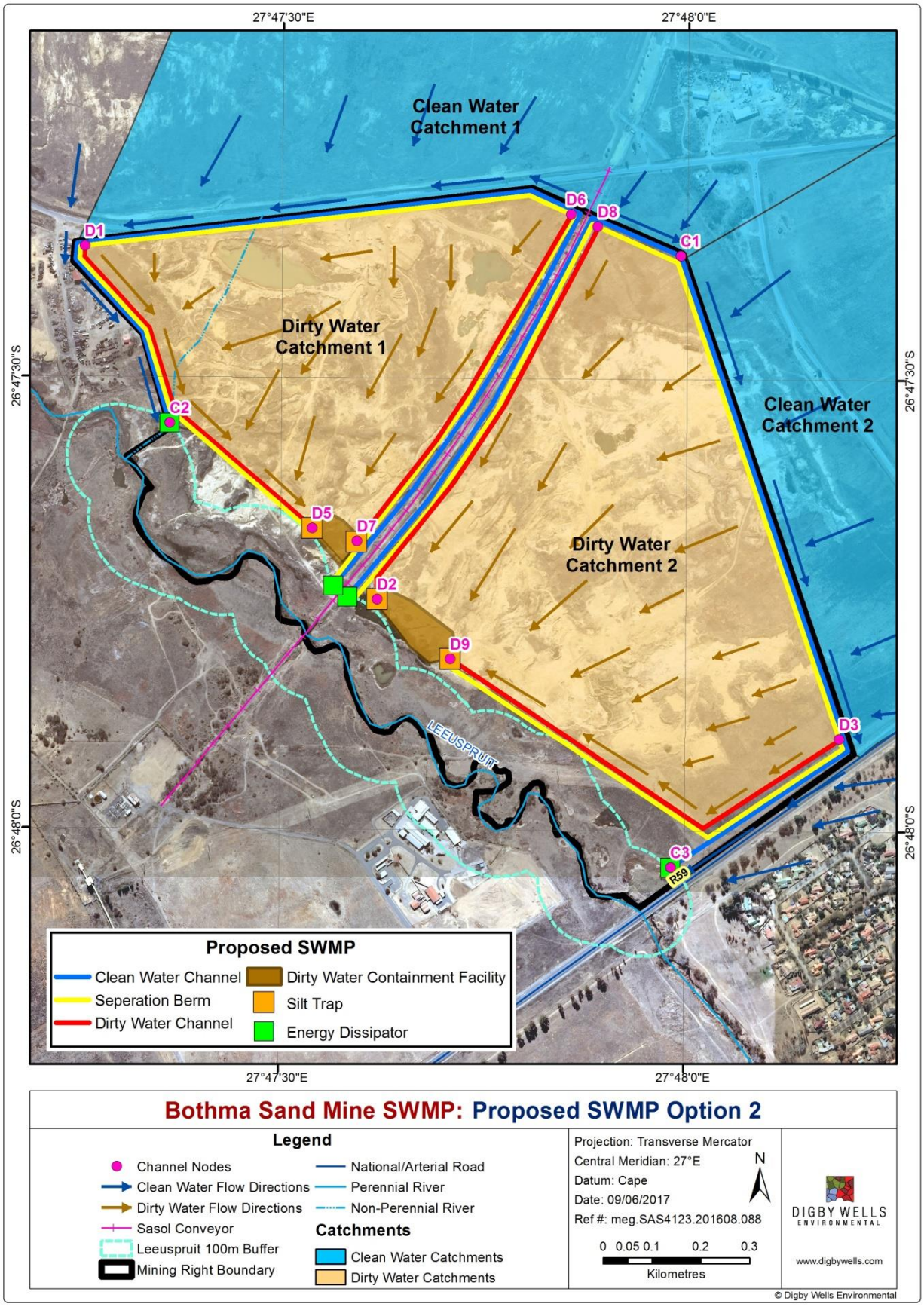

Figure 29: Proposed SWMP Option 2

5.6.6.2. CONCEPTUAL CHANNEL DESIGNS

GN704 requires that the clean and dirty water systems are designed, constructed, maintained and operated so that they do not spill more than once in 50 years. Therefore, the proposed channels were sized to accommodate the 1 in 50 year peak flows. Clean and dirty water channels will be designed to be trapezium in shape. Figure 30 indicates the proposed conceptual design of the channel and the berm.

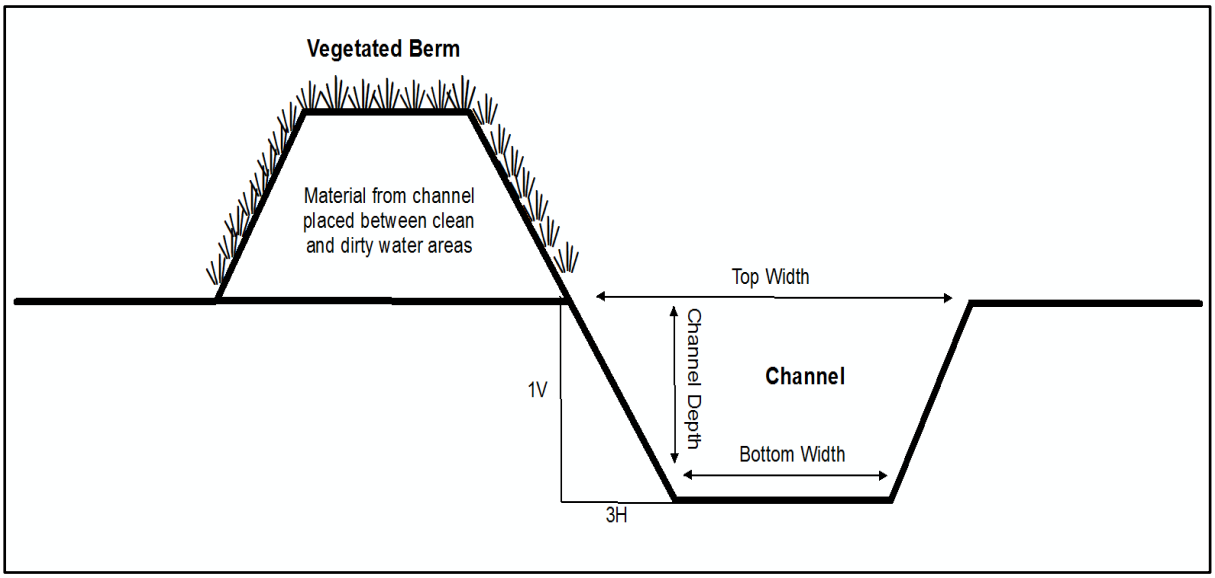

Figure 30: Conceptual Design of Channels and Berm

5.7 RISK ASSESSMENT / BEST PRACTICE ASSESSMENT

An impact/risk assessment was undertaken for this IWWMP (refer to Appendix I of this report for a copy of the impact assessment matrix). This section deals with the identification of risks/impacts and their mitigation measures. The following prediction and evaluation of impacts is based on the mining activities conducted at the project area.

The first stage of impact assessment is the identification of environmental activities, aspects and impacts. The receptors and resources are also identified, which allows for an understanding of the impact pathway and assessment of the sensitivity to change.

The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The values for the likelihood and consequence (severity, spatial scope and duration) of the impact are then used to determine whether mitigation is necessary.

The following criteria have been used to describe magnitude and significance of impacts in a systematic manner:

- Extent or spatial scale of the impact;
- Intensity or severity of the impact;
- Duration of the impact;
- Mitigatory potential;
- Acceptability;
- Degree of certainty; and
- Impact Magnitude/Significance.

Describing the impacts in terms of the above criteria, provides a consistent and systematic basis for the comparison and application of scoring impacts. The rating for each criterion is provided in Table 26.

TABLE 26: CRITERION FOR RISK ASSESSMENT

Rating	Comment
Impact criteria: Intensity or severity of the impact	
High:	Disturbance of pristine areas that have important conservation value.
	Destruction of rare or endangered species.
Medium:	Disturbance of areas that have potential conservation value or are of use as a resource.

	Complete change in species occurrence or variety.
Low:	Disturbance of degraded areas that little conservation value.
	Minor change in species occurrence or variety.
Impact criteria: Duration of the impact	
High (Long term) (more than 15 years)	Permanent
	Beyond decommissioning
	Long term (more than 15 years)
Medium (Medium term) (5 to 15 years)	Reversible over time
	Lifespan of the project
	Medium term (5-15 years)
Low (Short term) (0 to 5 years)	Quickly reversible
	Less than the project lifespan
	Short term (0-5 years)
Mitigatory potential	
High:	High potential to mitigate negative impacts to the level of insignificant effects
Medium:	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects.
Low:	Little or no mechanism to mitigate negative impacts.
Acceptability	
High (Unacceptable)	Abandon project in part or in its entirety

	Redesign project to remove impact or avoid impact
Medium (Manageable)	With regulatory controls
	With project proponent's commitments
Low (Acceptable)	No risk to public health
Degree of certainty	
Definite	More than 90% sure of a particular fact. Substantial supportive data exist to verify the assessment.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible:	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact, or the likelihood of an impact occurring.
Categories for the rating of impact magnitude and significance	

Rating	Comment
High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities or communities are disrupted to such an extent that these come to a halt. In the case of beneficial impacts, the impact is of a substantial order within the bounds of impacts that could occur.
Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are

	changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost and effort.
Low	Impact is of a low order and therefore likely to have a little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural and economic activities of communities can continue unchanged. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.
No impact	Zero impact.

5.7.1 SURFACE WATER AND GROUNDWATER

The impact assessment matrix conducted by the hydrogeologist is included in Section 7-7 of the Hydrogeological Report (Appendix C). The main impacts associated with operational phase activities include the following:

- Lowering of regional groundwater levels due to mine dewatering and depletion of groundwater from aquifer storage;
- Contamination of surface water and groundwater resources by seepage of unacceptable qualities of water from waste water management facilities into the water resources;
- Deterioration of surface water quality and possible siltation due to contaminated stormwater runoff which originates from the mining area footprint. Reduction of surface water runoff due to change in surface catchment areas in the form of berms and trenches;
- Increasing of surface water runoff due to vegetation clearance and onset of erosion;
- Reducing of groundwater recharge, which will lead to a reduction in stream discharge as baseflow ,as well as lowering of neighbouring boreholes yields; and
- Contamination of surface water and groundwater from the sediments that are removed from the settlement dams and used for rehabilitation.

The main impacts associated with mine post-operational phase activities include the following:

- Mine dewatering effects decreasing and post-operational rewatering;
- Impact on storm water drainage and increase in recharge of aquifer due to poor and incorrect rehabilitation; and
- Continued seepage of poor quality water from waste water management facilities.

Mitigation and management measures associated with the operational phase activities include the following:

- Development and implementation of an integrated groundwater and surface water monitoring program to cater for site specific needs;
- Development and implementation of a site stormwater management plan according to the NWA and GN704;
- Mine area rehabilitation according to the approved EMPr, as well as closure and rehabilitation plan; and
- Analysing the sediments used for rehabilitation to determine if the sediments are suitable for the process.

Mitigation and management measures associated with the post-operational phase activities include the following:

- Ensure that rehabilitation is properly conducted and in accordance with the approved mine closure and rehabilitation plan; and
- Ongoing monitoring during the post-operational phase. Decommissioning and rehabilitation of waste water storage facility.

5.7.2 WETLANDS

A risk assessment as per the requirements of the DWS' GN. 509 of 2017 in terms of the NWA has been conducted by the wetland specialist (Refer to Section 7 of the Water Resource Assessment report attached as Appendix B). The current sand mining operation has resulted in the loss of a seepage area. The loss of wetland areas cannot be mitigated, so the risk assessment will focus on risks associated with the floodplain (Leeuspruit River) system.

As this project is for the continuation of sand mining, impacts associated with the activities are potentially moderate. Modifications to the biotic integrity and instream and riparian habitat of the Leeuspruit River system are likely to continue during operation. The project will entail the clearing of vegetation and sand mining. This has the potential to increase erosion and sedimentation of downstream habitats due to mining activities and surface runoff during the wet season. Furthermore, due to the proximity of the operation to the floodplain system, direct impacts to the instream, marginal and riparian zones are likely.

A high risk, both with and without mitigation is expected for the mined seepage area. The loss of wetland areas cannot be mitigated, a potential offset strategy may be required in order to compensate for the lost seepage area. With reference to the floodplain system, the sand mining activities will entail the clearing of new areas to accommodate expansion (if needed) which entails the removal and stockpiling of topsoil. Further sand mining activities include the operation of equipment and machinery, the mining of sand and stormwater management. All of which will pose risks to the identified floodplain system, with the level of risk determined to vary from low to moderate. These low risk ratings may largely be

attributed to the project not necessarily having a direct impact on the Leeuspruit River system. The moderate risks determined for the study are associated with the operation of equipment and machinery and sand mining activities on the periphery of the wetland system. A single moderate risk rating, namely the operation of equipment and machinery, was re-allocated a low status due to implementation of additional mitigation methodologies listed below. Notable expected risks include the potential for erosion and increased sedimentation of the aquatic areas.

The mitigation measures prescribed below must be applied in order to address aspects that may impact on the floodplain system. The following sand mining specific mitigation measures are provided:

- The footprint area of the mining activities should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas;
- Exposed sand bank surfaces awaiting removal must be stabilised to prevent the erosion of these surfaces. Signs of erosion must be addressed immediately to prevent further erosion;
- Silt traps and fences must be placed in the preferential flow paths throughout the sand mine operations area to prevent sedimentation of the watercourse and wetlands;
- Berms and silt traps should be constructed on the periphery of the mining area in order to prevent sedimentation of the area into the adjacent floodplain system;
- Temporary storm water channels should be filled with aggregate and/or logs (branches included) to dissipate flows;
- Stockpiling of soil should take place outside of the watercourse. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds; and; and
- A suitable storm water plan must be compiled for the sand mine operation. This plan must attempt to displace and divert stormwater (clean water) from the operation areas, and discharge the water into adjacent areas without eroding the receiving areas. Separation of clean water from operations water will prevent contamination of clean water. It is preferable that run-off velocities be reduced with energy dissipaters and clean water flows discharged into the local watercourses.

The following general mitigation measures are provided:

- The water resource areas outside of the specific project site area must be avoided where possible;
- Laydown yards, camps and storage areas must be beyond the aquatic areas;
- Prevent uncontrolled access of vehicles through the water resources that can cause a significant adverse impact on the hydrology and alluvial soil structure of these areas;
- All chemicals and toxicants to be used for the sand mining activities must be stored outside the water resources and in a designated and bunded area;

- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- Erosion and sedimentation into the river channel must be minimised through the effective stabilisation (gabions and Reno mattresses) and the re-vegetation of any disturbed banks;
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil; and
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

5.8 ISSUES AND RESPONSE FROM PUBLIC CONSULTATION PROCESS

A Public Participation Process (PPP) is being undertaken for the Applicant. I&AP's will be provided opportunities throughout the process to provide comment and thereby participate in the PPP. I&AP's will be afforded an opportunity to review and comment on the draft IWWMP. The draft IWWMP will be made available to all registered I&AP for a period of 30 days from the 05July 2017 until 03 August 2017. The Public Participation Report describing the PPP for this WUL application is attached as Appendix D to this IWWMP. A summary of the comments and responses received to date are presented in Table 27 below.

TABLE 27: SUMMARY OF COMMENTS RECEIVED FROM I&APS

Name	Date	Method	Issues	Response	Aspect
Rand Water	23/05/2017	Email	Dear Sir/Madam Rand Water is hereby registering as IAP for the above-mentioned project. Kindly forward confirmation of registration as IAP to Natalie Koneight at nkoneigh@randwater.co.za Attached is Rand Water's Wayleaves, for your information. Can you please provide Rand Water with the following: 1. **The shapefiles for the infrastructure proposed as well as road connections/access roads.** 2. Coordinates of the development; 3. A layout plan for the development including development footprint; 4. Specialist studies being undertaken;	Dear Natalie, Thank you for your interest in the above mentioned project. Please note that you have been added to the project database as a Registered Interested and Affected Party (I&AP). Should you have any further comments or queries please feel free to contact me.	Locality of project.

Name	Date	Method	Issues	Response	Aspect
			5. Confirmation as to whether wayleaves will be required, from Rand Water 6. The detail about the facility that will receive the sewerage. 7. An agreement that the identified sewerage facility is aware of the development and that they have the capacity to accept the sewerage from the site without overloading the facility. Will there be any discharges other than the sewerage system that will increase storm water entering the environment. If so, has the development considered retention and stilling ponds to slow down high peak flows. If the sewerage facility cannot accept the additional load into their facility then this will have a negative impact on the environment and the pollution load into the river systems. **Minimum requirements for shapefiles (spatial data)** The shapefile must be in the geographic (decimal degrees) coordinate system in the		

Name	Date	Method	Issues	Response	Aspect
			WGS84 datum, in other words, not projected e.g. to Transverse Mercator. It is essential that the shapefile contain at least the following three files having the same prefix, but different extensions: · .shp – the file that stores the feature geometry (or the shape of the feature). · .shx – the file that stores the index of the feature geometry. · .dbf – the dBASE file that stores the attribute information of features. When shapefiles are created using ESRI's ArcGIS software, a file with the following extension must also be included: · .prj – the file that stores the coordinate system information. (Check the shapefile's properties and make sure that the coordinate system is set to geographic, WGS84). Optional extensions to include may be any of the following:		

Name	Date	Method	Issues	Response	Aspect
			· .xml – the file that stores metadata (information about the data). · .sbn and .sbx – the files that store the spatial index of the features. · .fbn and .fbx – the files that store the spatial index of the features for shapefiles that are read-only. · .ain and .aih – the files that store the attribute index of the active fields in a table or a theme's attribute table. The collection of files should be treated as one file and should never be separated, or else the shapefile will be rendered unusable. NB: Please note that a file with any of the following extensions is not a shapefile: .apr, .aep, .axl, .mxd. These are examples of map documents (commonly referred to as project files) created by different ESRI GIS software. Map document files only contain references to data stored on your hard disk and do not contain the data physically. Such a file cannot		

Name	Date	Method	Issues	Response	Aspect
			be opened without the accompanying shapefiles. Regards **Name:** Natalie **Surname:** Koneight		
Johan Botha (Sasol)	17/05/2017	Email	Attention: Cheyenne Muthukarapan Please register me as an IAP. Sasol Mining actively mined in this area and is currently busy with mine closure actions. The potential impacts of mining as well as issuing such a license must be investigated. Regards Johan Botha	Good Morning Mr Botha, Thank you for your response regarding this notification. Please note that you have been registered as an Interested and Affected Party for this project. Should you have any further comments or queries please feel free to contact me .	Rehabilitation
Tertius Bothma	30/05/2017	Email	Good Day Your Application Notice in the local newspaper refers.	Dear Mr Bothma, Thank you for your correspondence regarding S. Bothma and Son Transport (Pty) Ltd. Please be advised that your	Rehabilitation

Name	Date	Method	Issues	Response	Aspect
			Please ensure that the following persons are registered as I&APs:- 1. Tertius Bothma Beleggingstrust 2. Tertius Bothma The referred location is the site upon which is part of a court action against S. Bothma and Sons Transport (Pty) Ltd and the owners of the company (as part of the trusts). This action relates to a court order for their failure to rehabilitate their sand mine situated on our property (near the location of the water licence application). They have failed to adhere to the court order and we have instituted action against them. Please note that our contact details are:- Tertius Bothma mobile 082 652 1212 Office Number 016 976 9001 Email: tertius@izamix.co.za and bothmabatho@gmail.com We prefer that you communicate via email please.	comments have been noted and will be included in the Issues and Response Report. As a registered I&AP I will notify of updates and provide you with the opportunity to comment on the Scoping Report and Environmental Impact Assessment Report once available. Should you have any further concerns please feel free to contact me.	

Name	Date	Method	Issues	Response	Aspect
			Thank you. TERTIUS BOTHMA		
Pat Cunningham	30/05/2017	Email	Thank you for the notification regarding the application by S.Bothma and Sons Transport(Pty) Ltd for an integrated water use license. I advise that I am resident at 34 Siegfried Kuschke Street and as such wish to be registered as an interested and affected party. Before deciding what action, if any, I may wish to take, it will be appreciated if mores details can be provided on section 21(a) through to section 21(g), this; What 1. What water resource is to be used and how much water is intended to be taken.? 2. How will water be stored and where? 3. What diversion of the watercourse are intended? 4. How and where will discharging of water take place and into which watercourse?	Dear Mr. Cunningham, Thank you for the below email. As per your request, EIMS has registered you as an Interested and Affected Party (I&AP) for the S. Bothma and Son Transport Sand Mine and as such, you will be notified of all future opportunities to review and comment on reports in due course. Please find below information on the questions that you have with regards to the project. **1. What water resource is to be used?** The S. Bothma and Son Sand Mine will abstract about 238 899 m3 per annum of water from the Leeuwspruit, and make use of rainwater. **2. How will water be stored and where?**	Water Uses

Name	Date	Method	Issues	Response	Aspect
			5. How is it intended to dispose of water without contaminating a. Water resource? 6. Where and how is it intended to alter the watercourse and associated banks etc. Although your notification does not pertain to the development of the "sand mine" as indicated on the plan, your advice is requested as to who may be approached with regard to this development as there are concerns amongst local residents with regard to the following which may have to be addressed; A. How deep is this mine intended to be? B. Will there be "mountains" of sand, as this could be detrimental to residents when there are strong windows and sand will be blown into houses. C. What is the Life of this intended mine. Your assistance will be appreciated Thank you	The water to be abstracted (as indicated in (1) above is stored in processing dam, which feeds the two plants, and the return water from the plants is stored in settling dam (Pollution Conbtrol Dam). However there is a clean water dam within the Mining Right area which stores water from a natural spring and forms part of management of run-off water towards mining operations. **3. What diversion of the watercourse are intended?** According to the National Water Act (Act 36 of 1998), a watercourse refers to any spring, wetland, river or stream and any activity which impedes or diverts the water in a watercourse (including activities within 500m from a watercourse), are required to be licenced. As such, the mining infrastructure which fall within 500m of a watercourse or within a watercourse triggers the requirement for a Section 21 (c) water use.	

Name	Date	Method	Issues	Response	Aspect
			Regards Pat Cunningham Cell: 0825668999 Pat@cerberusrisk.co.za	**4. How and where will discharging of water take place and into which watercourse?** Periodic discharge/release of water from the mining infrastructure (e.g.: wash plant) will take place and will be directed into the existing Pollution Controlled Dam (PCD) onsite. This PCD is a “dirty” water containment facility to trap sediments with the overflow released into the environment. **5. How is it intended to dispose of water without contaminating a Water resource?** The contaminated water is disposed of into the Pollution Control Dam located within the Mining right of the mine. The Integrated Water and Waste Management Plan (IWWMP), which is the technical document that will be submitted as a supporting document for the Water Use Licence Application, will include environmental impacts from the use of	

Name	Date	Method	Issues	Response	Aspect
				water. During the course of the development of the IWWMP (and through relevant investigations of potential impacts), relevant mitigation measures are to be put forward which would aim at mitigate the possible contamination of a water resource. Please note that the contamination that is being referred to is sediment (clay only). No foreign materials will be discharged. **6. Where and how is it intended to alter the watercourse and associated banks etc.?** Please refer to Point 3 above. In terms of the NWA, Section 21(c) and (i) water uses are triggered together as they speak to similar impacts on the receiving water resources. **A. How deep is this mine intended to be?** The average depth of the mine is approximately 3.5 meters below ground	

Name	Date	Method	Issues	Response	Aspect
				level. In accordance with Mine Works Programme and the Environmental Management Programme approved for the Mining Right the Bothma Sand mine makes use of strip mining and may bench excavations 1:5 up until resource is mined out. **B. Will there be "mountains" of sand, as this could be detrimental to residents when there are strong windows and sand will be blown into houses?** The stockpiles will be approximately 2 -3 meters. Mitigation measures for dust suppression will be investigated and presented in said reports. Consecutive rehabilitation – vegetation and watering of roads **C. What is the Life of this intended mine?**	

Name	Date	Method	Issues	Response	Aspect
				The life of mine is approximately 10 years (ending in 2024). Please note that all your comments will be included in the Public Participation Report that will be submitted to the Department of Water and Sanitation for adjudication. Should you have any further queries, please do not hesitate to contact me. Kind regards, Sonja van de Giessen	
SAHRA	30/05/2017	Email	Dear Ms. Muthukarapan, We have received notifications for applications for Environmental Authorisation via mail for the farms as stated below. Despite our email from 18 May 2017 (below), we have yet to receive applications on SAHRIS in order to comment on them. Please submit an application on the South African Heritage Resources Information System (SAHRIS). Please follow the step-by-step tutorial videos	Dear Ms. Redelstorff, EIMS has loaded the project onto the SAHRA Information System.	I&AP registration

Name	Date	Method	Issues	Response	Aspect
			on the SAHRIS homepage (http://sahra.org.za/sahris/) and upload all documents to the case file. Kind regards, Ragna Redelstorff		
Mr. Pat Cunningham	08/06/2017	Email	Thank you for the response to my questions. May I please add the following resulting from your replies; 1. How is compliance with the legislation going to be monitored. I do have a concern that Govt. monitoring will not be up to required standard. Is there any independent alternate compliance monitoring facility available?. Will local residents, (I&AP) have unfettered access to the site to ensure compliance with the legislation. 2. What will happen if the pollution dam collapses, possibly due to heavy rain. Is there a disaster management programme in place for such an event and also any event that may cause an environmental problem ?	Dear Mr. Cunningham, Thank you for the email and below, please see our responses to each of your questions. **1. How is compliance with the legislation going to be monitored. I do have a concern that Govt. monitoring will not be up to required standard. Is there any independent alternate compliance monitoring facility available?. Will local residents, (I&AP) have unfettered access to the site to ensure compliance with the legislation.**	Monitoring, Pollution, Impact Assessment

Name	Date	Method	Issues	Response	Aspect
			3. Where are the various dams mentioned below to be situated and will there be any smell emanating from these dams which could impact on local residents? 4. Has a complete Risk Management assessment been carried out for this development and if so is there a copy of the report available for inspection? 5. What effect on the Vaal River, if any, is anticipated from this development. Again, I advise that at this point there is no intention to lodge any objections, but the right to do so in the future is reserved and will depend on the responses to the above and the feedback from the PPR response from Government. Thank you Regards P.M. CUNNINGHAM (Mr)	In terms of the Mining Right, the mine is required to submit annual Environmental Management Programme (EMP) Performance Audits to the Department of Mineral Resources (DMR). Water quality monitoring and dust monitoring is conducted by an external specialist. Feedback on the dust results and water monitoring results will be done annually with inclusion in the current EMP performance assessment reports. The Water Use Licence (WUL) would likely also contain further conditions with regards to monitoring/auditing and providing the relevant authorities the results thereof. As it is a mining site, Interested and Affected Parties (I&APs) will for their own safety not have unfettered access to the site however on request and upon approval, access could be granted.	

Name	Date	Method	Issues	Response	Aspect
				2. What will happen if the pollution dam collapses, possibly due to heavy rain. Is there a disaster management programme in place for such an event and also any event that may cause an environmental problem ? S. Bothma and Son Transport Sand Mine has a Safety, Health and Environmental (SHE) policy in place. As per the Mining Right, Condition 11.1, the mine also has a legal obligation to protect the environment: *"Subject to section 43 of the Act, the Holder shall, during the tenure of this right while carrying out the mining operation under this right, take all such necessary and reasonable steps to adequately safeguard and protect the environment, the mining area and any person/s using or entitled to use the surface of the mining are from any possible damage or injury*	

Name	Date	Method	Issues	Response	Aspect
				associated with any activities on the mining area." Furthermore, the Bothma Sand Mine has washed and screened sand for numerous years and part of the daily operations includes dam status maintenance. To date the Bothma Sand Mine has not had an incident of dam failure. Bothma Sand Mine also has emergency response procedure ISO9001:2015 which addresses processes followed in the event of an emergency situation. **3. Where are the various dams mentioned below to be situated and will there be any smell emanating from these dams which could impact on local residents?** All dams are located within the Mining Right of the mine. Due to the nature and purpose of these dams, it is highly unlikely that any smells should emanate	

Name	Date	Method	Issues	Response	Aspect
				from the dams as they would fulfil the role of sediment traps. The Integrated Water and Waste Management Plan (IWWMP), which is the technical document supporting the WUL Application, will be placed out for public review and include a map indicating the location of the dams. As a registered I&AP, you will be notified once the IWWMP is available for public review. **4. Has a complete Risk Management assessment been carried out for this development and if so is there a copy of the report available for inspection?** In terms of the requirements of this WUL application, specialist studies, including risk management assessments, have been conducted for the water components of the application. These reports form part of the IWWMP and as	

Name	Date	Method	Issues	Response	Aspect
				indicated in Point 3 above, will be made available for public review. **5. What effect on the Vaal River, if any, is anticipated from this development.** Local surface water drainage from the Bothma Sand Mine occurs via the Leeuspruit, which flows in a south-east/north-western direction towards the Vaal River, approximately 3 km to the northwest. The hydrogeological study that has been conducted indicates that without mitigation measures in place there may be a moderate "deterioration in surface water quality and possible siltation due to contaminated stormwater run-off which originates from the mining footprint area", however, with mitigation measures in place this becomes a low probability impact as the intention of these mitigation measures would be to	

Name	Date	Method	Issues	Response	Aspect
				prevent adverse effects on the surrounding watercourses. We trust that you will find this in order, however, should you have any further queries, please do not hesitate to contact us.	

5.9 ASSESMENT OF LEVEL AND CONFIDENCE OF INFORMATION

The updated specialist information, (which includes numerous studies commissioned in 2017) in this IWWMP update is regarded as sufficient to support the compilation of the IWWMP. The IWWMP should be annually amended to ensure effective ongoing management of the Applicant. Focus should be placed on calibrating the ground water model with up-to-date results to ensure the model remains accurate.

The assumptions, uncertainties and limitations for the specialist studies undertaken are provided below.

5.9.1 SURFACE WATER AND GROUNDWATER

The following project limitations and assumptions were applicable for this investigation:

- The findings recorded in the geohydrological report are limited to site observations and do not represent time series monitoring data;
- The scale of the investigation was set at 1:50 000 resolutions in terms of topographic and spatial data, except for geology, which was at a lower resolution of 1:250 000 scale; and
- The numerical groundwater flow model was developed based on existing geological and hydrogeological information. It should be stated that no site characterisation boreholes were drilled and/or pump tested for verification of geological and/or hydrogeological parameters.

5.9.2 WETLAND ASSESSMENT

The following aspects were considered as limitations for the wetland study:

- The aquatic baseline assessment was based on the results of a single wet season survey only, and information provided should be interpreted accordingly;
- The GPS used for wetland and riparian delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side;
- The current sand mining operation has resulted in the loss of expected wetland areas. As a result of this, wetland areas could not be affectively assessed and desktop information was used to supplement the findings; and
- Wetland systems identified at desktop level within 500 m of the project area were considered for the identification and desktop delineation, with wetland areas within the project area being the focus for ground truthing.

5.10 MATTERS REQUIRING ATTENTION

The Applicant needs to give attention to the following:

- At present both dirty and clean storm water are directed to the PCD leading to unplanned effluent discharge;
- Implementation of a suitable storm water management plan; and
- Implementation of an integrated surface and groundwater monitoring plan.

6 WATER AND WASTE MANAGEMENT

The following section describes water and waste aspects at the Applicants project area, as well as the related operational processes.

6.1 WATER AND WASTE MANAGEMENT PHILOSOPHY

The general principle of water management is the recognition that water is a scarce resource. This in turn leads to the other principles, such as water use minimisation (water conservation) or reuse of water and pollution prevention or the limitation of pollution of water.

Water that exceeds the quality, as set by DWS shall not be released from site, with the exception of emergency conditions, but it must be reused, thus reducing the quantity of intake of clean water. The Applicant will endeavour to:

- Continually seeking ways to improve its performance in terms of consumption, and water related impacts;
- Reduce consumption of clean water;
- Implement pollution prevention at source;
- Maximise, recycling and reuse of dirty storm water and process water;
- Implementation of process water treatment to facilitate reuse; and
- Collect, contain dirty storm water and process water on site for preferential use as process water.

The hierarchical management approach comprises the implementation of best practice measures to minimise water consumption and reduce impacts on water resources, by:

- Implementing measures to ensure compliance with relevant water and waste legislation and with other standards to which the organisation subscribes;
- Proactively identifying and implement actions that are required to achieve the water and waste related objectives;
- Implement these actions in an open and transparent manner;
- Implement on-going water and waste related monitoring to support legal compliance;
- Continually seeking ways to improve the performance of water and waste management systems, process and objectives; and
- Encourage open and transparent communication with regulatory authorities and other interested and affected parties within the context of the National Water Resource Strategy and Local Catchment Management Strategies.

6.2 STRATEGIES

6.2.1 SURFACE WATER

The general principle of water management is the recognition that is a scarce resource. This principal is guided by water use minimisation (water conservation) or re-use of water and pollution prevention or the limitation of pollution of water.

The goal of the Applicant is to minimise water consumption, impacts to the environment, running costs and to achieve environmental legal compliance, whilst maintaining adequate water supply as not to compromise the mining operations and supply of coal to industry. The following objectives are therefore set for the project:

- Water conservation by minimising water use. Water is reused wherever possible;
- Prevention of water pollution where possible;
- Minimise impacts on water resources and receiving water environment;
- Achieve and maintain legal compliance;
- Continuous mining operation to supply market need; and
- Production of quality coal for industry.

In order to achieve the above objectives, the Applicant is committed to uphold the following broad commitments:

- All water that can remain unpolluted will be kept separate and dirty water areas will be minimised;
- The use of water resources for processing and mining activities will constantly be evaluated to ensure that their use is optimised;
- No water will be discharged unless authorised by the DWS, especially water that exceeds the catchments water quality objectives, as set out by the National Authority, with the exception of emergency conditions if safety should demand so; and
- Dirty water catchments will be minimised and kept separate from clean catchments and all water contained here shall be re-used as far as possible, thus reducing the quality or raw water extracted;

All the relevant principles contained in DWA's Best Practice Guidelines (BPG) will be utilised to guide mine design and management practices. The Applicant will also ensure compliance with GNR 704 of the NWA, and is applying for the relevant exemptions indicated in Section 3.3 above.

6.2.2 WETLANDS AND AQUATIC ECOLOGY

Management actions should consider that the main impacts of the development are likely to be to water quality, as well as water quantity (flows) within receiving watercourses. As such, the main objectives for management are:

- To take all reasonable measures to prevent any disturbance, damage or impact to aquatic ecosystems outside of mining footprint;
- Minimise and prevent disturbance to wetlands and watercourses;
- Prevent impacts to water quality;
- Prevent and minimise erosion and sedimentation;
- Prevent flow changes in receiving watercourses;
- Considering the potential for some permanent loss of aquatic ecosystems habitat, it is strongly recommended that biodiversity offset measures are considered, preferably by formally protecting intact systems with similar ecosystem components;
- Effective bio-monitoring programme be implemented as soon as possible to assess and mitigate negative impacts on aquatic ecosystems;
- Manage biodiversity; and
- On-going rehabilitation (refer to Section 6.2.5 Rehabilitation Strategy and Implementation Programme).

6.2.3 GROUNDWATER

Please refer to Sections **Error! Reference source not found.** and 6.2.1 above.

6.2.4 WASTE

The following waste management strategies will be implemented:

- The waste management plan shall ensure the appropriate management of all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste etc;
- The Mine and Contractor(s) shall comply with the environmental management principles referenced in the NEMA. In respect of waste management, the ‘cradle-to-grave’ principle in particular must be adhered to so as to ensure accountability for correct waste handling, storage and disposal;
- The waste management system shall provide for adequate waste storage (in the form of waste skips and bins with lids), waste separation for recycling, and frequent removal of non-recyclable waste for permanent disposal at an appropriately licensed waste disposal facility. No waste

material is to be disposed of on site. Under no circumstances may there be any burial of waste underground or on the site;

- Waste shall be separated into reusable, recyclable and non-recyclable waste, and shall be further separated as follows:
    - Hazardous waste, consisting of substances that may be harmful to the receiving environment, and therefore require precautionary measures when handled. Examples include (but not limited to) oil, paint, diesel.
    - General waste, consisting of non-hazardous substances and substances that cannot be recycled. Examples include (but not limited to) construction rubble, excess construction materials that cannot be reused.
    - Recyclable waste, (where volumes are sufficient to make recycling feasible) shall preferably be deposited in separate bins. Recyclable material includes paper, tins and glass.
- The mine shall implement a waste removal regime that ensures waste containers do not exceed their capacity before being removed from site for disposal;
- Environmental awareness training given to workers on site shall include appropriate waste management practices to be implemented on site;
- Particular caution is to be exercised with regards to handling of hazardous waste, to ensure that it does not spill or leak from the waste collection containers. Refuse must also be protected from rain, which may cause pollutants to leach out;
- Littering shall be strictly prohibited. The site shall remain in a neat and tidy condition at all times. If required, the Applicant shall make use of regular litter patrols to remove litter and ensure the site remains clean, neat and tidy; and
- The mine shall maintain a waste register which shall be used to track all waste removed from site. Proof of appropriate waste disposal shall be kept on file at the site for auditing purposes.
- The mine shall have the sediments, that are removed from the desiltation of the dams, analysed. Should the results indicate that the sediments are not suitable for rehabilitation purposes, the Applicant will ensure that the sediments are correctly disposed of.

6.2.5 REHABILITATION STRATEGY AND IMPLEMENTATION PROGRAMME

As per the approved Environmental Management Programme (EMP), rehabilitation will be undertaken in a consecutive manner as soon as practicable after open cut mine disturbance to mitigate impacts on flora, fauna, landform, soil and surface water. There shall at no time be an area greater than 300 m X 300 m be exposed that is not being mined. The mining operations will take place at different

location on the mining site, depending on the quality of sand and the demand for different grades of sand i.e. building sand, plaster sand or casting sand.

The gradient of the slopes of the excavations will be planned in such a way that the run-off water will not cause wash-away after rehabilitation of the mine site. Sufficient contour walls, weirs and waterways will be constructed to prevent soil erosion.

Water control structures such as cut-off canals, berms and settling pits will be maintained on an ongoing basis and new ones will be erected as the need arises.

No waste dumps will be created. Where there is silt or slime, it will be used in filing a previously excavated areas, after the material has been dried out, it is covered with a layer of subsoil, followed by at least 0.5m of topsoil. The topsoil will be at least 100 mm higher than the ground level to provide for settlement

The following additional rehabilitations measures are provided by the wetland specialist:

- Rehabilitated ground: The gradient of the slopes of the excavations and waste dumps must be planned to prevent run-off from causing wash away after rehabilitation of the area. Sufficient contour walls, weirs and waterways must be constructed to prevent erosion;
- Water control structures: Control structures such as cut-off canals, berms and settling pits (ponds) must be constructed and maintained on a continuous basis, with new structures being constructed when the need arises;
- Rehabilitated waste dumps: No permanent waste dumps must be created. In the event of waste which includes sand, silt and slimes, this material must be used for infilling of excavated areas after drying of the material has occurred and once these sediments have been analysed to determine that they are not hazardous as per the provisions of NEMWA. These areas are then to be covered with subsoil and also a layer of topsoil.

The Storm Water Management Plan provides the following guidelines for the rehabilitation of the PCD.

- After ceasing the operation of the PCD, in accordance with the directive, the dam should be drained of water. Ensure that the water is not contaminated and that the drainage location has been agreed upon with DWS, prior to draining;
- The options for the closure and rehabilitation of the dam that could be considered are explained below;
- The sludge left in the dam after draining either needs to be removed or can be left in the dam for closure, depending on the leachable contaminant concentrations in the sludge. The sludge therefore needed to be analysed to determine whether the water passing through it would contain contaminant concentrations exceeding the limits specified by the SANS 241:2011 limits. If the water leachate complies with these standards, the sludge may be left in the dam; however, if these standards are not met, the sludge will need to be removed from the dam and safely disposed of at an appropriate site;

- The dam will need to be levelled after closure. To achieve this, the dam can either be filled up to its wall level with solids, or the dam walls can be breached and pushed into the centre to flatten the area. If the volume filled by the dam walls is not sufficient to level the area, external solids (soil material) can be brought in to fill the remaining volume as required;
- After the dam is closed and levelled, it must be ensured that the area is free draining, to prevent the pooling of rainwater in the future. The water must be directed to the lowest point in the area;
- After the closure and levelling of the dam, the appropriate vegetation should be introduced to the new surface area to promote its rehabilitation. This can be done by planting the standard vegetation mix for the highveld, which may include the following:
    - *Chloris gayana* (Rhodes grass- 4 kg/ha)
    - *Digitaria eriantha* (finger grass- 4 kg/ha)
    - *Cynodon dactylon* (Couch grass – 4kg/ha)
    - *Eragrostis teff* (Teff – 1kg/ha); and
- Furthermore, grass species that naturally occur in the general area may be added to refine this mix.

A Rehabilitation Strategy and Implementation Programme (RSIP) shall be developed for the mine, by a specialist and including timeframes closer to closure.

6.2.5.1 LONG TERM MONITORING, MANAGEMENT AND MAINTENANCE

A monitoring program consists of taking regular measurements of the quantity and/or quality of a water resource at specified intervals and at specific locations to determine the chemical, physical and biological nature of the water resource and forms the foundation on which water management is based. Monitoring programmes are site-specific and need to be tailored to meet a specific set of needs or expectations, as per the requirements of the DWAF Best Practice Guideline – G3: Water Monitoring Systems (DWA, 2006).

Monitoring, measuring, evaluating and reporting are key activities of the monitoring programme. These actions are designed to evaluate possible changes in the physical and chemical nature of the aquifer and geo-sphere in order to detect potential impacts on the groundwater. This will ensure that management is timely warned of problems and unexpected impacts that might occur, and can be positioned to implement mitigation measures at an early stage. Key objectives of monitoring are:

- To provide reliable groundwater data that can be used for management purposes;
- The early detection of changes in groundwater quality and quantity;
- Provide an on-going performance record on the efficiency of the Water Management Plan;

- Obtain information that can be used to redirect and refocus the Water Management Plan; and
- Determine compliance with environmental laws, standards and the water use licence and other environmental authorizations.

Surface water quality monitoring should be conducted on a monthly basis, whereas groundwater monitoring i.e. quality analysis and water level monitoring is conducted on a quarterly basis. Water quality reports, summarising monitoring results, should be submitted to the Regional Head with timeframes.

Due to the impact of the mine dewatering on spring flow as suggested by the numerical groundwater flow model simulations, spring flow measurement should be conducted on a quarterly basis to determine the impact of mine water abstraction on on-site springs identified.

Furthermore, it is recommended that a calibrated mechanical or electronic flow meter be installed at the abstraction points in order to monitor and record abstraction volumes. The latter should be included into the water quality report and send through for evaluation by the Department.

It is recommended that all water samples undergo an initial comprehensive water quality analysis to evaluate hydrochemical composition and identify potentially elevated parameters going forward. Chemical variables too should form part of the monthly/quarterly sampling run should include: pH, EC, TDS, TSS, COD, alkalinity (PAlk), SO4, NO3, Cl, F, Ca, Mg, K, Na, Al, Fe and Mn.

6.3 PERFORMANCE OBJECTIVES/GOALS

The Applicant has an approved Safety, Health and Environmental (SHE) policy, which outlines commitment towards environmental management and which provides the framework for all environmental activities on the mine.

There is a continual process of reviewing to assess the impacts of the mine's activities on the environment. All internal and external legal requirements pertaining to the Applicant are identified and regularly reviewed. Legal Compliance reporting takes place on an annual basis. The performance objectives are summarised in Table 28 below.

TABLE 28: PERFORMANCE OBJECTIVE FOR THE APPLICANT

Item:	Performance objective:
Process Water:	Required water quality standard
	Re-use and recycling of process water
	Accurate water balance (hour meter flows)
Ground Water:	Prevent deterioration of ground water quality
	Prevent aquifer contamination
Storm / Surface Water:	Clean and dirty water separation
	Diversion of clean storm water runoff around the mine area

Item:	Performance objective:
	Collection and containment of contaminated water
Waste:	Ensure legal proper disposal of waste at registered sites
	Minimize waste generation
	Re-use of recycle if possible
	Ensure proper storage before disposal to prevent pollution of environment

6.4 MEASURES TO ACHIEVE AND SUSTAIN PERFORMANCE OBJECTIVES

The IWWMP action plan identifies measures to achieve the water and waste related objectives. Refer to Section 6.5 below.

6.5 IWWMP ACTION PLAN

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
STAFF AND MANAGEMENT AWARENESS					
i) Staff awareness program and training	Risk mitigation	The Applicant must inform its employees of risk associated with their operations and make sure that all employees are trained prior to undertaking any activity associated with their operations. Ensure that the Contractor and key personnel are aware of the relevant provisions of the EMPr, sensitive environmental features and agreements made with individual landowners and/or land users.	Permanent/ Continuous	• Reducing in incidents and identified risks	Management • EMPr
ii.) Appoint Contractors Environmental Officer (CEO)	Oversee and enforce EMPr.	The Applicant's management to assign a team that will monitor EMPr implementation and compliance by the employees. Enforcement should be applied to those employees that are not complying.	Permanent/ continuous	• Management satisfied with CEO performance based on EMPr implementation	Management • EMPr • Compliance checklists • Audit reports
SITE OPERATION					
Water for human consumption	Water and soil pollution, health	Water for human consumption shall be available at the site offices and at other convenient locations on site. All drinking water must be from a legal source and comply with recognised standards for potable use. The Applicant shall comply with the provisions of the National Water Act, 1998 (Act 36 of 1998) and its Regulations pertaining to the abstraction of water from rivers and streams and the use thereof.	Weekly monitoring of waste and effluent removal/ disposal	• Adequate quantities of potable water, • Proper effluent disposal	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		All effluent from the office shall be collected and disposed of properly, (e.g. chemical toilets should be emptied). If this is not feasible (due to the construction duration or other difficulties), all effluent water from the camp / office sites shall be disposed of in a properly designed and constructed system, situated so as not to adversely affect water sources (streams, rivers, pans dams etc). Only domestic type wastewater shall be allowed to enter this drain. The effluent system should comply with provisions of the NWA.			
Sewage	Soil and water pollution; Waste disposal	The positioning of the chemical toilets shall be done in consultation with the Applicants Environmental advisor. Toilets and latrines shall be easily accessible and shall be positioned within walking distance from wherever employees are employed on the works. Use of the veld for this purpose shall not, under any circumstances, be allowed. Outside toilets shall be provided with locks and doors and shall be secured to prevent them from blowing over. The toilets shall also be placed outside areas susceptible to flooding. The Applicant shall arrange for regular emptying of toilets and shall be entirely responsible for enforcing their use and for maintaining such latrines in a clean, orderly and sanitary condition.	Weekly monitoring of sewage facilities, maintenance and disposal	• Adequate and operation sewage treatment/disposal	Management • EMPr • Compliance checklists
Waste Management	Soil and water pollution; Waste disposal	Where practically possible, general waste on-site must be reused or recycled. Bins and containers must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.).	Weekly monitoring of waste cleanup	• No waste or litter accumulation on site	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Solid Waste	Soil and water pollution; Waste disposal	A refuse control system shall be established for the collection and removal of refuse. Bins and containers must be available on-site for collection, separation, and storage of waste (such as wood, metals, general refuse etc.). Solid waste shall be stored within a designated area that is covered, utilising plastic wheelie bins for collection and disposal. Disposal of solid waste shall be at a DWS licensed landfill site or at a site approved by DWS in the event that an existing operating landfill site is not within reasonable distance from the site. No waste shall be burned or buried at or near the site offices, or anywhere else on the site.	Weekly monitoring	• No waste or litter accumulation on site • Proof of disposal certificates. • No burning of waste.	Management • EMPr • Compliance checklists
Wastewater	Soil and water pollution;	The Applicant shall comply with the provisions of the NWA and its Regulations pertaining to the storage and reuse of wastewater collected on site. Wastewater collection ponds should be lined and in compliance with the NEMWA and other legal requirements.	Monthly monitoring	• No ground and water contamination	Management • EMPr • Compliance checklists
Litter	Soil and water pollution; Waste disposal	No littering by construction workers shall be allowed. During the construction and operation period, the facilities shall be maintained in a neat and tidy condition and the site shall be kept free of litter. Measures shall be taken to reduce the potential for litter and negligent behaviour with regard to the disposal of all refuse. At all places of work the contractor shall provide litter collection facilities for later safe disposal at approved sites.	Bi weekly monitoring	• No waste or litter accumulation on site • Proof of disposal certificates. • Availability and maintenance of litter / refuse collection facilities.	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
				• No burning of waste.	
Hazardous waste	Soil and water pollution Waste disposal	Hazardous waste such oils etc. shall be disposed of in a DWS approved landfill site. Any spillage shall be attended to immediately and affected areas shall be promptly reinstated to the satisfaction of the engineer.	Weekly monitoring	• No spillages or direct disposal. • No waste or litter accumulation on site • Proof of disposal certificates. • Proof of reinstatement following any spillages. • No burning of waste.	Management • EMPr • Compliance checklists
Control at the workshop	Soil and water pollution; Waste disposal	Management and maintenance of plant and machinery will be strictly monitored according to the subsections below, regardless whether it is serviced on the site (i.e. at the place of construction activity or at a formalised workshop). All maintenance, including washing and refuelling of plant on site shall take place at designated locations at the workshop area. All machinery servicing areas shall be bunded.	Monthly monitoring	• Random visual inspection during site visits.	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Hazardous Material Storage	Soil and water pollution Waste disposal	Petrochemicals, oils and identified hazardous substances shall only be stored under controlled conditions. All hazardous materials shall be stored in a secured, appointed area that is fenced and has restricted entry. The Applicant should ensure that they keep proof that relevant authorisation to store such substances has been obtained from the relevant authority. In addition, hazard signs indicating the nature of the stored materials shall be displayed on the storage facility or containment structure. Before containment or storage facilities can be erected the Applicant should ensure that preventative measures are put in place to mitigate against pollution of the surrounding environment from leaks or spillage. The preferred method shall be a concrete floor that is bunded. Any deviation from the method will require proof from the relevant authority that the alternative method proposed is acceptable to that authority. The proposals shall also indicate the emergency procedures in the event of misuse or spillage that will negatively affect an individual or the environment.	Weekly monitoring	• No hazardous waste accumulation on site • Proof of disposal certificates. • No burning of waste. • Suitable and adequate hazardous substance storage areas. • Proof of submission and approval from the Employers Environmental Manager/Environmental Officer.	Management • EMPr • Compliance checklists
Fuel and Gas Storage	Soil and water pollution; Waste disposal	Fuel shall be stored in a secure area in a steel tank supplied and maintained by the fuel suppliers. An adequate bund wall, at least 110% of the volume stored, shall be provided for fuel and diesel areas to accommodate any leakage spillage or overflow of these substances. The area inside the bund wall shall be lined with an impervious lining to prevent infiltration of the fuel into the soil. Any	Weekly monitoring	• Inspect bunded area for leaks / drainage • Proof of disposal certificates.	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		leakage, spillage or overflow of fuel shall be attended to immediately. Gas welding cylinders and LPG cylinders shall be stored in a secure, well-ventilated area. Storage of hazardous substances must comply with construction regulations under the OHSA..		• No burning of waste.	
Oil and Lubricant Waste	Soil and water pollution; Waste disposal	Used oil, lubricants and cleaning materials from the maintenance of vehicles and machinery shall be collected in a holding tank and sent back to the supplier. Oils collected in this manner, shall be retained in a safe holding tank and removed from site by a specialist oil recycling company for disposal at approved waste disposal sites for toxic/hazardous materials. Oil collected by a mobile servicing unit shall be stored in the service unit's sludge tank and discharged into the safe holding tank for collection by the specialist oil recycling company. All used filter materials shall be stored in a secure bin for disposal off site. Any contaminated soil shall be removed and replaced. Soils contaminated by oils and lubricants shall be collected and disposed of at a facility designated by the local authority to accept contaminated materials.	Weekly monitoring	• Inspect bunded area for leaks / drainage • Proof of disposal certificates. • No burning of waste.	Management • EMPr • Compliance checklists
Soil and Stockpile Management	Soil erosion	Topsoil shall be removed from all areas where physical disturbance of the surface will occur and shall be stored and adequately protected. The Applicant will provide for the stripping and stockpiling of topsoil from the site for later re-use. Topsoil is considered to be the natural soil covering, including all the vegetation and organic matter. Depth may vary at each site. The areas to be cleared of topsoil shall include the storage areas. All topsoil stockpiles and windrows shall be maintained throughout the contract period in a weed-free condition. Weeds appearing on the stockpiled or windrowed topsoil shall be removed by hand. Soils contaminated	Monthly monitoring	• Visual inspection of stockpiles	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		by hazardous substances shall be disposed of at an approved DWS waste disposal site. The topsoil stockpiles shall be stored, shaped and sited in such a way that they do not interfere with the flow of water to cause damming or erosion, or itself be eroded by the action of water. Stockpiles of topsoil shall not exceed a height of 2m, and if they are to be left for longer than 6 months, shall be analysed, and if necessary, fertility improved before replacement. Stockpiles shall be protected against infestation by weeds. The Applicant shall ensure that no topsoil is lost due to erosion – either by wind or water. Areas to be topsoiled and grassed shall be done so systematically to allow for quick cover and reduction in the chance of heavy topsoil losses due to unusual weather patterns.			
Drainage / Storm water Management	Soil erosion /storm water management	The quality, quantity and flow direction of any surface water runoff shall be established with the aid of a qualified engineer prior to disturbing any area for construction purposes. Cognisance shall be taken of these aspects and incorporated into the planning of all construction activities. Before a site is developed or expanded, it shall be established how this development or expansion will affect the drainage pattern. No water source shall be polluted in any way due to proposed development. No wastewater may run freely into any of the surrounding environment or neighbouring properties. The contractor shall implement the storm water design in accordance with the approved Storm Water Management Plan. The Applicant and Contractor(s) shall ensure compliance with the requirements of the NWA and GN 704. All areas susceptible to erosion shall be protected by ensuring that there is no undue soil erosion resultant from construction and/or mining activities. Berms shall be constructed where necessary to direct all runoff into the stormwater system. Care must be taken to	Weekly monitoring	• Visual inspection, no excessive soil erosion or sedimentation.	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		avoid scouring and erosion and suitable measures should be placed in areas where runoff concentrates, in order to detain the sediment load and slow down the runoff. All erosion damage shall be repaired as soon as possible as directed by the Environmental Representative. Consideration shall be given to the placement of sedimentation ponds or barriers where the soils are of a dispersive nature or where toxic fluids are used in the construction process. The sedimentation ponds must be large enough to contain runoff so that they function properly under heavy rain conditions.			
Stockpiles	Soil erosion Visual impact Noise	No construction and operation related activities including stockpiling, temporary storage areas, temporary and permanent access routes, and temporary working areas are to take place within the area beyond the demarcated site boundary. The Applicant shall plan their activities so that materials in so far as possible, can be transported directly to, and placed at, the point where they will be used. The areas for the stockpiling of excavated and imported material shall be indicated and demarcated on the site plan, together with the contractor's proposed measures for prevention, containment and rehabilitation against environmental damage. The areas chosen shall have no naturally occurring indigenous trees and shrubs present that may be damaged during operations. Care shall be taken to preserve all vegetation in the immediate area of these temporary stockpiles. During the life of the stockpiles the contractor shall at all times ensure that they are: • Positioned and sloped to create the least visual impact; • Structurally sound and present no safety risk;	Weekly monitoring	• Visual inspection, no excessive dust	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		• Constructed and maintained so as to avoid erosion of the material and contamination of surrounding environment; and Kept free from all alien/undesirable vegetation. After construction, any areas no longer required for operation shall be re-instated to its original condition. No foreign material generated / deposited during construction shall remain on site. Areas affected by stockpiling shall be landscaped, top soiled, grassed and maintained until closure from the Environmental Advisor and the relevant National Authority is received. In all cases, Environmental Advisor shall approve the areas for stockpiling and disposal of construction rubble before any operation commences and shall approve their clause only when they have been satisfactorily rehabilitated.			
Spillages	Soil & water pollution	Watercourses such as streams, rivers, dams, etc. shall be protected from direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, wash water, and organic materials. In the event of a spillage, the Applicant should arrange for professional service providers to clear the affected area. All spills must be dealt with as per the Emergency Response Procedure. Should water downstream of the spill be polluted, and fauna and flora show signs of deterioration or death, specialist hydrological or ecological advice will be sought for appropriate treatment and remedial procedures to be followed.	Weekly monitoring	• Visual inspection	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Areas of Specific Importance	• Loss of populations of threatened plant species • Loss of habitat of threatened animal species • Loss of indigenous natural vegetation (primarily grassland) • Erosion and siltation due to change in runoff and drainage patterns • Establishment and spread of declared weeds and alien invader plants. • Noise impacts on local residents	Any area, as determined and identified as sensitive or of special interest within the site (e.g. wetlands) shall be treated according to the express instructions contained in these specifications or the approved EMPr. The overriding principle is that such defined areas requiring protection shall not be changed. • No unnecessary vegetation clearing will be allowed in natural vegetation areas.	Weekly monitoring	• No vegetation has been unnecessary removed, (photo graphic evidence)	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
Dust Control	Nuisance pollution	Dust caused by strong winds and operational activities shall be controlled by means of water spray vehicles. Exposed soils and material stockpiles shall be protected against wind erosion. The location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors A dust monitoring system needs to be put in place to ensure that dust falls within the acceptable limits as per the ambient air quality standards	Monthly monitoring	• Routine observation, no complaints from residents	Management • EMPr • Compliance checklists
Alien Vegetation	Habitat destruction	The Applicant shall establish an on-going monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act and Biodiversity Act). The Applicant shall be held responsible for the removal of alien vegetation within the boundary of the site disturbed during construction. This includes, for example, service roads, stockpile areas, and wherever material generated for or from construction has been stored temporarily.	Monthly monitoring	• Visual inspection, vegetation removal record by contractor, no unnecessary vegetation clearing	Management • EMPr • Compliance checklists
DECOMMISSIONING PHASE					
Decommissioning	Decommissioning and rehabilitation	Any additional licensing or permitting requirements must be identified prior to any decommissioning activities commence. Prior to the decommissioning a detailed decommissioning plan must be prepared. This plan should aim to follow the waste management hierarchy (reuse, recycle, reduce and dispose) in order to prevent unnecessary wastes. All waste which require disposal must be	Weekly	• Routine check for EMPr availability and awareness.	Management • EMPr • Compliance checklists

Activity	Environmental Aspect	Mitigation measures	Monitoring frequency and tools	Monitoring Indicators	Responsible party for implementation and Monitoring Tool
		disposed of at a suitably licenced facility. An inventory of infrastructure and wastes together with the ultimate destination (e.g. recycler, waste disposal) should be kept for future records. A rehabilitation plan must be prepared by a suitably qualified specialist. The sites must be rehabilitated to the pre-construction condition or alternatively to align with the surrounding land-uses at the time. The rehabilitated site must be protected from future erosion.			
Decommissioning	Decommissioning and rehabilitation	The area where the site offices are placed will require rehabilitation at the end of the contract. All construction material, including concrete slabs shall be removed from the site on completion of the contract, to the Applicants satisfaction.	Weekly	• Routine check for EMPr availability and awareness.	Management • EMPr • Compliance checklists
Decommissioning	Decommissioning and rehabilitation	Any disturbed areas should be rehabilitated with natural vegetation endemic to the area as soon as possible after decommissioning.	Weekly	• Routine check for EMPr availability and awareness.	Management • EMPr • Compliance checklists

6.6 CONTROL AND MONITORING

6.6.1 MONITORING OF CHANGE IN BASELINE INFORMATION

A monitoring plan will be developed and the results of the monitoring plan will be submitted to the relevant DWS directorates, as well as other government departments as required in terms of management objectives, action plan and applicable legislation and other legislative requirements.

6.6.2 AUDIT AND REPORT ON PERFORMANCE MEASURES

It is anticipated that the WUL or other applicable authorisations will require that regular formal audits be undertaken in order to assess the compliance with, amongst others, the WUL and IWWMP. As such, the applicant will cater for this requirement through regular internal and external audits in line with the frequency required by the WUL (usually on an at least an annual basis) and the other applicable authorisations.

6.6.3 AUDIT AND REPORT ON RELEVANCE OF IWWMP ACTION PLAN

It is anticipated that the WUL will require that the efficacy of the measures proposed as part of the action plan be reviewed and updated where required. As such, the IWWMP action plan will be reviewed and updated in line with the frequency required by the WUL (usually on at least an annual basis) and the other applicable authorisations.

6.7 LANDSCAPE MAINTENANCE PLAN

In order for rehabilitation to occur successfully, it is necessary for the mine to ensure that the land will be returned to a natural state and no further mining will occur on site. This requires landscape maintenance planning, and will need to be considered during the planning of the Final Rehabilitation Plan. The pre-mining site was identified as being degraded due to extensive livestock grazing and, therefore, the mine site must be rehabilitated to a condition better than before and the landscape must be maintained.

6.7.1 LAND PREPARATION

The purpose of land preparation is to ensure that the mining area is limited as far as possible and that pollution or contamination does not occur. The important factor to take into consideration when preparing for mining include:

- To limit the areas that will be affected by the mining development;
- To minimize future contact of toxic or polluting materials with the environment; and
- To maximize the recovery and effective storage of those mining profile materials that could be useful during the rehabilitation process after mining has been completed

The following needs to be considered during the implementation and operational phase of the project:

- Mine planning should be designed to ensure that mine infrastructure occupies a minimal area;

- The impacted area should be kept as small as possible and be clearly demarcated;
- Mining activities should be restricted to planned areas;
- Stockpiles should be located in demarked and approved area;
- Sand and soil that cannot be placed directly onto rehabilitated land should be stockpiled; and
- Infrastructure should be designed with closure in mind and should either have a clearly defined dual purpose or be easy to demolish.

6.7.2 SOIL STOCKPILING

It is necessary for sufficient topsoil to be stockpiled in order for it to be available for rehabilitation of the mining area and to support vegetation growth. It is, therefore, necessary to carefully plan, execute and monitor the stripping of the topsoil. This ensure that that soil is stripped from the correct area, within the mining footprint an at the correct depth and placed in the correct location. The following measure should be adhered to in order for impacts on the soil located within the stockpile are to be minimised:

- Soils should be loosely stockpiled;
- Restrict the disturbance of the stockpiled soil;
- Minimise the period of exposure of soil surface through careful planning;
- Limit the height of stockpiles; and
- Ensure that stockpiles are placed in a free draining location to limit waterlogging.

6.7.3 EROSION CONTROL

Soil erosion prevention and rehabilitation should take place during all phases of mining. Active monitoring by the Mine Manager and ECO must occur to ensure the prevention or early detection of soil erosion. Areas that are more susceptible to erosion must be installed with temporary and permanent works. The following measures are recommended for controlling erosion:

- Silt traps must be constructed in areas that are prone to erosion especially the periphery of the mining footprint in order to retain sediment-laden runoff;
- These silt traps must be maintained and cleaned on a regular basis; and
- Stormwater runoff must be diverted away from areas that are susceptible to erosion.

6.7.4 RE-VEGETATION

The main purpose when re-vegetating is to restore the area back to the pre-mining environmental state. It must be noted that as per the EMP, the mining site was degraded due to agricultural purposes and overgrazing. Therefore, there must be an improvement of the current system to a self-sustaining one. It has been indicated in the EMP that the area will be planted with *Eragrostis curvula.* However, this will need to be re-considered during the planning phase of the Final Rehabilitation Plan, as natural

ecological succession should be initiated. The following measures should be taken into account during re-vegetation:

- The disturbed soils must be placed correctly;
- Soil must be prepared by adding lime and fertilizer, followed by tillage to prepare the seed bed;
- A grass seed mixture consisting of indigenous species should be planted;
- Control and remove weeds where necessary;
- Leave pasture until natural grasses have become re-established; and
- Conduct annual monitoring.

6.7.5 ALIEN PLANT CONTROL

Alien invasive plant species out-compete indigenous vegetation as they are vigorous growers and adaptable. Disturbed areas are prone to alien invasive species and need to be identified, categorised and removed. Depending on the type of alien invasive plant species, either physical, chemical or biological measures can be used to remove them.

7 CONCLUSIONS

7.1 REGULATORY STATUS OF ACTIVITY

As detailed in Section **Error! Reference source not found.**, the applicant is required to compile and submit for adjudication, an Integrated Water Use License Application (IWULA) for the following NWA Section 21 water uses:

- Section 21(a)
- Section 21 (b)
- Section 21 (c) and (i), and
- Section 21(g).

7.2 STATEMENT ON WATER USES REQUIRING AUTHORIZATION, DISPENSING WITH THE REQUIREMENT FOR A LICENCE AND POSSIBLE EXEMPTION FROM REGULATIONS

In terms of the NWA, it is an offence to pollute any water resources to render it unfit for the propagation of fish and aquatic life, including rainwater, seawater, and subterranean water. An application for the exemption of the provision of GNR 704 is required for the mining of wetlands.

7.3 S27 (1)(A) EXISTING LAWFUL WATER USES IN TERMS OF SECTION 35

The applicant does not hold any water uses for this development on Portion Re. of Boschbank 12.

7.4 S27 (1)(B) THE NEED TO REDRESS THE RESULTS OF PAST RACIAL AND GENDER DISCRIMINATION

One objective of the NWA is to address past racial and gender discrimination and to alleviate poverty in South Africa; therefore it is of utmost importance to support and stimulate economic development in order to realise the upliftment of previously disadvantaged groups and/or individuals.). The Applicant recognizes the need to address the imbalances of the past and regards BEE to be one of the supporting pillars of the transformation process in South Africa.

A beneficiary trust has been formed to the benefit of the HDSA employees employed at the Applicant and the Lekwa Trust holds 26% shareholding in S. Bothma and Son Transport (Pty) Ltd. The Applicant has obtained a level 6 rating on the new charter with recent evaluation conducted by M-power rating agency, which is equal to a level 4 on the old charter. The Applicant promotes procurement with BEE

recognized companies and support a level one contributor black women owned tyre company, namely Rhamateola Tyres situated in Meyerton.

Skills Development: S. Bothma and Son Transport (Pty) Ltd value its employees as its most valuable asset and as such create the fair and equal opportunity to all to be trained within the requirement of the job if needed as well as per employee assessment outcome on annual basis and career path development the opportunity to be trained towards a career after the mining – portable skills such as brick layers, plumbing.

Clear targets and objectives set with training requirements in the annual Social and Labour Plan which are actively target driven on all aspects such as Adults Basic Education Training (ABET), portable skills, learner-ships, bursaries, women on the mine area.

S. Bothma & Son Transport (Pty) Ltd. understands the need to eradicate the legacy of the illiterate and are actively involved in ABET programme presented in-house by accredited ABET training authority.

7.5 S27 (1) (C) EFFICIENT AND BENEFICIAL USE OF WATER IN THE PUBLIC INTGEREST

The concept of “public interest” is a very complex one. Under the Water Act of 1956, permits were issued to users provided that they used the water beneficially. The use was considered beneficial if the mine was going to make a profit. Under the NWA, public interest goes much wider. The fact that the mine has to undertake a public participation process, and the public’s opinion is to be elicited, means that, at least, the public opinion can be gauged by the response and the comments and concerns received.

As public trustee of the water resources, the DWS 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 DWS has to ensure that the water is allocated equitably and used beneficially in the public interest, while promoting environmental values.

The beneficial use of the water is derived for the social and economic benefits resulting from the mining activity. Water will be used optimally to ensure minimum wastage.

The water use will be undertaken, managed and controlled in such a way to ensure that pollution of the water resources is minimised and avoided. Social and economic development will be facilitated, which will ensure that the use of the water resource will be of benefit to the local communities. Goods and services will be sourced from local businesses as far as possible, to enhance the economic benefits of the project.

A public participation process relating to the development has been undertaken and all the identified impacts can be mitigated taking the other water users into consideration. The public consultation process will be on-going throughout the life of mine.

7.6 S27 (1)(D) THE SOCIO-ECONOMIC IMPACT OF THE WATER USE OR USES IF AUTHORISED OR OF THE FAILURE TO AUTHORISE THE WATER USE OR USES

S. Bothma and Son Transport (Pty) Ltd. provides direct employment to approximately 198 employees in its various operations and has strong backward sectored linkages with potentially strong forward linkage. The household income multiplier is expected to be 2.65, indicating that the potential impact of closure of a transport and mining industry with a payroll for example of R1.8 million per annum, would be a loss of household income throughout the economy of approximately R4.770 million per annum.

6.7 S27 (1) (E) ANY CATCHMENT AGENCY STRATEGY APPLICABLE TO THE RELEVANT WATER RESOURCE

The catchment management agency for the Vaal River System was established on 29 January 2016, through the promulgation of GNR 81 in terms of the NWA, and is called the Vaal River Catchment Management Agency.

The following impacts have been considered:

- The direct impact of physical structures (environmental constraints to construction e.g. of weirs or dams);
- The implications of allocating and licensing water for use. Forestry and irrigation are examples of users where development based on water can mean the transformation of extensive areas of otherwise ‘natural’ environments;
- The allocation of water for equity. will include approaches towards the application of Schedule 1 Use, General Authorisations, the revitalisation of irrigation schemes, etc.;
- Failure to support equity, or appropriate development – noting the consequential impacts of poverty;
- Sanitation systems and the impacts on groundwater quality;
- The implementation of the Reserve; and
- The ability to monitor and manage compliance, thus protecting the resource and with it the environment.

All decisions regarding water are critical to the environment. Decisions must be made on a balance of social, economic and ecological costs and benefits, considering both the immediate and the long-term, and always with an eye out for the unintended consequence. It is the intention of the Internal Strategic Perspective (ISP) to provide the basis for integrated decision-making. The principles of environmental management underpin every strategy developed in this document.

There are a number of strategic areas with a particularly strong biophysical/ ecological emphasis. These include:

- The Reserve (groundwater, rivers, wetlands and estuaries);
- Water quality - surface and groundwater;
- The approach towards the clearing of Invasive Alien Plants;
- The management of wetlands;
- Land degradation. Erosion and sedimentation (land care); and
- Land use and especially how this is impacted by land reform and the re-allocation of water.

The roles of co-operative governance and the need for awareness raising and capacity building are key strategic elements of many strategies. In reality all strategies and all aspects of management have a strong interaction with the biophysical environment. This ISP endeavours to capture all of these concerns in discussion and through a strategic approach which emphasises the will of the DWS to manage the environment to the best benefit of the country and its people.

7.7 S27 (1) (F) THE LIKELY EFFECT OF THE WATER USE TO BE AUTHORISED ON THE WATER RESOURCE AND ON OTHER WATER USERS

The economy of the Upper Vaal Management area consists of widespread urbanisation, mining and industrial activity, which relate to gold and coal deposits in the area occur in the northern part of the water management area. Collectively, mining and industrial development in the Upper Vaal River water management area produce a total of 45 % of South Africa's Gross Domestic Product (GDP). Economic activity in the rest of the Upper Vaal water management area mostly relates to livestock farming and rain fed cultivation (Hall and Jennings, 2007; NWRS, 2004). Due to ongoing economic growth and continued urbanisation, further growth in water demand is expected in the area. It is therefore paramount that water allocation decisions are made, taking cognisance of only marginal potential for further resource development. The main water use in the Upper Vaal is, therefore, shared by the industrial, urban and mining sectors, which account for 80% of water usage. Irrigation accounts for 9% of water usage and power generation accounts for 7%. The remainder is used for supply to rural areas. These percentages do not include water transfer in and out of the management areas. Aside from these usages, water is also transferred in and out of the Management areas. The Upper Vaal area transfers water out to the Crocodile, Marico and Olifants Management areas and transfers water in from the Thukela, Usutu & Mhlatuze Management areas as well as from Lesotho as per the agreement between South Africa and Lesotho via the Lesotho Highlands Water Project. The Upper Vaal area has an impact on Botswana, Lesotho, Namibia, Zimbabwe, Mozambique and Swaziland (DWA, 2014). The main potential impact which was identified and mitigated in this regard includes the following:

- Wetlands;
- Groundwater; and

- Surface water.

Water is re-cycled and re-used by the Applicant.

7.8 S27 (1) (G) THE CLASS AND THE RESOURCE QUALITY OBJECTIVES OF THE WATER RESOURCE

The Vaal River downstream of Vaal Dam to the outlet of C23J (Integrated Unit of Analysis (IUA) UM) includes the urban areas of Vereeniging, Vanderbijlpark, Sasolburg and Parys. In the reach between Vaal Dam and the Vaal Barrage the three main tributaries (Suikerbosrand, Klip and Rietspruit rivers) discharge into the Vaal Barrage, each conveying significant volumes of treated waste water and mine discharge water. Management of the flow entering this reach is from Vaal Dam and is influenced by the water users in and downstream of the Vaal Barrage, the urban return flows and mine dewatering discharges as well as the releases form Vaal Dam to maintain the TDS concentration at 600 mg/l (DWA , 2012).

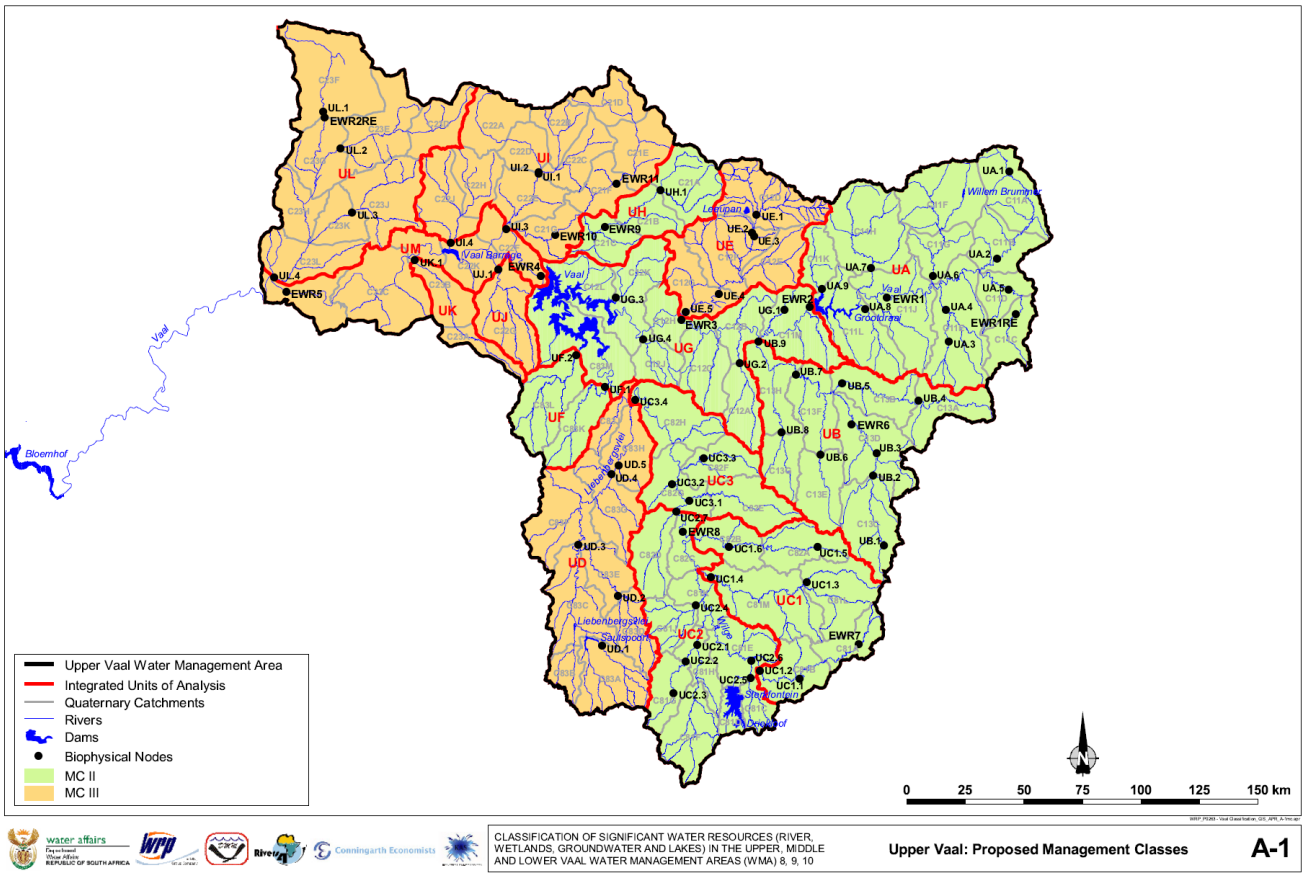

Figure 31: Classification of significant water resources (river, wetlands, groundwater and lakes) in the upper, Vaal water management areas (WMA)

Two EWR sites were defined in this IUA, one with a C Ecological Categories (EC) and the other a C/D EC state, both with a HIGH EI providing motivation that the Recommended Ecological Category (REC) should be an improvement of the PES. However, the assessment of this scenario as part of the Reserve study indicated that the implications of this improvement have significant impacts on the economy. The

operational scenario accepted for the purpose of defining the Reserve was therefore to maintain the PES. The scenarios evaluated during this study still do not achieve the REC and for that reason the PES was used in the catchment configuration for this IUA (DWA, 2012).

7.9 S27 (1) (H) INVESTMENT ALREADY MADE AND TO BE MADE BY THE WATER USER IN RESPECT OF THE WATER USE IN QUESTION

To date, the Applicant has made the following investments:

- Compiled an Environmental Management Programme;
- Compiled various specialist studies (Wetland assessment, hydrogeological report and a Storm Water Management Plan), and
- Undertaken a Public Participation process.

7.10 S27 (1) (I) THE STRATEGIC IMPORTANCE OF THE WATER USE TO BE AUTHORISED

The strategic importance of the water use to be authorised includes:

- The vital contingency of delivery of specified high quality classified washed and screened sand to major construction industries;
- Securing jobs and additional job creation in future;
- Contingency of training programmes provided to employees and external learner-ship programmes to improve skills base;
- Support to local economy and national economy with purchasing of services and goods; and
- Contingency of LED projects in conjunction with local Metsimaholo council to the benefit and growth of local community.

7.11 S27 (1) (J) THE QUALITY OF WATER IN THE WATER RESOURCE WHICH MAY BE REQUIRED FOR THE RESERVE AND FO MEETING INTERNATIONAL OBLIGATIONS

The following reservations apply with respect to the transfer of water into and out of the water management area, and the provision of water for future growth:

- The existing transfer of 491 million m³/a from Lesotho, which is to be increased to 835 million m³/a after the commissioning of Mohale Dam in Lesotho. – reserved by international agreement for use in and transfer from the Upper Vaal water management area;

- Existing transfers from the Thukela water management area up to the installed capacity of 630 million m³/a. The yield benefit in the Vaal System is 736 million m³/a – reserved in the Thukela water management area;
- Future large-scale water resources development on the Thukela River is reserved mainly for transfer to the Upper Vaal water management area. Current planning allows for an additional transfer of 475 million m³/a – reserved in the Thukela water management area;
- Existing transfer of 55 million m³/a from the Buffalo River in the Thukela water management area to the Upper Vaal water management area – reserved in the Thukela water management area;
- Transfers from the Usutu to Mhlatuze water management area at the current capacity of 63 million m³/a – reserved in the Usutu to Mhlatuze water management area;
- Existing transfers from the Upper Vaal water management area to the Olifants water management area of 36 million m³/a for power generation, plus an allowance of 38 million m³/a for future growth. (Included in Tables D8.3 to D8.6.) – reserved in the Upper Vaal water management area;
- Transfers from the Upper Vaal water management area through the Rand Water distribution system to meet requirements in the Crocodile (West) and Marico water management area which are in excess of the capacity of the local resources in the Crocodile (West) and Marico water management area. Currently this amounts to 514 million m³/a and is projected to increase to 723 million m³/a. As an upper high growth scenario, transfers may need to increase to 1 125 million m³/a. (Figures included in Tables D 8.5 and D 8.6.) – reserved in the Upper Vaal water management area;
- Releases from the Upper Vaal water management area along the Vaal River to users in the Middle Vaal and Lower Vaal water management areas to meet their realistic needs that cannot be supplied from own resources. Little change is expected from the current transfer of 828 million m³/a, although it may increase to about 910 million m³/a in 2025 under the high growth scenario – reserved in the Upper Vaal water management area;
- Current surplus transfer capacity into the Upper Vaal water management area is to be reserved for growth in urban, industrial and mining water requirements in the Upper Vaal and Crocodile (West) and Marico water management areas, and is not to be used for commercial irrigation;
- The allocation of surplus yield in the Upper Vaal water management area will be subject to national authorisation as it can be allocated to users in the Upper, Middle, Lower Vaal as well as Crocodile (West) and Marico and Olifants water management areas; and
- The Upper Vaal water management area forms the central component of the Vaal River System, which extends over several water management areas. As water resources

management in the Vaal River System impacts to some degree on the water quantity and quality in all the interlinked water management areas, management of the Vaal River System is to be controlled at a national level.

7.12 S27 (1) (K) THE PROBABLE DURATION OF ANY UNDERTAKING FOR WHICH A WATER USE IS TO BE AUTHORISED

The Mining Right is currently valid until 2025, therefore, this is the number of years for which the WUL should be authorised.

7.13 KEY COMMITMENTS

The Applicant is committed to implementing and reviewing the IWWMP action plan included into this document (Refer to Section 6.5 above).

8 REFERENCES

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